

**Under a Censored Sky:
Astronomy and Rabbinic Authority in the Talmud Bavli and Related Literature**

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ABSTRACT

Under a Censored Sky: Astronomy and Rabbinic Authority in the Talmud Bavli and Related Literature

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Until the last few decades of the twentieth century, research on Judaism and astronomy and related celestial sciences tended to emphasize the medieval and Second Temple periods. To date, with the exception of analyses of the Jewish calendar and its development, few studies in the history of science have focused upon the rabbinic period, although a growing number of scholars, including Annette Yoshiko Reed, Noah Efron, and Menachem Fisch, have begun to address this gap.

The emerging sub-field of the history of rabbinic science ca. 70-750 C.E., spans the fields of both Jewish studies and the history of science. This dissertation represents an original contribution to knowledge, demonstrating both the richness of celestial discourse in the Babylonian Talmud and the nuanced play of differing typologies of rabbinic authority articulated by Avi Sagi, Michael S. Berger, and other scholars, particularly epistemic and deontic authority. These are shown to interact strongly with rabbinic discourses addressing the overlapping celestial concerns of astronomy, astrology, astral magic, astrolatry, and cosmogony.

By examining these astronomical topics together in a study of this kind for the first time, I demonstrate a recurrent pattern of tight rabbinic controls over the celestial

sciences preserved in the Babylonian Talmud. This is of importance to the trajectory of Jewish scientific thought due to the enduring centrality of the Bavli.

I also underscore an idealized portrayal of rabbinic legal deontic authority over these sciences, and a focus upon shows of honour and prestige associated with the rabbinic station itself in the Bavli. Further, I highlight the ways in which these preserved talmudic portrayals also serve to illuminate the self-presentation of the rabbis as inheritors of the interpretive and legislative powers bequeathed to them by God, the cosmic lawgiver, at the time of creation and at the giving of the Torah on Mount Sinai.

Dedication

This dissertation is dedicated to my beloved grandmother, Stella Zilbert (née Fineberg) *zikhronah livrakhab* (1917-2008), who did not live to see the completion of my doctoral studies. Her support and love for me, and her encouragement of my thirst for knowledge, made this dissertation possible.

פיה פתחה בחכמה ותורת חסד על לשונה

(Proverbs 31:26)

Acknowledgements

Shifting gears and leaving my previous career for graduate school was perhaps one of the most exhilarating and daunting transitions I'd ever made prior to becoming a parent. Almost overnight, I shifted from being a professional writer to learning how to be a student, and found myself immersed in a very different culture. But it was also an inevitable and irresistible leap.

Two graduate degrees, a marriage, a baby, and three moves later, the work is complete. But of course, I could not have navigated the process alone, and I'm grateful to too many people to list. Should I inadvertently leave someone out, I hope they will forgive me.

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I have been blessed with a caring and invested thesis advisor, Dr. Ira Robinson, who has guided me through my Ph.D. and my dissertation with great patience and deep understanding. I greatly enjoyed our close readings from Maimonides' *Mishneh Torah*, and will always be grateful for his willingness to meet with me at my home when our families lived in the same neighbourhood. All graduate students striving for work-family balance should be fortunate enough to have such an advisor.

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I've been fortunate for the members of my committee, including my thesis advisor, Dr. Ira Robinson, Dr. Lorenzo DiTommaso, for whom I also served as Research Assistant on two occasions, and Dr. Naftali Cohn. I also had the pleasure of working with them to help coordinate a 2011 conference at Concordia University on the theme of *History, Memory, and Jewish Identity*, and this was one of the highlights of my doctorate.

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about God and the origins of the universe, and why you want to learn Latin? Although we cannot get those years back, may you only be inspired by my efforts and perseverance. My very deepest thanks and love to you, my sweetheart, for your patience with my long writing sessions sequestered away, and for your visits to my office to give me hugs and kisses and tell me jokes – welcome breaks indeed. Yes, Mummy’s “book” is finished now. Let’s head to the library to celebrate.

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Notes on Style

Citations and Transliterations:

Citations and transliterations follow the general-purpose Hebrew transliteration style of the *SBL Manual of Style*.

The abbreviations used are as follows:

Abbreviations:

Primary sources:

| | |
|-----------------|------------------------|
| <i>b.</i> | Babylonian Talmud |
| <i>m.</i> | Mishnah |
| <i>y.</i> | Jerusalem Talmud |
| <i>t.</i> | Tosefta |
| <i>Gen.Rab.</i> | Midrash Genesis Rabbah |

Rabbinic Editions consulted

Mishnah:

MS Parma, Biblioteca Palatina, De Rossi 138

Midrash Rabbah:

Theodor, J. and Albeck Ch. 1965. *Midrash Bereshit Rabba: Critical Edition with Notes and Commentary*. Jerusalem: Wahrmann Books.

Babylonian Talmud:

Vilna edition

Escorial, Biblioteca de El Escorial, G-I-3 II-I-8, 165

Hamburg, Staats-und Universitätsbibliothek, 165, 95

Vatican, Biblioteca Apostolica, 115, 117, 134

London, British Library, Harl. 5508 (400)

London, British Library, Or. 5558 A/13; BL Or. 5558 K/9

Munich, Bayerische Staatsbibliothek, 95, 140

New York: JTS, Jewish Theological Seminary of America Library, Rab. 108 (EMC 319), Rab. 1608 (ENA 850), JTS Rab. 218 (EMC 270); JTS ENA 2076.4;- JTS ENA 4189.1-2; JTS ENA 3690.7; JTS Ms. 10719

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Oxford: Bodleian Library, Oxford University, Bodl. heb. b. 13 (2834) 6-7; Bodl. heb. c. 17 (2661) 54; Bodl. heb. d. 45 (2674) 62-65; heb. d. 58 (2658) 11-18, Oxford Opp. Add. fol. 23

Cambridge, Cambridge University Library, Cambridge, England, T-S AS 78.55; T-S AS 78.215; T-S AS 81.2; T-S F1 (1) 93; T-S F1 (1) 95; T-S F1 (2) 102; T-S F2 (1) 165; T-S F2 (1) 162; T-S F2 (1) 14; T-S F2 (1) 83; - T-S F2 (2) 1;- T-S F2 (2) 62; T-S NS 329.952

New York: Bazzano, Archivio Storico Comunale Fr.

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Introduction:
Jewish Astronomy and Rabbinic Authority in Context

“In questions of science, the authority of a thousand is not worth the humble reasoning of a single individual.”

-Galileo Galilei, *Dialogue Concerning the Two Chief Systems of the World*

0.1 Rabbinic Judaism, Astronomy, and Authority

The history of rabbinic Judaism has been viewed through a variety of lenses in contemporary scholarship. Over the past few decades, studies of a rabbinic Judaism presented as a monolithic institution wielding power over the shape of Judaism in Late Antiquity have, moreover, been largely supplanted by analyses calling this self-presentation by the early rabbis into question. The view of a great Sanhedrin, once held to be the seat of rabbinic power, has been replaced by scholarly viewpoints highlighting the Sanhedrin as a construction of the early rabbis during the mishnaic period. As such, an overarching interest shared by more recent analyses spans the dynamic of rabbinic authority that appears in these early self-presentations. For the purposes of this study, the question of whether or not these authority dynamics are historically valid or verifiable is secondary to the analysis of presentations of rabbinic authority as they are preserved in the primary texts.

In addition to scholarly analyses of authority in early rabbinic Judaism, the twenty-first century has seen the emergence of academic interest in the intersection between Judaism and the sciences. Such studies have broached these topics by analyzing not only the place of Judaism in the history of science, but even more recently, the place of the

sciences in Judaism. In this dissertation, my own lens is that of rabbinic authority dynamics and a focus on evidence for a pattern of tight controls over interrelated celestial topics and practices (astronomy, calendar, astrology, astral worship, and cosmogony) in the Babylonian Talmud, also known as the Bavli, the multi-volume anthology of writings written and compiled by generations of Amoraim and subsequent anonymous redactors between approximately 250 and 750 C.E.¹

This study represents an original contribution to this emerging field by demonstrating that rabbinic interest in the celestial sciences overlaps significantly with the theme of authority in the texts in a dynamic pattern that strongly and consistently highlights rabbinic claims not only to halakhic authority, but to a form of authority emphasizing the rabbinic station itself and the primacy of halakhic rulings, and de-emphasizing the authority of science and the empirical, including the laws of nature and the cosmos. Further, I demonstrate that this form of authority is rooted in the idealized self-presentation, preserved in the Bavli, of the rabbis being the sole inheritors of the interpretive and legal authority handed to the rabbis by God, the heavenly lawgiver, at the giving of the Torah on Mount Sinai, and ultimately unfolding from God's cosmogony in Genesis.

¹ As Richard Kalmin summarizes the challenge of interpreting the redaction history of the Bavli: "Due to their anonymous character, the chronology of these editors and the material they composed is difficult to assess. Some scholars claim that the anonymous material comprises the latest stratum of the Talmuds, while other scholars claim that it was produced contemporaneously with the material produced by the Amoraim. Throughout this book I make every effort to avoid taking a stand on this issue in the absence of concrete proof, since in my opinion, scholars too often base conclusions about the chronology of the text based on preconceived notions regarding the provenance of the anonymous material. Very often we will be able to assert responsibly only that the anonymous material postdates the latest Amoraic material in a given text." (Kalmin, 2014, *Migrating Tales: The Talmud's Narratives and Their Historical Context*. Oakland: University of California Press., xi)

My analysis further peers at this recurrent motif through the lenses of theories of authority that demonstrate the primacy of a powerful, idealized elite self-presentation for the early rabbis, even at the expense of scientific accuracy. I also underscore an idealized portrayal of rabbinic legal authority over these sciences in the texts, and a related, recurrent concern regarding the importance of shows of honour and prestige associated with the rabbinic station itself, as they have been preserved in the Bavli.

Indeed, this play of authority manifests itself in the texts as control over astrology and astral magic, bans on astrolatry, tight controls over calendar, intercalation and the proper time for festival observance, and the very tightest controls surrounding cosmogony – i.e., *Ma'aseh Bereshit*. In turn, as I demonstrate, this display of control over cosmogony in the texts to be examined ultimately reflects a concern about inquiries regarding what came before creation, the primacy of God and the Torah blueprint for the cosmos, and the perceived and presented inheritance of authority by the rabbis over key celestial spheres, and scientific practices connected to them on Earth.

Although my analysis focuses primarily on the Bavli, I also turn to related texts from the formative period of rabbinic Judaism when required to support my analyses of the Bavli.² While numerous other rabbinic texts, including the Yerushalmi, also contain astronomical content, my primary emphasis upon the Bavli is due to the enduring

² The Babylonian Talmud is the multi-volume commentary upon the Mishnah composed and redacted by generations of rabbis, beginning with its composition by Amoraim and redacted and finally closed by the seventh or eighth centuries. Supporting these texts and more fully extending my arguments are selected texts from the Mishnah, set down by the Tannaim after the destruction of the Second Temple in the first few centuries of the common era, the Tosefta, or supplements to the Mishnah, as well as carefully chosen selections from the exegetical stories of the Aggadic Midrash of this formative period in rabbinic Judaism. No attempt is made to ascertain the redactional layers from which the scientific material arises; key to this study is the preservation of this data in the Bavli as it has been preserved and transmitted.

centrality and richness of this anthological work in Jewish thought, and to its contributions to the subsequent development of scientific topics in rabbinic literature. Hence, debates concerning the cosmos and astronomical topics in the Bavli contribute significantly to the trajectory of the history of science in rabbinic Judaism. Indeed, numerous rabbinic commentaries regarding astronomy from the medieval period through the contemporary Orthodox milieu continue to rely upon astronomical sources found in the Bavli. As such, the interconnected astronomical *topoi* discussed and debated in the pages of the Bavli shed light upon the development and expression of astronomy in rabbinic literature from the Sasanian period onward.

Therefore, the intent in this analysis is not to prepare an exhaustive catalogue of the history of authority in science and astronomy throughout the rabbinic corpus, but to be strategic by analyzing the play of different types of rabbinic authority in the Bavli. In the introductory chapter to follow, I clarify my focus on the halakhic process and its relationship to the exercise of two key types of rabbinic authority upon the history of science, with the aim of underscoring the argumentation and authority claims found in the Bavli, and the ways in which these claims are used for political purposes rather than to affirm the primacy of the empirical sciences. As the Bavli builds upon the Mishnah, some analyses of selected mishnaic sources are a desideratum.³ I also cite several passages

³ The complexity of the Bavli's commentary upon the Mishnah is beyond our scope here. As Kalmin describes the matter, merely referring to the Bavli as a commentary upon the Mishnah is insufficient, as "the Bavli's discussions are based on scripture, Baraitot, or Amoraic statements, or consist entirely of sources whose connection to the Mishnah is fragile or artificial. (Kalmin, 2014, *Migrating Tales*, xiv)

from the Midrash Rabbah where relevant to my argument. (i.e., to demonstrate scientific awareness in rabbinic texts) This is my guiding principle with respect to text selection.

Returning to the lens through which the texts will be viewed, my analysis aims to examine the interplay between two forms of authority described in slightly differing ways by Avi Sagi and Michael S. Berger in the primary texts, namely, epistemic and deontic authority, the first form referring to the authority predicated on expertise in one or more knowledge domains, and the second, to authority based on position or status alone.⁴ In this study, my contention is that, due to the concern of Late Antique rabbis regarding their status as a marginal group vying for power within their host societies, as well as within rabbinic circles themselves, rabbinic texts related to celestial phenomena tend to favour and reinforce deontic authority.⁵ Due to the preservation of, and commentary upon, the Mishnah in the Gemara, much of this earlier layer is preserved in the Bavli, making the task of separating the Hellenistic and Sasanian scientific strata one from the other a challenge. However, my emphasis is upon the nuanced pattern of authority in the Bavli as it has been preserved and transmitted; while the redaction history of the scientific material may never be fully ascertained, the value of this study is in its presentation of recurrent power dynamics that reveal an informative pattern within the history of rabbinic celestial science.

⁴ As I will note in chapter one, the nuances of the epistemic-deontic conceptualizations lend themselves particularly well to an analysis of the reception of scientific phenomena in rabbinic Judaism, and it is this theory that most strongly informs the current analysis.

⁵ On the early rabbinic movement as a system of alliances and power relations between groups of rabbis, also see Catherine Hezser, 1997, *The Social Structure of the Rabbinic Movement in Palestine*. Tübingen: Mohr-Siebeck.

Deontic authority may be defined as the power vested in a particular status or position (e.g., the rabbinate, head of the *bet din*) – over epistemic authority, related not to the rabbinic station, but to mastery of specific forms of expertise or knowledge, such as scientific scholarship. As such, the framework of epistemic versus deontic authority is a particularly effective and useful hermeneutical lens through which to peer at the primary texts to be examined in chapters two through four.⁶ This is particularly true when analyzing the rabbinic self-presentation of the imperative to honour Torah scholars, and grant them exceptional privileges associated with celestial practices such as astrology, astral magic, and inquiries into the period prior to creation.

Upon demonstrating numerous examples of this nuanced play of both epistemic and deontic authority, and the primacy of the latter, in chapter two, on deontic authority over nature, and in chapter three, on its imposition over mathematical and calendrical precision, I turn to the most telling examples of deontic rabbinic self-presentation in chapter four, which spans more challenging – and potentially threatening – celestial *topoi*, including astral magic, astrolatry, astrology, and cosmogony. Here, the most closely guarded and tightly controlled source of deontic authority, cosmogony, emerges as a key focus owing to the direct relationship between creation, cosmology, and the authority that comes with the power to interpret the Torah account of creation. This is to say that

⁶ Here, I must also point to important contributions by Christine Hayes regarding the fascinating legal authority skirmish between R. Gamaliel and R. Joshua in *m. Rosb HaShanah* 2:8-9, dealing with rabbinic responses to threats to their authority. This will be more fully analyzed in chapter three, but also see Hayes, 2006, “Rabbinic Contestations Of Authority.” *Cardozo Law Review*, 28:1, 123-141; Eadem, 2004, “Authority and Anxiety in the Talmuds: From Legal Fiction to Legal Fact.” In Jack Wertheimer, Ed. *Jewish Religious Leadership: Image And Reality, Volume 1*. New York: JTS, 127-54.

the rabbinic claim to authority is in large part based on their interpretations of the purpose of creation being the imperative to establish rabbinic authority so as to implement God's cosmic Torah dictates on Earth. In essence, in the Bavli and related texts, the rabbis presented themselves as heirs of the creative power and agency bequeathed to them by God when the Torah was given to Moses. Indeed, as I demonstrate, the primacy of deontic authority over celestial *topoi* in the texts is strongly informed by early rabbinic discourses surrounding the created cosmos and its manifestation from Torah, the ultimate source and wellspring.

In the text-analytic chapters, I demonstrate that although epistemic authority associated with scientific expertise is expressed in the texts, it is the deontic tendency that emerges as the primary force shaping the expression of celestial topics in the Bavli. I demonstrate this exertion of deontic authority in a number of key rabbinic texts, beginning with its manifestation in chapter two, the *sugya*, or pericope, of *b. Bava Metzi'a* 59b, the story of the Oven of Akhnai, considered to be the *locus classicus* of rabbinic authority, in which nature and epistemic authority are overturned by the rabbinic exercise of deontic authority. Indeed, as Sagi has written, unlike epistemic authority, which may be viewed as provisional, “deontic authority must always be obeyed, even when apparently wrong.” (Sagi 2008, 200)

Due to its focus on the broader conception of deontic rabbinic authority with respect to nature and the heavens, and the overturning of epistemic authority, this *sugya* is then used to help unpack similar texts in chapters three and four related to the rabbinic

preoccupation in the texts with exerting deontic control over celestial topics. These include the strongly empirical topic of mathematics, so vital to the development of calendrics and predictive astronomy, as well as astral magic, astrolatry, astrology, and cosmogony.⁷ For example, calendar represents control over Jewish time and authority over the observance of festivals, rabbinic concerns regarding astrolatry and astral magic reflect similar concerns regarding appropriate modes of Jewish worship and proper respect toward God, and astrology is related to the prediction of Jewish destiny.

0.2 Interdisciplinary Rationale – the Gaps in the Literature

At this point, I underscore several central questions and assumptions underlying my interdisciplinary approach to both the primary and secondary literature. First, the question may well be asked – what is it about celestial topics that merits special emphasis through the lens of authority, as compared to halakhic topics also controlled by the rabbis, such as the laws of *Niddah*, *Kashrut*, and Torts, for example? The answer to this question brings us directly to the primary rabbinic texts, which reveal a discernible pattern of preoccupation with power and control in response to scientific expertise, or epistemic authority.

⁷ The inclusion of mathematics is critical to this analysis, as it is inextricably linked to mathematical astronomy, including calendrical computations such as intercalation. It is also emblematic of the empirical; a mathematical calculation must always be replicable and is demonstrably true. This serves to highlight the play of deontic authority as it relates to epistemic authority in chapter three, where even mathematical accuracy is overshadowed by *halakhab*. I examine this material in light of evidence for rabbinic access to mathematical and scientific ideas, if not outright awareness.

Indeed, my first assumption is that I contend that the celestial *topoi* are uniquely potent in the rabbinic imagination by means of their intrinsic connection to the heavens, creation, and cosmic law. However, as I also describe, with this potency comes a challenge and a threat to rabbinic authority, as empirical truth does not necessarily agree with halakhic truth. As such, another area of inquiry might well be how much authority the rabbis have to interpret and question the celestial sciences and God's cosmogonic and cosmological ordering principles. Moreover, is this authority shown to be equal to their rabbinic licence to subjectively interpret other laws, such as those of *kasbrut*? And when they are confronted with seemingly irrefutable empirical facts that oppose their goals, how do they respond in the texts?

As I demonstrate, the textual pattern is a response not based upon demonstrating scientific expertise, but upon extolling and elevating the primacy of the rabbinic station and its authority to overturn the empirical, even when it may easily be shown to be correct. I further highlight the ways in which these self-presentations in the texts may have served to reinforce the rabbinic project during its formative centuries, during which time the rabbis were a marginal group. (Schremer 2010, 321; Schwartz 2001, 120)

However, given the maintenance of the earlier stratum in the Bavli, this is a self-presentation that found itself preserved and largely upheld in the Talmud.

This tendency to elevate the rabbinic station itself is represented again and again in the texts. For example, I will note the primacy of deontic authority in the allowance of exceptions to bans related to celestial phenomena such as astrology, magic, and even

cosmogony, but only for rabbis of prestige.⁸ Moreover, I demonstrate the vital place of highlighting and maintaining the honour of the rabbis – and of God – particularly in the presentation of calendrical, mathematical, and cosmogonic texts. Finally, as I also emphasize, another dimension of the dynamics presented in these texts is that of rabbinic shows of authority. Rabbinic self-presentation and the sometimes quite dramatic show of deontic authority over the epistemic may, in a very real sense, go hand in hand.

A second question then suggests itself. That is, why view the discourses on the spectrum of celestial topics together? Indeed, astronomy/astrology, calendar development, astrolatry, astral magic, and cosmogony have been approached from numerous directions in the scholarly literature, with implications for the broader discourse of science in rabbinic Judaism.⁹ However, it cannot be overstated that rabbinic astronomy in the Late Antique context must not be examined anachronistically, using the lens of contemporary science in which astronomy and other celestial topics are bracketed and viewed separately from each other. Here, I point to the concern of Reed regarding anachronistic readings of late antique Jewish science, which have been used to advance contemporary scientific perspectives on the ancient Jewish sciences. (Reed 2007, 462) On this point, Reed calls for a focus upon the Late Antique contexts and points of view when working with these literatures. This forms my second assumption, for I am in

⁸ Deontic authority is linked to the rabbinic station, and to conceptions of elite status. This was a preoccupation of the early, emerging rabbinic movement in Palestine, in which non-rabbis also had access to Torah learning, as well as within the Sasanian context in which rabbis were not the only purveyors of wisdom to Jews.

⁹ See, for example, Norbert Samuelson, 1994, *Judaism and the Doctrine of Creation*. Cambridge: Cambridge University Press.

agreement that far too many studies incorporate ancient scientific concerns in ways that are ultimately used to support or serve as mere backdrops to contemporary arguments regarding Judaism and science. Nevertheless, with renewed scholarly interest in Late Antique rabbinic science, magic, astrology, cosmogony and other overlapping areas, it is hoped that a redoubled emphasis on sociohistorical context will inform future studies.

Indeed, perhaps the most notable aspect of the representation of Jewish celestial concerns in the primary rabbinic literature is that astronomy as such is rarely in itself the focus. Instead, the texts tend to reveal a great deal of overlap among celestial topics, making distinctions challenging at best. This is as true in the Bavli as it is in the Mishnah.¹⁰ As such, given the challenge of separating these areas one from the other in the Late Antique context, joint analyses may be fruitful and offer many benefits, such as the ability to move more closely toward putting our contemporary lenses aside and seeing the ancient celestial sciences with rabbinic eyes.

Earlier studies of these astral domains considered separately as discrete entities contributed to our understanding of the reception of these *topoi* in early rabbinic Judaism. However, upon examining the primary sources in their own right, a more complex picture emerges, highlighting the need for synthesis. Indeed, this is the first time that celestial and related mathematical concerns have been viewed together through the prism of rabbinic authority. In so doing, I aim to both highlight novel connections and to close

¹⁰ Although the emphasis in this study is upon the Bavli, a note is in order here regarding the choice to incorporate selected rabbinic writings spanning the Roman context commented upon in the Bavli where called for. This necessity comes into play, for example, in my analysis of the concept of the mage, or magi, and in the discussion of possible modes of transmission of scientific knowledge in chapter three.

this gap in the research, which spans both subtle constructs related to the epistemic and deontic dimensions of rabbinic authority and the history of astronomy in rabbinic Judaism.

The third assumption of this analysis is that the background to the history of Jewish astronomy in rabbinic Judaism is rich and vast, and hence, cannot be ignored in a study of this nature. This background literature is ultimately embedded in the significant body of literature pertaining to astronomy and celestial divination in the ancient Near East by authors including Francesca Rochberg, Erica Reiner, Otto Neugebauer, and John Steele, among others.¹¹ The primary astronomical literature simply mushrooms in the Second Temple period, with studies of the *Astronomical Book of Enoch* (*1 Enoch* 72-82),¹²

¹¹ Also see studies of Israelite astronomy and celestial content in the Hebrew Bible by John F.A. Sawyer (1972 and 1981), William Dever (1973), F.R. Stephenson (1975), H. Van Dyke Parunak (1978), Lawrence Zalcman (1981), Isak Cornelius (1990), Frans du T. Laubscher (1994), Ann Jeffers (1996), Anthony Aveni and Yonathan Mizrahi (1998), P. Kyle McCarter (2000), Ron Pirson (2001), Sara L. Gardner (2005), David R. Miano (2006), and Jeffrey Cooley, whose 2013 publication, *Poetic Astronomy in the Ancient Near East: the Reflexes of Celestial Science in Ancient Mesopotamian, Ugaritic, and Israelite Narrative* was the first recent study of its kind, enriching the fields of ancient Near Eastern and Jewish studies, as well as archaeoastronomy scholarship.

¹² While this is not intended to be a comprehensive listing of the manifold studies of the *Astronomical Book*, notable publications include Gabriele Boccaccini, 2002, "The Solar Calendars of Daniel and Enoch." In J. Collins and P.W. Flint (Eds.), *The Book of Daniel: Composition and Reception*. Leiden: Brill, Vol 2, 311-328; James H. Charlesworth, 1977, "Jewish Astrology in the Pseudepigrapha, the Dead Sea Scrolls, and Early Palestinian Synagogues." *The Harvard Theological Review* 70:3-4, 183-200 and James H. Charlesworth, James, 1987, "Jewish Interest in Astrology during the Hellenistic and Roman Periods." In *Aufstieg und Niedergang des römischen Welt*. Edited by W. Haase and H. Temporini. Berlin: W. de Gruyter, II.20.2, 926-950, both publications spanning the *Astronomical Book* and Qumran findings; Andrei A. Orlov, 2001, "Overshadowed by Enoch's Greatness: 'Two Tablets' Traditions From *The Book of Giants* to *Palaea Historica*." *Journal for the Study of Judaism* 32:2, 137-158; Idem., 2005, *The Enoch-Metatron Tradition*. Tübingen: Mohr Siebeck; Matthew Black, 1985, *The Book of Enoch or 1 Enoch: A New English Edition*. Leiden: E.J. Brill; Michael A. Knibb, 1978, *The Ethiopic Book of Enoch*, Vols. 1 & 2. Oxford: Oxford University Press; George W.E. Nickelsburg, 1981, *Jewish Literature Between the Bible and the Mishnah*. Philadelphia: Fortress Press; James C. VanderKam, 1984, *Enoch and the Growth of An Apocalyptic Tradition*. Washington, D.C.: The Catholic Biblical Association of America. Also see the magisterial 2005 volume, *Exploring Ancient Skies: An Encyclopedic Survey of Archaeoastronomy*, by David H. Kelley and Eugene F. Milone, which spans these periods. Nevertheless, its omission of numerous Jewish astronomical concerns that could have greatly enriched the publication is equally obvious to the trained eye.

and material of an astronomical/astrological, and calendrical nature found at Qumran,¹³ as well as astronomical narratives that portrayed biblical characters such as Abraham and Moses as magical/astrological heroes for apologetic purposes.¹⁴

¹³ On this rich and vast topic, the following key publications are illustrative but the list is by no means exhaustive: Matthias Albani, 1994, *Astronomie und Schöpfungsglaube: Untersuchungen zum astronomischen Henochbuch*. Neukirchen-Vluyn: Neukirchener Verlag; Matthias Albani, 1999, "Horoscopes in the Qumran Scrolls", In Peter W. Flint and James C. VanderKam, Eds., *The Dead Sea Scrolls After Fifty Years*. Leiden – Boston – Köln: Brill, 279-330; Martin G. Abegg, Jr., 1999, "Does Anyone Really Know What Time It Is: A Reexamination of 4Q503 in Light of 4Q317." In Donald W. Parry and Eugene Ulrich. *The Provo International Conference on the Dead Sea Scrolls*. Leiden, Boston and Koln: Brill, 396-406; Jonathan Ben-Dov and Stéphane Saulnier, 2008. "Qumran Calendars: A Survey of Scholarship 1980-2007." *Currents in Biblical Research* 2008, 7:1, 124-168; Jonathan Ben-Dov, 2008, *Head of All Years: Astronomy and Calendars at Qumran in their Ancient Context*. Leiden: Brill; Idem, 2011. "The 364-Day Year in the Dead Sea Scrolls and Jewish Pseudepigrapha." In John M. Steele, Ed. *Calendars and Years II: Astronomy and Time in the Ancient and Medieval World*. Oxford and Oakville: Oxbow Books, 69-105; Jonathan Ben-Dov, 2011, "The Qumran Dial: Artifact, Text, and Context." In J. Frey, Carsten Claussen, and Nadine Kessler. *Qumran und die Archäologie. Wissenschaftliche Untersuchungen zum Neuen Testament* 278; Tübingen: Mohr Siebeck, 211-237; Idem, 2012, "Lunar Calendars at Qumran? A Comparative and Ideological Study." In Jonathan Ben-Dov, Wayne Horowitz, and John M. Steele, *Living the Lunar Calendar*. Oxford and Oakville: Oxbow Books, 173-189; Ron H. Feldman, 2012, "Tame and Wild Time in the Qumran and Rabbinic Calendars." In Jonathan Ben-Dov, Wayne Horowitz, and John M. Steele, *Living the Lunar Calendar*. Oxford and Oakville: Oxbow Books, 191-209; Uwe Glessmer and Albani, Matthias, 1999, "An Astronomical Measuring Instrument from Qumran." In Donald W. Parry and Eugene Ulrich. *The Provo International Conference on the Dead Sea Scrolls*. Leiden, Boston and Koln: Brill, 407-442; Helen Jacobus, 2010, "4Q318: A Jewish Zodiac Calendar At Qumran?" In Charlotte Hempel, Ed. *The Dead Sea Scrolls: Texts and Context*. Leiden: Brill, 365-395; Mladen Popović, 2007, *Reading the Human Body: Physiognomics and Astrology in the Dead Sea Scrolls and Hellenistic-early Roman Period Judaism*; idem., 2011, "4Q186. 4QZodiacal Physiognomy. A Full Edition." In G.J. Brooke and J. Høgenhaven, Eds. *The Mermaid and the Partridge: Essays from the Copenhagen Conference on Revising Texts from Cave Four; Studies on the Texts of the Desert of Judah 96*. Leiden: Brill, 221-58; Idem., 2011, "Astrologische und magische Traditionen im antiken Judentum und die Texte vom Toten Meer." In S. Beyerle and J. Frey, Eds. *Qumran aktuell: Texte und Themen der Schriften vom Toten Meer*. Biblisch-Theologische Studien 120. Neukirchen-Vluyn: Neukirchener, 111–36; Francis Schmidt, 1998, "Ancient Jewish Astrology: An Attempt to Interpret 4QCRYPTIC (4Q186)." In Michael E. Stone and Esther G. Chazon, *Biblical Perspectives: Early Use and Interpretation of the Bible in Light of the Dead Sea Scrolls*. Leiden: Brill, 189-205; George Snyder Jr., 1997, "Mishmarot Calendars from Qumran Cave 4: Congruence and Divergence." Unpublished Doctoral Dissertation. Cincinnati, Ohio: Hebrew Union College – Jewish Institute of Religion; James C. VanderKam, 1998, *Calendars in the Dead Sea Scrolls: Measuring Time*. London and New York: Routledge; Michael O. Wise, 1994, "Observations on New Calendrical Texts from Qumran," in *Thunder in Gemini and Other Essays on the History, Language and Literature of Second Temple Palestine*. Sheffield; Sheffield Academic Press, 222–39; John J. Collins, 1998, *The Apocalyptic Imagination*. Grand Rapids and Cambridge, U.K.: William B. Eerdmans Publishing Company.

¹⁴ See, for example, Pablo Torrijano, 2002, *Solomon, The Esoteric King: From King to Magus, Development of a Tradition*. Leiden: Brill; Abraham Melamed, 2010. *Myth of the Jewish Origins of Science and Philosophy*. Jerusalem: The Hebrew University Magnes Press; Idem., 2012, "The Myth of the Jewish Origins of Philosophy in the Renaissance: from Aristotle to Plato." *Jewish History* 26, 41–59; Menahem Stern, 1974, *Greek and Latin Authors on Jews and Judaism*. (3 v.) Jerusalem: Israel Academy of Science; Annette Y. Reed, 2004, "Abraham as Chaldean Scientist and Father of the Jews: Josephus ANT. 1.154-168, and the Greco-Roman Discourse

It also bears mentioning that there is a nascent awareness in scholarship of evidence for some measure of connection between rabbinic astronomy, calendrics, mathematics, and earlier traditions, including Second Temple literature, with the caveat that research in this area is still in its early days.¹⁵ For example, I point to research into the transmission history of the celestial sciences, both to and within rabbinic Judaism, as well as from earlier periods and from other locations in the ancient Near East. Indeed, until very recently, toward the beginning of the twenty-first century, the trajectory in the scholarly literature has been to maintain that rabbinic astronomy and calendrical mathematics and their Second Temple and Mesopotamian antecedents existed in separate spheres.¹⁶ However, as but one counterexample, recent research efforts have begun to revisit strongly suggestive literary and calendrical connections between Second Temple and rabbinic literature. (Jacobus 2010; Swartz 2001; Reed, 199, 244-46) Clear evidence for the presence of Mesopotamian *materia medica* is also attested in the Bavli, sometimes in concert with astronomical/astrological content, demonstrating not only the fluidity of

About Astronomy/Astrology.” *Journal for the Study of Judaism* XXXV:2, 119-158. Also note the interplay of religion, science, astrology, and magic – a tight connection that leads to several of my own conclusions regarding rabbinic interpretations of astrology and astral magic in Late Antiquity.

¹⁵ Beyond our scope, but nevertheless indicative of the emergence of ongoing research into the transmission of the history of science, is recent research by Jonathan Ben-Dov regarding the transmission of Mesopotamian calendars to the Mishnah. See 2014, “Time and Culture: Mesopotamian Calendars in Jewish Sources from the Bible to the Mishnah.” In U. Gabbay and S. Secunda, *Encounters by the Rivers of Babylon*, Tuebingen: Mohr Siebeck, 217-254.

¹⁶ Note, for example, the opinion of Meir Bar-Ilan that “Rabbinic astronomy cannot be considered a continuation of earlier priestly concepts. Rabbinic astronomy began rather as a popular and practical occupation, with anti-priestly affinities, and only through generations of tradition did it gain a scientific value.” (Bar-Ilan 2004 “Astronomy”, 2038.)

scientific knowledge transmission in Late Antiquity, but the difficulty of making clear separations between domains that are now marked as scientific.¹⁷

While the precise modes of calendrical, astronomical, and mathematical transmission may never be known, these compelling findings shift the interpretive landscape, calling into question earlier assumptions regarding the place of early Jewish astronomy in rabbinic thought and the origins and evolution of the fixed Jewish calendar.¹⁸ Indeed, the move in Jewish studies toward the fuller examination of early Jewish astronomical and calendrical influences upon rabbinic scientific thought is an important one. Its articulation will shed light upon the rabbinic milieu, enhancing our understanding of both the transmission history of the sciences during this formative period of Judaism, and, one hopes, the reception of these sciences by rabbinic authorities.

The fourth underlying assumption of this work is that much remains to be unpacked and written about the rabbinic sciences. In addition to the secondary literature spanning the astronomical sciences in Second Temple Judaism, there has also been a very strong scholarly emphasis upon astronomy and Judaism in the medieval period, at which time Jewish astronomical study flourished.¹⁹ Given the existence of strong astronomical

¹⁷ Pertinent findings by M.J. Geller (1991, 2000, 2014) will be discussed at more length in chapter one.

¹⁸ On the nature and roles of Jewish calendrics, see Sacha Stern, 2001, *Calendar and Community: A History of the Jewish Calendar Second Century BCE-Tenth Century CE*. Oxford: Oxford University Press and Idem, 2012, *Calendars In Antiquity: Empires, States, and Societies*. Oxford: Oxford University Press.

¹⁹ During this period, Islamic scholars translated and absorbed Greek science, and there was interplay between Muslim and Jewish scholars. As a result, the primary and secondary literature on astronomy/astrology became similarly vast, encompassing the writings of such authors as Abraham Ibn Ezra, Nachmanides, Gersonides, Abraham Bar Hiyya, and studies of astronomical tables. The scientific writings of

concerns in the periods immediately sandwiching Late Antiquity, we might wish to question why there is a distinct narrowing of astronomical concern in the secondary literature spanning the rabbinic period. Indeed, to date, few studies on the history of science have focused upon the rabbinic period, leaving it under-researched. In his 1998 article, "On the Influence of 'Greek Wisdom': Theoretical and Empirical Sciences in Rabbinic Judaism", Giuseppe Veltri summarized the state of scholarship on rabbinic science as follows:

According to the mainstream of modern research in Late Antiquity sciences, Rabbinic Judaism is not considered a fertile field for pursuing anything of theoretical interest or about scientific development, but is regarded as, at best, a conglomeration of popular, magical and religious practices and beliefs. Scholars of the history of sciences tend to avoid dealing with these "dark" Middle Ages, claiming to find their appropriate object in the later golden age of the Jewish "mediation" of science, i.e., in the period extending from the Arabic conquest until the expulsion from Spain. (Veltri 1998, 300)

In a similar vein, in her 2007 article, "Was there Science in Ancient Judaism?"

Reed highlights the lack of scholarly focus on ancient Judaism and science. (2007, 462)

During the decade following the publication of this latter article, several scholars, including Reed, Noah Efron, Menachem Fisch, Jonathan Ben-Dov, and Mladen Popović, have aimed to fill this void. However, this is a new field within Jewish studies, and many areas remain unexamined. As such, this dissertation represents an original contribution to an emerging sub-field related to the history of science in the rabbinic period.

Maimonides, who both championed astronomy and calendar and engaged in sustained polemic against astrology, were voluminous.

0.3 Theoretical and Methodological Considerations

My approach to the primary texts is primarily text-critical, emphasizing close readings as seen through the lens of the authority theories and frameworks of Avi Sagi²⁰ and Michael S. Berger, the latter of whom sets out a “typology of justifications” for the authority of the early rabbis. (Berger 1993, 7) My base text for analysis is the Vilna edition of the Bavli, with additional editions brought in only where variant readings, additions, or omissions are of special interest to my analysis or shed further light on the reading.²¹ With the exception of other translations quoted in secondary sources, translations and paraphrases are my own.

My analyses of the Bavli are presented within its historical Sasanian context where known. Presented as it frequently is within the commentary of the Gemara on the Mishnah, the Roman context and its contributions to the celestial discourses inherited by the Bavli are also discussed with as much context as is possible and relevant.²²

I must also highlight the challenge of definitions with respect to the often nebulous terms “magic”, “religion”, and “science.” Operational terms for each of these

²⁰ Sagi, in turn, borrowed terminology from theorist from Richard T. De George, adapting it to the rabbinic context.

²¹ See Rabbinic Editions Consulted, p. xiv. My direct quotes from the Mishnah are from MS Parma, Biblioteca Palatina, De Rossi 138, as well as from within the Bavli.

²² On the presence of earlier Hellenistic Jewish and non-Jewish redactional layers in the Bavli, see, for example, Richard Kalmin, 2011, “Problems in the Use of the Babylonian Talmud for the History of Late-Roman Palestine: The Example of Astrology.” In Martin Goodman and Philip Alexander, Eds. *Rabbinic Texts and the History of Late-Roman Palestine*. Oxford: Oxford University Press/British Academy, 165-83; Idem., 2014, *Migrating Tales: The Talmud's Narratives and Their Historical Context*. Oakland: University of California Press; Daniel Boyarin, 2007, “Hellenism in Jewish Babylonia.” In Charlotte Fonrobert et al. Eds. *The Cambridge Companion to the Talmud and Rabbinic Literature*. Cambridge: Cambridge University Press, 336-63.

are by no means fixed, nor should they be, particularly with respect to our retrospective gaze at Late Antiquity, as pointed out earlier. Indeed, as Reed has rightly stated, there persists a tendency in scholarship “to overlay the modern dichotomy of ‘religion’ vs. ‘science’ upon other dichotomies common in the modern historiography of ancient Judaism, including traditional contrasts like Semitic vs. Greek, Near Eastern vs. Hellenistic, and Jewish vs. foreign. . .” (Reed 2014, 218)

In essence, the literature spanning each of these problematic terms, their overlaps, and their discontinuities, is enormous, and attempts to wrest clear definitions have loomed large in the religious studies and anthropological literatures. However, it is by no means my intention to establish clear definitions in this analysis; rather, my interest is in how the nexus of celestial concerns, including astral magic, tends to function within the rabbinic texts.

Early theories attempting to properly define “religion” and/or to set it apart from phenomena including “magic” and “science” have been articulated by numerous scholars, from the assertion of the primitive origins of religion and functionalist, need-based emphasis on the sacred by Émile Durkheim, and the definition, by Edward Burnett Tylor of religion as animistic, childlike supernatural belief, wherein belief in a deity persists as a “survival” now replaced by science. (Durkheim, 1915; Tylor, 1920) So too, in the writings of Friedrich Schleiermacher, the author describes religion as a feeling of “absolute dependence.” (Schleiermacher 1928, 16f) I also point to Clifford Geertz, who defined religion as “(1) a system of symbols which acts to (2) establish powerful,

pervasive, and long-lasting moods and motivations in men by (3) formulating conceptions of a general order of existence and (4) clothing these conceptions with such an aura of factuality that (5) the moods and motivations seem uniquely realistic.”

(C. Geertz 1993, 90)

As Dorothy Hammond rightly pointed out in her 1970 article, “Magic: A Problem in Semantics”, earlier anthropological theorists tended to view magic as distinct from religion, even though there was some overlap between these spheres. Nevertheless, Hammond herself envisioned magic as a subset of religious practices, continuing a pattern of reification. Much current scholarship has moved away from reified views of “religion,” “science”, and “magic” in favour of more sophisticated social systems-based theories.²³

With such nuance and context in mind, I find the approaches of both Rebecca M. Lesses and Kimberly B. Stratton to be most useful in illuminating the functions and uses of magic in antiquity, as well as the challenges related to the frequent reification and universalization of the term and its use to marginalize others.

More to the point with respect to the relationship between magic and rabbinic authority, Lesses underscores the function of magic ritual as ritual performances used to

²³ See also Reed’s cautious approach to these terms and the Jewish sociohistorical context. As she writes, “Here as there, my focus shall be less on the place of Judaism within the history of science, and more on the place of ‘science’ in the history of Judaism. Accordingly, I shall not be concerned to argue for this or that Jewish text as ‘really scientific,’ whether by the standards of non-Jewish cultures of the past, or by the standards of modern ideals of rationalism, empiricism, secularism, or progress. (Reed 2014, 198)

gain power. (Lesses 1998)²⁴ Stratton further frames magic as a social discourse – that is, as “a socially constructed body of knowledge that is enmeshed in and supports systems of power.” (Stratton 2012, 246) Here, in a vein reminiscent of Bronisław Malinowski, magic does not consist of universal practices that can be easily defined, “but as culturally specific ideas about illegitimate and dangerous access to numinous power, whose applications need to be considered on their own terms in order to understand the work they do in their respective societies.”(245)²⁵ Informed by the concepts of discourse described by Michel Foucault, Stratton points to magic as “a socially constructed object of knowledge that has a specific history and origin.” (247)²⁶ Of note to my discussion of the relationship between astral magic and deontic authority in chapter four is the centrality of power and domination within this socially constructed knowledge discourse. (Stratton 2012, 247, citing Foucault 1979, 27) Indeed, the situation of magic at the centre of power struggles within rabbinic circles is at the core of our discussion of astral magic.

In like fashion, the definition of “science” is embroiled in the history of religion and science, which, as David B. Wilson expresses the matter, “has been a contentious subject.” (Wilson 2000, 2) Between the 1970s and the contemporary period, scholarship

²⁴ In essence, magic defined as ritual shows of power. As I will demonstrate, with respect to astral magic and related celestial topics and the assertion of deontic authority, performance and show are also components of the process.

²⁵ That is, Malinowski’s emphasis on practices or rituals being framed within their proper social contexts. Indeed, Malinowski viewed magic and religion not as easily defined, discrete categories, but rather, a practice could be defined as “magical” if it was designed to effect short-term results, and “religious” if the goal was longer-term, or aimed toward a more general goal such as the prosperity of a village. See Bronisław Malinowski, 1925, *Magic, Science and Religion and Other Essays*. 1948 Reprint. Long Grove, Illinois: Waveland Press.

²⁶ See also similar contextualization in specific sociocultural milieus with respect to women and witchcraft in Kimberly B. Stratton, Dayna S. Kalleres, 2014, Eds. *Daughters of Hecate: Women and Magic in the Ancient World*, Oxford and New York: Oxford University Press, 3 *et passim*.)

has seen the rise and fall of the notion of outright conflict between religion and science, to be replaced by more nuanced, complex analyses. (Ibid., 8-9) The question of the demarcation of religion from science has, nevertheless, been a concern of contemporary theorists, including philosophers of religion and science, who, according to Stephen C. Meyer, “generally recognize that science and religion do represent two distinct types of human activity or endeavor. Most acknowledge that they require different activities of their practitioners, have different goals, and ultimately have different objects of interest, study, or worship.” (Meyer 2000, 19)

This has led some theorists to suggest demarcation schemes ranging from outright compartmentalization to complementarity. These theoretical constructs neither allow for conflict nor agreement between religion and science, because they are simply non-overlapping domains with no shared realms of experience. (19) Indeed, while it is possible to define the term “science” on its own terms from a contemporary perspective, by underscoring the primacy of the scientific method, as Reed expresses it, “even today, ‘science’ is far from a monolith, bearing coherence and unity mainly as an ideology shared by multiple distinct disciplines.” (Reed 2014, 200)

Moreover, relationally speaking, when it comes to the points of potential connection between science and religion, there is no scholarly consensus.²⁷ Additionally, the need to avoid anachronistic interpretations of the early sciences of Late Antiquity,

²⁷ For a glimpse of these definitional challenges and debates, also see Seth L. Sanders, 2014, “I Was Shown Another Calculation”, 88, and a response to Sanders by Loren Stuckenbruck, “Philological and Epistemological Remarks on Enoch’s Science”, in which Stuckenbruck addresses what he perceives as Sanders’ casual usage of the term “science”, which he considers epistemologically problematic in the ancient context. (Stuckenbruck, 104)

and in specific locations at specific times, further complicates and confounds any real attempt to establish a universal definition of “science” in the rabbinic context.

With definitions of religion, science, and magic being as fluid as they are, the follow-up question, that of taxonomy, becomes exponentially more problematic. To highlight one example among many, scholarship to date has tended to define and categorize astronomical and astrological materials in early and rabbinic Judaism according to their relationship to calendar, or in accordance with time periods and literary genres.²⁸ In the strictest sense, as Jeremy Black and Anthony Green define – and reify – the terms, “astrology refers to observation of the movements of astral bodies with a view to divination of the future thereby, as opposed to astronomy” which is value-neutral. (Green and Black, 36) However, as I have described, the demarcation between the fields of astronomy and astrology was far from clear in antiquity (Rochberg 2004, 11). Similarly, as Reed points out, it is at least as difficult to distinguish “religious” and “scientific” concerns in the ancient context. As well, within the context of early Judaism, the study of God’s creation under the rabbinic rubric of *Ma’aseh Bereshit* also links celestial science and religion each with the other. (Reed 2007, 463)

In light of these definitional and taxonomical challenges, and with the intention to avoid reification or anachronism as much as possible, I follow the example of Reed, whose general preference is to use the blended term astronomy/astrology to more

²⁸ Evidenced by the large body of scholarly literature on the apocalyptic tradition, specifically upon the *Astronomical Book of Enoch* (1 *Enoch* 72-82). Also see the burgeoning research on astronomy as applied to calendrics, by Sacha Stern, Stéphane Saulnier, Jonathan Ben-Dov, Gabriele Boccacini, Y. Tzvi Langermann, Helen Jacobus, and others.

accurately and carefully represent the complex of celestial concerns and practices in the ancient Near East, as well as the Second Temple and rabbinic periods, unless the distinction between astrology and astronomy is obvious.²⁹

Where appropriate to our analysis, and further demonstrating the fluidity of the terms at hand, I also choose to consider astrology as a subset of the larger set or category pertaining to magical practices, though there is no clear-cut or uniform view of this taxonomy in scholarship. Indeed, numerous scholars, including Kocku Von Stuckrad (2011 “Astral Magic”, 247, 251 *et passim*) and Veltri (1998 “The Rabbis and Pliny”, 64) view and analyze the categories of “astrology” and “magic” together, and support the placement of divinatory practices such as astrology either within the broader category of ‘magic’ or as significantly overlapping with it. However, another trend in scholarship urges that a distinction be made between magic and astrology in antiquity (Bar-Ilan 2002 *Sympathetic Magic*, 384), as astrology was held to be scientific. Gideon Bohak has chosen to hone in on “magical texts and artifacts” to what he sees as the necessary exclusion of related, but non-intrinsic “occult” sciences, including astrology, which he categorizes as divinatory.³⁰ This distinction between magic and astrology, then, brackets astrology within the purview of divination. In turn, for Bohak, divination is a subset of the “occult sciences” differing from “magic” due to his view that magical technologies and occult

²⁹ As I will demonstrate in my later discussion of the rabbinic material, however, this conflation of astronomy and astrology – and hence, magical concerns – within the ancient context, may have served as one of several key trends affecting the role and status of astronomy in rabbinic Judaism.

³⁰ Not all scholars share this view – for example, where Bohak sees astrology as divinatory, and Bar-Ilan sees astrology and magic as distinct, numerous other scholars see magic, divination, and astrology as part of a similar process. Bohak does mention that magic and astrology were sometimes performed by the same practitioners (2008, 4), and later, he describes the rabbinic story of the magician Amaleq, who was also an astrologer. (Idem., 365)

domains were distinct disciplines practiced by different people, with only accidental overlap (Bohak 2008, 4 *et passim*) As I demonstrate in this analysis, however, celestial texts that may be bracketed as magical and astrological overlapped significantly in the Bavli, and both were known, performed, and described by the rabbis themselves.³¹ Indeed, as Georg Luck has described, magical activities earlier in antiquity had generally been performed by a single individual, with their systematization and differentiation taking place later on in antiquity, with a strong push toward systematization during the Hellenistic era. (Luck 2006, 14; cited in Alexander 2005, 8-9.)

On a related note, comment is in order regarding the exclusion of mystical texts when addressing astral magic and cosmogony as these are presented in the Bavli. Certainly, authority plays itself out in varying ways in the mystical literature dated to Late Antiquity, including the *Merkavah* literature. As Gideon Bohak notes, there was no definitive or substantive connection between Jewish magic and mysticism in Late Antiquity:

In circumscribing these contacts, we certainly should not assume that Jewish magic and Jewish mysticism flowed from the same source or that one was a by-product of the other. It seems quite clear that these were independent activities, with different aims and methods and often performed by different people. On the other hand, there clearly are cases where non-Jewish magical technology, which is so visible in the Jewish magical texts, also entered the Hekhalot literature, and there seems to have been some transfer of esoteric knowledge from the Jewish mystics to the Jewish magicians as well. Future research, and especially the study of hitherto unpublished Jewish magical and mystical texts, will no doubt shed more light on these processes, but for the time being we may conclude that although late-antique Jewish magic and mysticism did not stem from the same social circles, and did not share the same body of knowledge, they did not hesitate to borrow each other's technical innovations

³¹ Moreover, both magical and astrological motifs may be found on amulets and in magical inscriptions dating to Late Antiquity, lending credence to the scholarly view that astrology and magic were often performed by the same practitioners.

when these were deemed useful for their own aims and needs. (Bohak, 2008. *Ancient Jewish Magic*, 339)

In a similar vein, Alon Goshen Gottstein argues that although *Ma'aseh Bereshit* and *Ma'aseh Merkavah* are described together in the admonitions found in *m. Hagigah* 2.1, these interdictions do not represent the same literature. (Goshen Gottstein 1995, 200-201) As such, my analysis of the literature on cosmogony and *Ma'aseh Bereshit* focuses upon its relationship to authority establishment and maintenance. The *Hekhalot* literature and astrological texts including *Sefer Yezirah* are beyond the temporal scope of this study due to their medieval dating. Moreover, works dealing with angels, demons, and adjuration by wonder workers are also beyond my purview, as they provide no immediate or logical context for my analysis of astral magic.

Finally, with respect to both the avoidance of anachronism when gazing backward at the ancient celestial sciences, broadly conceived, and the definitional and taxonomical challenges described here, I briefly underline a classification challenge related to the conflation of astronomy and astrology in the ancient context, leading to astronomy becoming embroiled in the controversial discourse surrounding astrology, astrolatry, and astral magic in rabbinic Judaism – a taxonomical quandary I term *category ambivalence*. This category ambivalence imbues astronomy with some of the perceived dangers of astrology and associated practices. I will return to this idea and its import to future studies in the concluding chapter of this analysis.

0.4 Overview of Chapters

In chapter one, the literature review, I review the relevant scholarly celestial topics and their relationship to authority in order to establish a foundation for my text analyses in later chapters and demonstrate the contribution of this study. I begin by acknowledging relevant secondary sources on general and rabbinic theories of authority that best frame the sources on rabbinic authority found in chapters two through four. I then turn to the more nuanced theories of epistemic and deontic authority that inform my analysis. This is followed by a review of the relevant existing literature on celestial *topoi*, addressed in chapters two through four, as well as evidence for both their transmission to the Bavli and for rabbinic access to this knowledge.

Upon addressing the vital question regarding what the rabbis of the formative period of Judaism may have known about the sciences, I survey the compelling evidence for rabbinic access to Mesopotamian and Greek learning on nature, rabbinic medicine, mathematics, astronomy, healing omens and techniques, and other scientific fields. For example, included is research conclusively demonstrating rabbinic awareness of Mesopotamian astronomy and medicine by virtue of Akkadian terminology preserved in the Bavli.³² Further support for rabbinic knowledge of these sciences is brought from aggadic midrash, in *Gen.Rab.* 6:8, in which an awareness of, and active interest in, Mesopotamian and Hellenistic science are displayed. Moreover, the rabbis were aware of the completion of a square using a gnomon, a Greek technique. The cumulative evidence

³² Indeed, rabbinic interest in healing is both closely connected to magic and astrology, and illuminates the interest of the Tannaim and Amoraim in the Mesopotamian and Hellenistic sciences where these serve rabbinic agendas.

is suggestive of the likelihood that rabbis would have had some access to Roman and Sasanian science and mathematics if they chose to seek it out.

Given the evidence for access to scientific knowledge, the question then becomes how we might explain the disjointed rabbinic style of engagement with the celestial sciences and mathematics. That is, what may have led to their lack of mathematical precision – most tellingly displayed by the rabbinic rounding of π to 3? Was it due to an actual lack of knowledge or a need for only the most practical or applied forms of scientific knowledge as some scholars assert, or was it due to outright dismissal and devaluation of such knowledge? I then highlight the related scholarly debates surrounding the hotly debated topic of ‘the rabbinic mind’, the propensity of this purported mindset toward scientific thought, and the alleged relationship of this mode of rabbinic thought to the development of science during the rabbinic period.³³

Next, I review the literature on tightly controlled celestial topics including astrolatry, astral magic, cosmogony, and astrology, as well as rabbinic calendar development. Each is presented in various ways in the disparate secondary sources as mediators of cosmic power, from rabbinic attempts to control the calendar in third and fourth century Palestine to the continuing political calendrical struggles related to the maintenance of status manifested in the Bavli. Similar struggles are demonstrated with respect to rabbinic attempts to control solar worship among Palestinian Jews, and this concern is shown to persist into the Sasanian context, which was aniconic, unlike

³³ See Jacob Neusner, 1988, “Why No Science in Judaism?” *Shofar* 6:3, 45-71; Annette Y. Reed, 2007, “Was There Science in Ancient Judaism? Historical and Cross-Cultural Reflections on ‘Religion’ and ‘Science.’” *Studies in Religion* 36:3-4, 461-495.

Parthian society, posing certain questions for scholars of rabbinic Judaism. A key theme that emerges in the survey of the secondary literature, and in my later text analyses, is that there is no single view of astrolatry, calendar, astral magic, astrology, and cosmogony in the Bavli. Rather, a series of perspectives are displayed in the text dependent on and subject to authoritative judgments by the rabbis.

Moreover, as I also point out, these judgments shift and easily provide space for exceptions to all rules related to celestial control, but again, only for rabbis of great prestige, or in order to support existing deontic authority structures. Despite admonitions against astrology in a number of rabbinic sources, for example, astrology is nevertheless utilized as a means of selecting the head of the *bet din* (Rubenstein 2012, “Astrology”). So too is the domain of *Ma’aseh Bereshit* very tightly controlled, with clear exceptions for rabbis of high (deontic) status.

In chapter two, the first text-analytic chapter of three, I begin my analysis by examining rabbinic approaches to the created natural world in the Bavli in order to properly frame the subsequent chapters related to the created celestial realm. Here, I establish the groundwork for chapters three and four by examining the key literature to date on the rabbinic views of, and imagined authority over, nature, including the heavens. Highlighted is the potent motif of the rabbis as not merely inheritors of the mantle of ongoing creation in the natural world – but perhaps even more importantly, their claim in the texts to the divinely appointed right to pass judgment over and interpret natural phenomena as manifestations of God’s cosmogonic and cosmological ordering principles

on Earth as in the heavens. This broader approach to nature serves to frame my subsequent analysis of rabbinic control asserted over the topics of cosmogony and its creation of an overarching, unfolding cosmic order. This frames a richer presentation of similar rabbinic perceptions of the heavens in the Bavli. Here, as I will demonstrate, the cosmos orient themselves to support Torah law.³⁴

My text analysis in this chapter focuses upon the *sugya* of the Oven of Akhnai in *b. Bava Metzi'a 59b*, which presents a show of rabbinic authority as it relates to nature and deontic rabbinic control over it. This *sugya* is then used to help unpack more specific expressions of the exercise of deontic authority in the celestial *topoi* analyzed in the following two chapters. The beginning of the theme of public display of deontic authority is also broached in this chapter, in which the laws of nature are subverted, and epistemic authority and empirical knowledge are overturned, and an epistemic authority, R. Eliezer, is shamed in a very public way, in favour of the primacy of deontic authority.

In chapter three, I present evidence for the existence of astronomy and mathematics in rabbinic settings, suggesting transmission from foreign cultures, as well as access to these sources on the part of the rabbis, if not outright awareness of them. Further, I present primary texts demonstrating the clear devaluation of astronomy, calendar, and mathematics in favour of what may be termed *halakbic truth*. I further reinforce this devaluation by analyzing rabbinic texts that merely approximate the value π rather than seeking and using the more precise figures accessible to the rabbis. I highlight

³⁴ Rabbinic hermeneutics to this effect are demonstrated in *b. Nedarim 39b*.

the same pattern in primary texts in the Bavli and related literatures that present the assertion of deontic rabbinic authority over astronomical/calendrical expertise and epistemic authority.

Here, it must be noted that mathematics is key to the question of rabbinic deontic authority for several reasons. First, it is the mediating science between astronomy and calendar, hence its inclusion in this analysis. Second, it is emblematic of the empirical. Mathematics is not subject to the vagaries of opinion, rabbinic or otherwise. Whatever the political agenda at hand, π is always π . However, as the analysis in chapter three makes clear, the peripheral and devalued role of mathematics and astronomy may be found in rabbinic statements such as that in *m. Avot* 3:18, where we read that the laws of *Qinnim* (bird offerings) and *niddah* (laws of the menstruant) are the core laws, whereas astronomy and mathematics are mere “seasonings” of wisdom.

The analysis of *b. Hullin* 95b and *b. Berakhot* 63a found here also clearly underscore the repeated presentation of the rabbi who knows *halakhot* related to such matters as the laws of *kasbrut* as being far greater than one who knows how to intercalate the calendar and fix new moon dates. Finally, I analyze *b. Rosh HaShanah* 25a, a *sugya* which may be seen as a more specific astronomical and calendrical counterpart of *b. Bava Metzri'a* 59b, in which deontic authority very clearly overturns epistemic authority related to astronomical and calendrical calculations – again, shaming the epistemic authority in a very public manner that creates a show of deontic authority – a display intended to clearly demarcate and reinforce or establish rabbinic authority by virtue of status.

Chapter four brings the analysis to a close, with an emphasis upon celestial *topoi* generally marked as either banned or well controlled. Here, I demonstrate the ways in which rabbinic presentations of astral topics, including astral magic, astrolatry, astrology, and creation serve as markers of rabbinic deontic authority, with special emphasis upon cosmogony and the tightly controlled study of *Ma'aseh Bereshit*, marked as the earliest expression of God's own deontic authority over the cosmos and its unfolding into other celestial topics.

In order to accomplish this, I analyze rabbinic primary texts spanning astrolatry and punishment (*b. Avodah Zarah* 42b-43b; *b. Sukkah* 29a), astral magic (*b. Shabbat* 75a; *b. Ta'anit* 23a), astrology (*b. Shabbat* 156a-b; *b. Pesahim* 113b; *b. Sukkah* 29a, *b. Berakhot* 64a, and other sources), as well as rabbinic control over cosmogony (*b. Hagigah* 11b-13a). Here, the themes of punishment and reward – whether actually meted out or presented in the texts for rhetorical effect – for halakhic obedience and virtue in connection to the heavens are strongly highlighted. For example, the punishment indicated in *b. Sukkah* 29a for showing disrespect to the head of the *bet din*, a rabbi of prestige, is a solar eclipse, emblematic of the heavens being out of their proper order, thus mirroring a lack of proper honour shown to an elite rabbi on Earth.

In my analysis, I also note a pattern of exceptions made for high ranking rabbis who are permitted to perform magic in the Bavli due to their status, as well as for Honi, the Circle Drawer, in *m. Ta'anit* 3:8b and *b. Ta'anit* 23a, whose special, deontic status before God allowed him to perform public acts of astral weather magic without suffering

the normal repercussions alluded to in the texts. I also demonstrate a tellingly similar pattern of admonitions or ambivalence toward astrology paired with its usage – or the presentation of its usage – to consolidate deontic rabbinic authority in the *bet din*.

Nevertheless, as I also note in *b. Shabbat* 156b, the observance of *halakhab* – and hence, obedience of rabbinic law – ultimately serves as a means of protection against the dangers of astrology. The implication is clear: If halakhic observance protects against negative astrological forecasts, how much more so does the virtue of the rabbinic station?

Also included within this chapter are text analyses and discussions of the peculiar play of deontic authority that spans cosmogony, and exceptions for rabbis of prestige to the rule against delving into the question of the time prior to creation. Once again, as I demonstrate through my analysis, in the Bavli, celestial topics are tightly bound with the primacy of God's creation, and the unfolding of this created natural world based upon the blueprint of Torah law. As I also demonstrate, this rabbinic self-presentation in the texts also manifests itself in attempts to control worship (e.g., astrolatry) and astral magic, and establish authority over the destiny of Israel and the ability to discern such a destiny (e.g., astrology). Indeed, as I demonstrate through my analysis in this chapter, these celestial topics, connected as they are to God's creation and hence, to the remaining interconnected celestial topics, are powerful mediators of authority.

In my concluding chapter, I discuss the ways in which the celestial topics presented are used to overturn epistemic authority and consolidate the deontic rabbinic authority that, in the rabbinic imagination, ultimately stems from God's cosmogony in

Genesis. This, I submit, was a means of consolidating status in the texts in the face of social and political contexts where rabbis were competing with other sources of wisdom and authority also favoured by Jews.

However, paradoxically, the laws of nature and the cosmos set in motion by God's creation are relegated to a lesser status than rabbinic legislation. We see this unpacked in the deontic victory over the empirical laws of nature in *b. Bava Metz'i'a* 59b, and in the astronomical and calendrical *sugya* of *b. Rosh HaShanah* 25a, as well as in numerous examples in which mathematical precision can be shown to be devalued in the Bavli. I reiterate the importance of these devaluations of the empirical in light of evidence presented for likely awareness of, and access to, empirically correct scientific values. In the texts we have examined, then, it is clear that celestial topics are received and employed not merely to describe the natural world, but to support the self-presentation of rabbinic status and the rabbinic project as the primary areas of focus, and the natural world and the empirical sciences describing it as secondary.

Here, I also articulate the concept of category ambivalence, the unavoidable taxonomical confusion that arises due to the enmeshed nature of the celestial *topoi* at hand, particularly astronomy/astrology, which brings the taint of astral magic into rabbinic thinking about the skies. As I more fully describe, where there is perceived threat, deontic rabbinic authority tends to be invoked and presented in the texts. We see the pervasive nature of this response to threats to deontic authority in the Bavli, where rabbinic anxiety regarding astrolatry, particularly solar worship and its icons, is present

despite the aniconic tendency of the Sasanian period.³⁵ I further explain the consequences of category ambivalence for the scholarly study of astronomy and astrology in rabbinic Judaism, and suggest two ways of softening its impact. Next, I describe and analyze some of the key implications of this power dynamic. For example, ways in which deontic authority mediated by these celestial topics has helped to shape rabbinic views of the cosmos, broadly conceived, and more specifically, through the prism of the scientific *topoi* described in this study.

Finally, I note the ways in which historians of science, and scholars of both ethnoastronomy and Jewish studies, might come to address the gap that exists in the secondary literature related to scientific expressions in rabbinic literature, and more pointedly, to the history of astronomy in rabbinic literature. I conclude with possible directions for future research.

³⁵ On rabbinic anxiety toward threats to their authority, also see Christine Hayes, 2006, "Rabbinic Contestations Of Authority." *Cardozo Law Review*, 28:1, 123-141; *Eadem*, 2004. "Authority and Anxiety in the Talmuds: From Legal Fiction to Legal Fact." In Jack Wertheimer, Ed. *Jewish Religious Leadership: Image And Reality, Volume 1*. New York: Jewish Theological Seminary, 127-54. On rabbinic anxiety in the Sasanian context, see Richard Kalmin, 2008, "Idolatry in Late Antique Babylonia: The Evidence of the Babylonian Talmud." In Yaron Z. Eliav, Elise A. Friedland, and Sharon Herbert, Eds. *The Sculptural Environment of the Roman Near East: Reflections of Culture, Ideology, and Power*. Leuven and Dudley, MA: Peeters, 629-57.

Chapter One: Prior Scholarship – A Foundation for Synthesis

“You shall fear the Lord your God!— this includes Torah scholars.”
-b. Bava Qamma 41b

1.1 Rabbinic Authority and the Celestial Sciences: Overview and Relevance

As noted in the introduction, rabbinic presentations of astronomy often encompass numerous celestial *topoi* related to the observation, study, and awe of the skies. Natural extensions of these topics also found in the Bavli include the broader context of rabbinic responses to the natural world, as well as mathematics, which is indispensable to Jewish calendar development. These contexts, both natural and numerical, support the scientific frame for our analysis of rabbinic astronomy and authority, for as my later analyses of relevant primary sources will reveal, the rabbis’ control-oriented responses to nature and empirical knowledge serve to determine and shape the directions taken by astronomical topics in rabbinic literature. This is particularly highlighted and framed by studies demonstrating rabbinic access to mathematical and scientific information, leading to the question: What motivated them to consistently overrule the epistemic authority of science and mathematics?

The aim of this review of scholarship is to survey the key research to date pertaining to Jewish celestial topics in the Bavli, and where appropriate, scholarship regarding rabbinic control over these spheres. Given the presentation of these topics as distinct in previous studies of Judaism and astronomy, my inclusion of these studies serves to situate my own unique contributions in which I analyze the play of deontic

authority through a variety of celestial lenses seen together, and highlight the recurrent pattern of deontic authority and the assertion of rabbinic control in the primary texts. Here, I provide an overview of the relevant trends and threads that may be found in the secondary literature to date, beginning with a presentation of the theories of authority that inform my analysis.

As mentioned in the introduction, the relationship between God and celestial *topoi* (i.e., the heavens) assigns them particular potency when serving as mediators and conductors of deontic rabbinic authority in the Bavli, with cosmogony reigning supreme due to the rabbinic claim to the mantle of Torah and God's creation, and their continuation of this mandate on Earth. As such, rabbinic interest in and control over celestial topics in the Bavli is recurrent and persistent. Their interest in not only creation, but observational astronomy, astral magic, astrolatry, and astrology may ultimately be discerned as expressions of an overarching concern regarding control over time and space.

By rabbinic *authority*, and this must be stressed, I refer to several interconnected concerns, including the sages' appeal to tradition³⁶ and the Divine revelation of the dual Torah, both written and oral, the authority of the Torah text and its rabbinic

³⁶ For an examination of the rabbinic claim to transmitted authority and tradition, see Albert I. Baumgarten and Marina Rustow, 2011, "Judaism and Tradition: Continuity, Change, and Innovation" In Ra'anan Boustan, *Jewish Studies at the Crossroads of Anthropology and History*. Philadelphia: University of Pennsylvania Press, 207-37.) A general analysis of the limitations of rabbinic authority is provided in Eli Turkel, 1993, "The Nature and Limitations of Rabbinic Authority." *Tradition* 27:4, 80-99. For broader historical perspective on the boundaries of dispute beyond which even the most authoritative rabbi may not tread, see Marc Angel, 1990, "Authority and Dissent : a Discussion of Boundaries." *Tradition* 25:2, 18-27.; A brief treatment of dissent in the Babylonian Talmud may be found in David Daube, 1971, "Dissent in Bible and Talmud." *California Law Review* 59, 784-794.

interpretations, the binding force of *halakhab*, and the formation and maintenance of rabbinic expertise.³⁷ These conceptions take us beyond dated models of authority as mere conformity to orders imposed from above, or the exertion of one-way standards imposed on a population of believers.³⁸

The question of rabbinic authority has been broached by numerous scholars and from diverse perspectives, including studies of charismatic authority based on the strength of individual rabbinic personalities, the gendering of authority, rabbinic authority and the body, and the consolidation of early rabbinic authority. Several key recent studies include: Charlotte Elisheva Fonrobert, *Menstrual Purity: Rabbinic and Christian Reconstructions of Biblical Gender* (2000), describing the formation of rabbinic knowledge of gynaecology based in part on Greco-Roman medicine in light of the rabbis' halakhic authority; *Execution and Invention: Death Penalty Discourse in Early Rabbinic and Christian Cultures*, by Beth A. Berkowitz (2006), which argues that both Christians and early rabbis made use of death penalty discourse to establish their authority; and *The Memory of the Temple and the Making of the Rabbis*, by Naftali S. Cohn (2013), arguing that the rabbinic authors of the Mishnah focused on the Temple in their writing in order to establish and bolster their authority during the formative period of rabbinic Judaism.³⁹

³⁷ On medieval and later interpretations of the chain of transmission from Sinai as stated in *m Avot* 1:1, and its conferral of authority to the rabbis and their office, see G.J. Blidstein, 1998, "Mishnah *Avot* 1:1 and the Nature of Rabbinic Authority." In *Judaism and Education*. Beer-Sheva: Ben-Gurion Univ of the Negev Press, 55-72. On the matter of rabbinic expertise as expressed in the Babylonian Talmud, for example, see Tzvi Novick, 2007, "A Lot of Learning is a Dangerous Thing: On the Structure of Rabbinic Expertise in the Bavli." *Hebrew Union College Annual* 78, 91-107.

³⁸ See, for example, Samuel S. Cohon, 1936, "Authority in Judaism." *Hebrew Union College Annual* 11, 593-646.

³⁹ Fonrobert, 2001, "When Women Walk in the Way of Their Fathers: On Gendering the Rabbinic Claim for Authority", *Journal of the History of Sexuality* 10:3/4, Special Issue: Sexuality in Late Antiquity, 398-415; for a

Other analyses of rabbinic authority are grounded in the primary texts themselves.

As Charlotte Fonrobert describes the latter form:

Anyone who comes to read books or study texts does so within a specific, culturally determined psychological or emotional context, particularly in the case of religious or canonical texts that are claimed to be foundational by religious communities. Such texts are never just part of the distant past, long since gone. They continue to structure reality and to form ways to look at the world. Rabbinic literature is canonical in that it has been foundational to Jewish culture throughout its history since the destruction of Jerusalem. It makes claims on its students and constructs a voice of authority. These texts have a continuous life, down to the present, and are used and abused to justify structures of authority, as well as to critique such structures. (Fonrobert 2000, 2-3)

Indeed, over the past few decades, numerous scholars, including Steven Fine and Jacob Neusner among them, have presented the sweeping paradigm of rabbinic authority deriving from the Torah alone.⁴⁰ As Steven Fine points out in his 1998 article, “This is the Torah that Moses Set Before the Children of Israel: Scripture and Authority in Rabbinic Judaism,” the crux of authority and Scripture is encapsulated in the revelation of the Torah by God to Moses, and thence, to the Children of Israel, in Numbers 9:23. (Fine 1998, “This is the Torah”, 523) In the same vein, Neusner sums up the matter of the authority of the dual Torah and its transmitters as follows in his 1985 article, “Religious Authority in Judaism: Modern and Classical modes”:

For Judaism in its classical literature, three things go together: revelation, canon, and authority. To state matters in theological language, God revealed the Torah to Moses at Mount Sinai. Authority rests upon God's will and word to Moses. We obey because we listen to what God commands us to do. Since what God gave to Moses, in particular, was the Torah—that is, revelation—it follows that God's will reaches us in the Torah, and we

discussion of charismatic authority, see Bruce Chilton and Jacob Neusner, 1999, *Types of Authority in Formative Christianity and Judaism*. London and New York: Routledge, chapter 3; Mira Balberg, 2011, “Rabbinic Authority, Medical Rhetoric, and Body Hermeneutics in Mishnah Nega'im.” *AJS Review* 35:2, 323–346

⁴⁰ The emergence of the rabbinic canon and the authority structures surrounding this matter are beyond the scope of this study. On the development and authority of the rabbinic canon, see David Charles Kraemer, 1991, “The Formation of Rabbinic Canon: Authority and Boundaries.” *Journal of Biblical Literature*, 110:4, 613-630.

obey the Torah because it is what God tells us to do. Then, to continue the theological account, religious authority derives from the will and word of God in the Torah that God gave to Moses. If we want to know what is authoritative, we therefore must refer to the Torah, that is to say, the canon of holy books enjoying the status of Torah. The canon contains and constitutes Torah. Authorities who master or claim to know the Torah then exercise authority. So the three are one: revelation, canon, authority. (Neusner, *Religious Authority in Judaism*, 374-75)

Citing *m. Sotah* 9:14⁴¹ and *t. Sotah* 14:7-9⁴² as source texts, Neusner asserts that rabbinic authority exerts influence over a changing society, with that society's destiny being reliant upon loyalty to and respect for the rabbis. For Neusner, authority is bound up with revelation and canon. (Neusner 1985, 376) Moreover, the rabbis, with their expertise, are "word made flesh", speaking authoritatively about Scripture and Jewish law. In turn, the rabbi's authority stems from revelation itself, and in fact, becomes part of the revelatory process writ large through Jewish history. (385-6)

In a broader study of authority, *Authority: Construction and Corrosion*, Bruce Lincoln describes the multifaceted construction of authority as a "conjuncture of the right speaker, the right speech and delivery, the right staging and props, the right time and place, and an audience whose historically and culturally conditioned expectations establish the parameters of what is judged 'right' in all these instances." (Lincoln, 11) Similarly nuanced, textured perspectives of rabbinic authority have been offered by Louis Jacobs, Avi Sagi, and Michael S. Berger.

⁴¹ Illustrating the reliance of Judaism upon the lives and persons of the sages: e.g., "When Ben Zoma died, exegetes came to an end./When R. Joshua died, goodness went away from the world. [. . .] When R. Aqiba died, the glory of the Torah came to an end./ When R. Hanina b. Dosa died, wonder-workers came to an end." (In Neusner 1985, 379)

⁴² Key in which are the citations of Judges 17:6, "Every man did that which was right in his own eyes," followed by the Tosefta's "And the whole kingdom went rotten, declining more and more." (In Neusner 1985, 380)

In his 1980 article, “The Talmud as the Final Authority,” Jacobs questions the resistance to halakhic change due to the immutability of Divine law as mediated by the sages, particularly due to the authority of the Babylonian Talmud, stating that the *halakhab* is ultimately based on fundamentalism. He also asserts that the inability to change or question *halakhab* without being accused of denying that the Torah is from heaven is the heart of the matter. (Jacobs, 47) Further analyzing the imperative to obey the sages in his 1995 study, “Models of Authority and the Duty of Obedience in Halakhic Literature,” Sagi describes two types of authority that may be noted in Jewish tradition – epistemic and deontic, based on the theories of R.T. De George.⁴³ As Sagi describes them, “These two models differ regarding such fundamental questions as authority's source of legitimation, the duty of obedience incumbent on community members acknowledging this authority, and the relation between the authorities and other members of the community.” (Sagi, 2)

The epistemic model is one in which authority is predicated on expertise. This, in turn, is also reliant on a relationship between the authority who possesses this expertise and group members who do not. (2) However, such expertise-based authority is ultimately shaky and temporary, as others can theoretically acquire similar expertise. De George would go further than this, however, stating that epistemic authority is not true authority, as it can guide and provide expert advice, but not demand obligations calling

⁴³ R.T. De George, 1985, *The Nature and Limits of Authority*. Lawrence: University of Kansas Press, chaps. 3-4.

for communal obedience.⁴⁴ (3) Sagi notes examples of epistemic authority in *y. Horayot* 1:1, which states that one must only obey a sage if their advice is known to be true, or can be proven. Further, *m. Horayot* 1:1 states that it is, in fact, forbidden to follow a court's ruling if an error was detected. (3-4) The epistemic model of authority, then, "thus assumes the equality of all community members before the Torah, which belongs to the whole of Israel." (10) The deontic model,⁴⁵ however, is described by Sagi as follows:

The basic assumptions of this model state that an authority can validly order certain acts to be performed, and can also compel other members of the community to obey. Rather than on knowledge, deontic authority is based on the power invested in the person in authority to determine binding norms. Conceptually, deontic authority implies an obligation of unconditional obedience, meaning that an authority must always be obeyed, even when apparently wrong. The epistemic model of authority stresses that knowledge is binding on all members of the community, whereas the deontic model emphasizes the special status of the authorities. (Sagi, 11)

For example, the authority struggle presented in the *sugya* of the Oven of Akhnai in *b. Bava Metzi'a* 59b, upon which I will focus in the following chapter, is deontic rather than epistemic, "suggesting a confrontation between truth, as represented by R. Eliezer, and authority, as represented by the sages." (4-5) As Sagi demonstrates, there are numerous supports for deontic authority in the rabbinic corpus, resting on the rationales of God's commandments, the Divinely inspired or charismatic nature of the rabbi, and the consent

⁴⁴ On the application of epistemic authority in the Yerushalmi, see Adiel Schremer, 2010, "The Religious Orientation of Non-Rabbis in Second-Century Palestine: a Rabbinic Perspective." In Z. Weiss et al., Eds. *Follow the Wise: Studies in Jewish History and Culture in Honor of Lee I. Levine*. Ed. Z. Weiss et al, 321, Fn. 15, citing Seth Schwartz, 2001, *Imperialism and Jewish Society 200 B.C.E. to 640 C.E.* Princeton: Princeton University Press, 120: The Yerushalmi, ". . .interested though it is in playing up rabbinic authority, never describes the rabbis as possessing jurisdiction in the technical sense. No one was compelled to accept rabbinic judgment. The rabbis could threaten, plead, and cajole but could not subpoena or impose a sentence. Only the Roman governor and his agents had such authority."

⁴⁵ Deontic authority is key to my own analysis, in later chapters, of rabbinic literary episodes in which the authority of the sages essentially trumps nature, mathematics, and indeed, even miracles.

of the public. (15) Deontic authority, as presented by Sagi, is one way of ensuring Jewish collective and halakhic uniformity.⁴⁶ (22) In the chapters to come, this general model of epistemic and deontic authority serves to inform my own analysis of selected scientific and mathematical rabbinic texts.

Similarly, in his 1993 article, “Rabbinic Authority: A Philosophical Analysis,” Berger more pointedly addresses epistemic authority.⁴⁷ (Berger 1993, 61) As Berger expresses it, the process of vesting a sage with authority is not necessarily conscious or purposeful; however, once epistemic authority is granted and certain ideas are accepted, authority then becomes something else that transcends the rabbi’s prestige or expertise. Instead, these ideas are assumed to be correct by the community, and are then treated as a normative foundation for other activities and topics that become “part of a living tradition.” (67-68) Having moved from the sphere of practice or belief into the *modus vivendi* of a community, however, the texts that represent the tradition become authoritative sources in themselves. (77)

In a fuller exposition of the topic in his 1998 volume, *Rabbinic Authority*, Berger surveys and analyzes several models that may explain rabbinic authority. Among these is the model of authority created by R.S. Peters, who delineates the difference between “being *in* authority or *an* authority” (Berger, 14, citing Peters 1958, 204-24). Here, Berger

⁴⁶ Here, Sagi cites Nachmanides. While this is beyond the temporal scope of this study, it is clear that the conversation regarding the authority of the Tannaim and Amoraim does not end with the closing of the Bavli.

⁴⁷ Here, Berger contrasts epistemic authority with sociologist Max Weber’s charismatic authority, comprising part of a tripartite model also including traditional and legal-rational authority. (As described in Max Weber, 1958, “The three types of legitimate rule”. *Berkeley Publications in Society and Institutions*. 4:1, 1-11. Translated by Hans Gerth.

points to a distinction that can be shown to play itself out in the scientific rabbinic texts I will analyze in this study. Further, applying the “interpretive community” concept of authority championed in the reader-response theory of Stanley Fish, Berger defines this model of rabbinic authority as follows:

Rather than a normative claim to obedience which must be justified by reasons somehow “outside us,” “Rabbinic Authority” is more accurately a way of describing an interpretive community (broadly construed) that fashions its ‘form of life’ in accordance with the laws, commentaries, and insights of the Talmudic Sages. (15)

He further subdivides this model into two parts:

1. The Torah commandment, in Deut. 17:8-13, to obey the generation’s prevailing scholars
2. The system of lawmaking and interpretation vested in the authority of the Sanhedrin or designated sages. (14)

Berger ultimately outlines and demonstrates the image of authority presented by the rabbis according to this model, as well as their “quasi-historical claim” to the authority of Moses. (Berger, 14) In many ways, this model may be seen as an extension and refinement of his 1993 comments on the texts embodying a tradition becoming authoritative (Berger 1993, 77) The utility of this model is key in further illuminating the play of rabbinic authority in rabbinic texts related to the celestial sciences, including *b. Bava Metzi’a* 59b, the Oven of Akhnai, considered to be the *locus classicus* of rabbinic authority, and a *sugya* I see as a parallel to *m. Rosh HaShanah* 2:8. However, as I will demonstrate in chapter two, the *sugya* found in *b. Bava Metzi’a* 59b may also be used to unpack similar rabbinic writings regarding their idealized literary authority over nature, encompassing several astronomical episodes in the primary literature.

1.2 The 'Rabbinic Mind' and Scientific/Mathematical Discourse: Knowledge, Boundaries, and Trajectories

In order to properly frame the importance of my analyses in chapter three of the apparent devaluation of mathematics, astronomy, calendrical calculations, I now turn to the key existing scholarly literature on scientific and mathematical discourse in the rabbinic context related to rabbinic access to scientific knowledge, and evidence for their ways of thinking about this knowledge in the Bavli.

I first provide an overview of relevant sources pertaining to scientific knowledge during this period, including questions that are core to our discussion of the early scientific concerns evident in the rabbinic corpus. Namely, what did the rabbis know about astronomy and mathematics and other sciences, how did this shed light on scientific knowledge transmission, and how did they know it? Moreover, what has the secondary literature to date noted with respect to the themes of rabbinic authority, the interconnections between celestial *topoi*, and the primacy of cosmogony and God's cosmic rulership among them? Finally, I address the literature regarding the ways in which the rabbis appeared to think about scientific topics. This is of no small importance, for if it can be shown that the rabbis had access to scientific topics as early as the mishnaic period, this opens up a very different question: Namely, given the existence of both Roman and Sasanian strata in its pages, why was scientific and mathematical accuracy not a priority in the Bavli?

It is now well known that the Tannaim and Amoraim were indeed in possession of some transmitted scientific knowledge, and there is compelling evidence for transmission of this information from Hellenistic and Babylonian contexts, whether direct or indirect. The earliest scholarship on rabbinic science emphasized medicine, including numerous studies on healing, and this sub-field of interest in Jewish studies is still quite active.⁴⁸ Medicine is one area in which the rabbis strove to excel, and their prioritization of medicine and healing was such that permissions were often given for the production of magical healing remedies, or *segulot*, despite a generally negative perspective on magic in rabbinic literature.

Rabbinic medical knowledge presented and preserved in the Bavli is clearly based on the transmission and incorporation of earlier scientific knowledge. As Mira Balberg has pointed out, “Many scholars of rabbinic literature have shown that the rabbis were familiar with Graeco-Roman medical perceptions and concepts, and have striven to reveal traces of Hellenistic medicine in rabbinic compilations.” (Balberg, 324)

An example is provided by M.J. Geller who describes Akkadian *materia medica* in the Bavli in his 1991 article “Akkadian Medicine in the Babylonian Talmud” and in his

⁴⁸ Several sources of note include J. Snowman, 1935, *A Short History of Talmudic Medicine*. London: John Bale; Z.H. Chajes, 1960, “Demons, Witchcraft, Incantations, Dreams, and Planetary Influences: Medical Prescription and Curative Methods in the Aggadah.” In Z. H. Chajes, *The Student’s Guide Through the Talmud*. New York: Feldheim, 233-244; J. Preuss, 1978, *Biblical and Talmudic Medicine*. (tr. F. Rosner) Lanham, Maryland: Rowman & Littlefield Publishers; Stephen Newmyer, 1984, “Climate and Health: Classical and Talmudic Perspectives.” *Judaism* 33:4, 426-438; J.N. Lightstone, 1992, “Matters Pertaining to Divination and Healing.” In H. N. Bialik and Y.H. Ravinitzky, Eds., *The Book of Legends: Sefer ha-Aggadah*. New York: Schocken, 789-804; Samuel S. Kottke, 1996, “Demons and Diseases in Bible and Talmud.” In *Illness and Healing in Ancient Times*. Haifa: Reuben and Edith Hecht Museum, 32-38; Giuseppe Veltri, 2010, *Magic and Healing: The Oxford Handbook of Jewish Daily Life in Roman Palestine*. In Catherine Hezser, Ed. *The Oxford Handbook of Jewish Daily Life in Roman Palestine*. Oxford: Oxford University Press, 587-602; Mira Balberg, 2011, “Rabbinic authority, Medical Rhetoric, and Body Hermeneutics in Mishnah Nega‘im.” *AJS Review* 35:2, 323-346.

2000 piece “An Akkadian Vademecum in the Babylonian Talmud.” For example, Geller notes the presence of the Akkadian omen series, *Summa Ibru*, in *b. Niddah* 23b in a discussion of teratological omens related to miscarriage and stillbirth. (Geller 2000, 4)⁴⁹ From this evidence of transmission, I would argue for the strong potential for numerous survivals and transmission of astronomical material from the Akkadian context in the Bavli. This is a particular likelihood due to the inextricability of omen texts from astronomical/astrological concerns in Mesopotamia.⁵⁰

Moreover, rabbinic interest in healing is both closely connected to magic and astrology – demonstrated, for example, by astrological rules for blood-letting in *b. Shabbat* 129b – and illuminates the interest of the Tannaim and Amoraim in the Hellenistic and Babylonian sciences where these were useful or relevant to their needs.

Geller points to the neglect of the Bavli as witness to Sasanian Babylonia due to the emphasis upon comparing talmudic to classical texts by the *Wissenschaft des Judentums* school in the nineteenth century in order to de-orientalize Jewish studies. Naturally, while the Hellenistic context is appropriate with respect to the Mishnah, the Yerushalmi and certain Midrashim, he continues, it does not properly illuminate the Sasanian context.

⁴⁹ Also see Charlotte Elisheva Fonrobert, 2000, *Menstrual Purity*. Redwood City: Stanford University Press. This is an important analysis of science and authority in tractate Niddah and the imposition of rabbinic authority upon women’s bodies. Here, Fonrobert analyzes this dynamic set against Greco-Roman gynecological literature.

⁵⁰ Other key sources on such survivals in the Bavli include M.J. Geller, 2000, “The Survival of Babylonian Wissenschaft in Later Tradition,” in *The Heirs of Assyria: Proceedings of the Opening Symposium of the Assyrian and Babylonian Intellectual Heritage Project*. Held in Tvärminne, Finland, October 8-11, 1998; Idem., 2004, “Akkadian Healing Therapies in the Babylonian Talmud”. Preprint 259 of the Max-Planck-Institut für Wissenschaftsgeschichte, 1-60. Also see M.J. Geller, 2014, *Melothesia in Babylonia: Medicine, Magic, and Astrology in the Ancient Near East*. Science, Technology, and Medicine in Ancient Cultures 2. Boston and Berlin: Walter De Gruyter.

(Geller 2000, 3-4)⁵¹ Indeed, the Bavli presents a context removed from the Hellenistic milieu, even though a great deal of this earlier stratum is preserved within it, in the Mishnah, as well as the commentary of the Gemara, which does not always veer far afield of the Hellenistic scientific assumptions of the Mishnah. On this point, Geller concludes that despite these attempts by the *Wissenschaft des Judentums* to associate the Talmud with classical texts alone, the Sasanian setting of the Bavli remains vital (Geller 2000, 2) This general context has also been illuminated by Yaakov Elman and Shai Secunda.⁵²

More specifically, with respect to the transmission of astronomical and related mathematical information to rabbinic contexts, a number of important studies on rabbinic astronomy have been published over the past few decades, several of which deal with the question of transmission or authority.⁵³

In his 1962 article, “Elements of a Lunar Theory in the Mishnah, Rosh Hashanah 2:6, and the Talmudic Complements Thereto,” Ernest Wiesenberg presents evidence for a lunar theory based on elaborations, in the Tosefta and in citations of various *baraitot*, of

⁵¹ Indeed, many omens in rabbinic literature are listed under the rubric of *darkhei ha-emori*, ‘Amorite Practices,’ among which Veltri has found many parallels with Pliny, suggesting that some of the omen traditions in Palestine were based upon Classical sources. (Veltri 1998-99, *passim*; 2002, *passim*) Other omens, however, have clearly Mesopotamian origins, such as a talmudic omen regarding a snake: if a snake fell on the bed, it says: ‘he is poor, but he will end up being rich. If (the woman) is pregnant, she will give birth to a boy. If she is a maiden, she will marry a great man.’ (Geller 2000, “The Survival”, 3-4)

⁵² See, for example, Elman, 1994, *Authority and Tradition: Toseftan Baraitot in Talmudic Babylonia*, New York: Yeshiva University Press; Idem., 2007, “Middle Persian Culture and Babylonian Sages: Accommodation and Resistance in the Shaping of Rabbinic Legal Tradition.” In Charlotte Elisheva Fonrobert and Martin S. Jaffe, Eds., *Cambridge Companion to Rabbinic Literature*. Cambridge: Cambridge University Press, 165-197; Shai Secunda, 2013, *The Iranian Talmud: Reading the Bavli in Its Sasanian Context*. Philadelphia: University of Pennsylvania Press.

⁵³ Worth mentioning is the 1943 article, “The Zodiacal Light in Semitic Mythology” by Solomon Gandz. This is a classic if outdated source that is noteworthy for the philological and cross-cultural approach characteristic of his work, and which is brought to bear on his examination of the planets in biblical and talmudic literature. However, it does not contribute to the scope of this study.

the skeletal account found in *m. Rosh HaShanah* 2:6 regarding the interrogation of witnesses of the new lunar crescent to establish their credibility. (Wiesenberg, 153) Wiesenberg concludes that the witnesses themselves had little astronomical expertise; rather, this expertise was in the possession of the rabbinic examiners, and included such knowledge as declination, solar and lunar longitudes, lunar elongation, latitude, and parallax. These were shown to be verified by means of calculation. (Idem., 195) The question of whether these calculations were derived from Hellenistic science, and possibly that of Mesopotamian provenance as well, is a compelling one – though once again, whether this took place by direct or indirect transmission is difficult to say at this time. What is touched upon but not fully articulated in this analysis of the earlier astronomical mishnaic text that informs the calendrics of the Bavli is the dynamic of idealized self-presentation of rabbinic authority found in the Mishnah.

Rabbinic interest in the names of the planets in *b. Shabbat* 156a, and a direct connection between the planets and cosmogony, are examined by Robert R. Stieglitz, who describes the evidence for rabbinic planetary names left by Epiphanius, Bishop of Constantia/Salamis (d. 402). (Stieglitz 1981, 5) Here, Stieglitz points to the “Semitic (Chaldean?)”⁵⁴ terms employed by astrologers, concluding that “if these were indeed the native Chaldean terms, they may have their roots in much earlier periods when Babylonian astronomy/astrology was already well developed.” (Stieglitz, 137)

⁵⁴ Question mark placed by Stieglitz.

Meir Bar-Ilan describes the rabbis' overall understanding of astronomy in his 2004 piece, "Astrology in Ancient Judaism," "Astronomy in Ancient Judaism," stating that the beginnings of rabbinic astronomy were non-scientific in nature, and that, over time, a more scientific approach developed. However, it is difficult to ascertain rabbinic attitudes toward astronomy due to often contradictory evidence. In keeping with the medical findings of M.J. Geller, however, Bar-Ilan does point to a growing rabbinic awareness of Mesopotamian and Hellenistic astronomy. Despite their shaky grasp of geography, for example, they described the Earth as a ball⁵⁵ (*y. Avodah Zara* 3:1, 42c), which raises yet more questions regarding transmission points. Nevertheless, Bar-Ilan states that despite their interactions with non-Jewish scientists, there is no evidence that the rabbis ever read a non-Jewish astronomical text. (Bar-Ilan "Astronomy", 2038-9) As I demonstrate in chapter three, this is called into question by parallel text passages in *Gen.Rab* 6:8, *b. Pesahim* 94b, and the writings of sixth century Alexandrian monk, Cosmas Indicopleustes. It is also vital to consider modes of oral transmission common in the Late Antique context, as well as both the interest in science displayed by the rabbis and the presence of the scientific information, demonstrating access. This is a particularly salient point given the known presence of the Hellenistic and Persian *materia medica* in the Bavli. Moreover, lack of evidence does not constitute proof of absence. Due to the very real possibility that such evidence for literary transmission was not adequately preserved

⁵⁵ To elaborate slightly, in *y. Avodah Zara* 3:1, Rav Yonah stated that Alexander the Macedonian flew high up on an eagle's back until he saw that the Earth was a ball and that the sea was a plate. Here, Rav Yonah is shown to be aware of a Greek source supporting the roundness of the Earth. We note a similar reference to the Earth being shaped like a wheel in *Gen. Rab.* 63:14.

and did not survive Late Antiquity, we must rely on hints and literary evidence to be found here and there in the Bavli, and I contend that these hints demonstrate rabbinic access to the material at the very least, as well as evidence of transmission, even if indirect, of astronomical material.

In a similar vein, we turn to a 1971 article by B. Z. Wacholder and D. Weisberg, “Visibility of the New Moon in Cuneiform and Rabbinic Sources,” in which evidence is presented for the visibility of the moon in cuneiform sources and talmudic texts, demonstrating great similarity in the Mesopotamian and rabbinic procedures for establishing the new month by viewing the lunar crescent, or *molad*. (Wacholder and Weisberg, 227-228). The authors hypothesize that the 19-year calendar cycles of Mesopotamia, Palestine, and Greece are ultimately Mesopotamian in origin, and conclude as follows:

Some possible paths of transmission to the west might have been cultural links between Palestine and Mesopotamia during the pre-exilic period; the experience of the returnees in the Persian period; or the Phoenician bridge between Mesopotamia and the southern part of the Levant coast. Nor would it be difficult to envisage how the Greeks, who had extensive contacts in Mesopotamia in the pre-Christian centuries, might then have learned of the 19-year cycle. (Idem., 241)

However, in his 2010 article, “Neo-Assyrian Astronomical Terminology in the Babylonian Talmud,” Jonathan Ben-Dov comments on the Wacholder and Weisberg source, viewing it as merely suggestive of similarity, not conclusive of rabbinic dependency upon Mesopotamian provenance. (Ben-Dov 2010, 267) Nevertheless, Ben-Dov proceeds to describe and analyze a statement by Rav Nahman in *b. Rosb HaShanah* 21a that he sees as representing a stronger case for direct influence. This, he writes, is

“due to the use of a technical term and to the fact that the Jewish sage in question lived on Mesopotamian soil.” (Ibid.) Here, the technical term used is משלים סיהרא ליומא, meaning “when the moon is full during the day” – a common bit of astronomical data that is frequently found in cuneiform sources, and which may be either Sumerian or Akkadian in origin.⁵⁶ In any event, Ben-Dov concludes that it was part of the Babylonian astronomical “Lunar Six” data set dating to the sixth century B.C.E. (268) and that it reflected Mesopotamian observations of the moon. This may well suggest that certainly within the Babylonian milieu, the rabbis may have been practitioners of Babylonian astronomy. Here, supplementing the medical evidence mentioned earlier, Ben-Dov summarizes the matter: “Just as the Babylonian sages used medical terms from Akkadian literature, they seem to have used earlier astronomical terms as well. (270) This too serves to frame my assumptions and arguments in chapter three regarding rabbinic awareness of transmitted scientific information and mathematical techniques.

As demonstrated in several of these studies, scientific, mathematical material and both related terminology and loan words are attested in rabbinic literature. Cultural and scientific transmission from Mesopotamia to Hellenistic Greece and Rome⁵⁷ is at this point in the history of science, a given, with Babylonian mathematical astronomy and its

⁵⁶ The statement, as presented in Ben-Dov, is as follows:

אמר להו רב נחמן להנהו נחתי ימא לא ידעיתון אתון בקבעא דירחא כי משלים סיהרא ליומ בערו חמירא
אימת משלים בחמיסר הא אנן מארבסר מבערינן לדידהו דמגלו להו עלמא מארבסר משלים

“R. Nahman said to the seafarers: “You do not know when the new moon is fixed (lit., ‘do not know the fixation of the month’)—when the moon completes the day clear away the leaven (for Passover).” (question): When does it become full? On the fifteenth (day of the month)! But we clear away (already) on the fourteenth! (answer): For them, who have a clear view (lit., ‘the world is revealed to them’), it completes already on the fourteenth.” (Ben-Dov 2010, 267)

⁵⁷ Alexander Jones comments on the evidence for Babylonian mathematical schemes in Greek astronomy, Stating that Hellenistic Greek astronomers knew about the “Chaldean” origins of their astronomy. (Jones, 77)

accompanying mathematics reaching Greece, specifically the astronomer, Hipparchus, by the second century B.C.E. The likely route of transmission was Alexandria. (Robson 2005, 14) Indeed, Alexander Jones describes this transmission pattern from Babylonia to Greece and, onward, to Rome, as “a gradual trickle of basic concepts and the occasional parameter from about 500 B.C. followed by a sudden flood of detailed information in the second century B.C.,” and from there, into other regions, including India. (Jones, 88-89) In most cases, the prevailing trend was toward the wide transmission and dissemination of Babylonian source material throughout Late Antiquity.⁵⁸ Although this does not conclusively prove the transmission of Babylonian and Greek astronomies and mathematics into rabbinic Judaism⁵⁹ as fully expressed systems, I reiterate the point that the evidence presented here certainly demonstrates that scientists and scientifically-

⁵⁸ Other transmission studies of note include J. M. Steele, 2011, “Visual Aspects of the Transmission of Babylonian Astronomy and its Reception into Greek Astronomy.” *Annals of Science* 68:4, 453-465; Jan P. Hogendijk, 1996, “Transmission, Transformation, and Originality: The Relation of Arabic to Greek Geometry.” In F. Jamil Ragep, Sally P. Ragep, and Steven Livesey, Eds. *Tradition, Transmission, Transformation*. Leiden and New York: E.J. Brill, 31-64; Bill M. Mak, 2013, “The Transmission of Greek Astral Science into India Reconsidered-Critical remarks on the Contents and the Newly Discovered Manuscript of the Yavanajātaka.” *History of Science in South Asia* 1, 1-20.

⁵⁹ On a final note related to transmission, Mladen Popović describes indirect access to Babylonian scholarship by Jewish scholars in the second part of the first millennium B.C.E. in his 2013 article, “Networks of Scholars: The Transmission of Astronomical and Astrological Learning between Babylonians, Greeks and Jews.” In Jonathan Ben-Dov and Seth Sanders, Eds., *Ancient Jewish Sciences and the History of Knowledge in Second Temple Literature*. New York: New York University Press, 1-2. This indirect mode of transmission of Babylonian astronomical/astrological material to Palestine during the Second Temple period likely, according to Popović, took place “through various intermediaries, Aramaic and other channels, as well as via a—more vague—continuous tradition. Via such indirect channels, elements of Babylonian and Greek astronomical and astrological learning reached certain people and certain places in Jewish Palestine, at least those at Qumran and the movement behind the Dead Sea Scrolls.” (Idem., 25) The question of whether or not such astronomical/astrological traditions survived into the post-destruction period, however, is, of course, highly speculative.

inclined rabbis in both the Roman and the Sasanian⁶⁰ contexts would have had ready access to this knowledge.

Mathematics is strongly represented in this study owing to the dependence of astronomical calculations, rabbinic calendar development, and even astrological praxis upon the ability to understand and implement calculations. As such, it is vital to the development of astronomy and functioning, accurate calendar systems within cultures, as demonstrated by the Babylonian and Greek development of astronomical systems of calculation and prediction. Without mathematical precision, a developed astronomical system is simply not possible. Moreover, in the primary texts to be examined, including *m. Avot* 3:18 and *b. Hullin* 95b, for example, we note the close pairing of mathematics and astronomy. Despite rabbinic awareness in the Bavli of the importance of calendar development and the need to use mathematics to calculate and intercalate, however, the Jewish calendar was not established and fixed all at once, but over the course of centuries. (S. Stern 2001, *passim*) I offer several possible reasons for this delay on examination of the secondary material on calendrical diversity later in this chapter, as well as my own analysis of the calendrical and mathematical texts in chapter three.

Given the evidence for access to rich scientific and mathematical traditions related to the celestial sciences in the Bavli, there are two more questions in the literature to be

⁶⁰ On the Sasanian context, David Pingree, 1963, in “Astronomy and Astrology in India and Iran,” writes that knowledge of Iranian astronomy/astrology begins with Shapur I (240-270), and that “He encouraged the spread of Greek and Indian science within his realm.” *Isis* 54:2, 241. He further comments that Indian yuga-astronomy came to influence Sasanian science quite deeply. (246). Moreover, according to Pingree in his 2001 article, “From Alexandria to Baghdād to Byzantium. The Transmission of Astrology.” *International Journal of the Classical Tradition* 8:1, 5, Greek and Indian astrological texts were translated into Pahlavi.

addressed in this section, and later, in my own analysis. The first is, how did the rabbis engage with mathematics, and the second, which stems from the rabbis' overall relationship to nature, the sciences, mathematics, and astronomy in particular is – why?

To answer the former question, I turn to the few secondary sources on rabbinic mathematics that exist in the literature, none of which fully address the broader questions of authority or scientific perspectives.⁶¹ Nevertheless, they do highlight key questions to be addressed by this study, including the lack of precision in many rabbinic calculations and formulae. This secondary literature on rabbinic mathematics to date is either outmoded or incomplete. I include it here in order to demonstrate the state of the literature this far, as well as to provide a frame for the mathematical texts I examine in chapter three.

The first major work of its kind was W.M. Feldman's 1931 book, *Rabbinical Mathematics and Astronomy*. Feldman had as his goal the elucidation of the mathematical knowledge the rabbis possessed, and their contribution to the field. (Feldman 1931, vii) However, he also incorporates a number of medieval commentaries on earlier rabbinic mathematics in his treatise, muddying the waters. One of the deficiencies of this work, which remains important primarily because it is, to date, the only work of its kind and scope, is one that the author himself points out early on – Feldman is neither a

⁶¹ Most sources treat medieval Jewish astronomy and mathematics. One of the best recent sources on the latter, for example, is Y. Tzvi Langermann and Shai Simonson, 2000, "The Hebrew Mathematical Tradition." In H. Selin, Ed. *Astronomy Across Cultures: The History of Non-Western Astronomy*. Great Britain: Kluwer Academic Publishers, 167-188.

mathematician nor an expert in rabbinic literature.⁶² (Idem., x) Nevertheless, there are elements in Feldman’s work that are useful to this study. For example, he states that the astronomical and mathematical information in the possession of the rabbis post second-century was derived from the *Almagest*.⁶³ (Ibid.) That Ptolemy can be detected in rabbinical scientific discourse is clear. We see this in the demonstrated rabbinic awareness of Ptolemaic astronomy found in *Gen.Rab.* 6:8, as I mentioned earlier. Nevertheless, as Feldman points out, R. Jonah only accepted the spherical Earth theory in the fourth century. As Feldman states, it is obvious “that the Talmudic Rabbis had very hazy ideas regarding the daily rotation of the heavens, although they ultimately adopted Ptolemy’s geocentric theory.” (Ibid.) Further, Feldman points to the “haphazard” presentation of mathematics and astronomy in the Talmuds, with no attempt at systematization. As he states:

That the mathematical or astronomical facts directly or indirectly mentioned in the Talmud, most probably represent a portion only of the total Rabbinical knowledge of this subject, can be inferred from the fact that great reticence was observed with regard to matters of astronomical theory. Indeed, so jealously was the secret of the calendar [*sod ha-ibbur*] guarded that R. Chanina, the Palestinian who constructed a calendar outside Palestine, was reprimanded for committing such a reprehensible act, by R. Josi ben Kepar and another, who were specially sent from Jerusalem for that purpose. His plea that R. Akiba did a similar thing in Nehardea was met by the rebuke that whilst the latter left no one in Palestine equal to the task of calendar making, the same was not the case with R. Chanina, for ‘the kids you left in Palestine have now become horned goats.’ (Feldman, 6)

⁶² As Solomon Gandz points out in his 1933 review of Feldman’s book, “Rabbinical Mathematics and Astronomy by W. M. Feldman.” *Isis* 19, 209.

⁶³ Although this astronomical work by Ptolemy was entitled Ἡ Μεγάλη Σύνταξις or ‘The Great Treatise’ in Greek, its original title was Μαθηματικὴ Σύνταξις, or ‘Mathematical Systematic Treatise,’ perhaps more fitting given the dependence of the astronomical material in the *Almagest* upon mathematics, as I describe in chapter three.

This passage, highlighted by Feldman, is remarkable for our purposes for several reasons, as it presents a clear example of the exercise of deontic authority at work within an astronomical and mathematical context. While epistemic authority is also implied by the inferred astronomical expertise of Rabbi Akiva, it is ultimately the prestige and tradition of the latter that holds sway in this case, demonstrating clear deontic authority.

Although no major innovations were made by the rabbis according to Feldman, there were several astronomers among them, including R. Gamaliel, Samuel, and R. Joshua, who seems to have been familiar with the periodicity of a comet. (220) Feldman sums up his perception of rabbinic mathematical awareness as follows, however:

The ancient Jewish Rabbis were in respect of their mathematical knowledge more like the Babylonians, Egyptians and Romans, but certainly did not equal the Greeks in their geometrical speculations. Not only did they not produce such mathematical geniuses as Thales, Pythagoras, Euclid, Archimedes, etc., but there is no evidence whatever that they discovered anything original in mathematical theory. Indeed, their mathematical knowledge was of a very meagre and unsatisfactory kind. For [. . .] even such geometrical facts as the relations between the area of a circle and that of its inscribed or circumscribed squares, were obviously taken for granted (without any attempt at verification) on the strength of the opinion of Roman philosophers – who were themselves very poor mathematicians. (Ibid.)

Ultimately, Feldman leaves us with his view that the mathematics found in the Bavli “is entirely of a practical character and was merely used by the Talmudic Rabbis as a help in the exposition and development of the civil and religious laws.” (Idem., 221) This, he contrasts with the mathematical interest of the Greeks, who, he claims, studied for the sake of knowledge. The rabbis, he concludes, did not seem to display similar interest in theory, but were content to apply the mathematics they knew, however lacking in rigour, to practical problems. (Ibid.) It is notable that in his conclusion, Feldman cites

Voltaire, who wrote “Les juifs ne furent jamais ni physiciens, ni geometres, ni astronomes.” He comments that this had become untrue in his 1930s context. However, it was also mostly untrue in the Late Antique context, affirming his lack of inquiry into the broader achievements of the early rabbis. This is a quote, moreover, that mirrors a certain deterministic and essentialist view of the rabbis that I will treat shortly in the upcoming summary of the scholarly debate regarding “the rabbinic mind” – that is, the question of whether the early rabbis simply did not think in ways that allowed for a scientific or mathematical tradition at all. (Ibid.)

It is then, little surprise that in a 1933 review of Feldman’s volume by Solomon Gandz⁶⁴, he critiques Feldman for his omission of several important facts – notably, the Arabic influence upon Maimonides and other medieval commentators on rabbinic mathematics, and, one detects by reading between the lines, for including such lengthy, anachronistic commentaries at all (Gandz 1933, 208) – views with which I am in basic agreement.⁶⁵ More generally, Gandz also points to the lack of expertise in History of

⁶⁴ Gandz was also widely published in the field, spanning Antiquity and the Medieval period in works including Solomon Gandz, 1929, “Studies in History of Mathematics From Hebrew and Arabic Sources: The Terminology of Multiplication in Arabic and Hebrew Sources.” *Hebrew Union College Annual* 6, 247-262; and in 1938-39, “Studies in Hebrew Mathematics and Astronomy.” *Proceedings of the American Academy for Jewish Research* 9, 5-50.

⁶⁵ A note of interest, however, is a comment by Gandz on Feldman’s careless treatment of *Mishnat ha Middot*, to which Feldman refers twice by different names, having taken the material from two different secondary sources. Here, Feldman refers to the book once as a second century CE source, and once as a Judeo-Arabic sources. (Gandz 1933, 211 citing Feldman, 23) In fact, scholarship has been divided on the dating of this work, which defines the biblical calculation of π as being $3 \frac{1}{7}$ and not 3. In a 1938-39 paper, Gandz assumes the earlier dating, and conjectures that the original Hebrew found its way into Arabic, influencing a work by al-Khwārizmī (circa 820, Baghdad), which bore a strong resemblance to *Mishnat ha Middot*. (Gandz 1938-39, 15-16) The medieval dating by Moritz Steinschneider was due to this strong resemblance to *al-Kitāb al-mukhtasar fī hisāb al-jabr w’al-muqābala*, also known as *The Algebra*, a work of al-Khwārizmī. (See Tony Lévy, 2011, “Mathematik Bei Den Juden, Cent Ans Apres.” In Reimund Leicht, Gad Freudenthal, Eds. *Studies on Steinschneider: Moritz Steinschneider and the Emergence of the Science of Judaism in Nineteenth-Century Germany*. Leiden:

Mathematics and Hebrew Philology admitted to by Feldman, asserting that “he displays a rather deplorable lack of historical and philological training. (Idem., 209) Nevertheless, this volume filled a void in its time.⁶⁶

As for the relevant contributions to the history of Jewish mathematics by Gandz himself, his 1938-39 article, “Studies in Hebrew Mathematics and Astronomy,” presents an awareness of the transformation of two squares ($a^2 + a^2$) into a third square (b^2) by the application of areas in both the Yerushalmi and the Bavli. This, writes Gandz, also shows a rudimentary awareness of the Pythagorean theorem “which apparently was not yet quite clear to those practical surveyors.” (Gandz 1938-39, 11) The fact that they did not comment on the square of the diagonal being equal to the sum of the two squares, with no balance remaining, suggests a lack of knowledge to Gandz. (10) However, as he also demonstrates, there was rabbinic awareness of the completion of a square by means of a *gnomon* – a Greek mathematical figure – added to a square to maintain its form and create a larger square. This was, according to Gandz, “well known” to the Tannaim, as evidenced in *m. Middot* 3, in Seder *Qodashim*, regarding the measurements of the Temple and the Temple Mount. In this discussion, “the shape of a *gam*” is mentioned, and it is

Brill, 462.) A medieval dating of *Mishnat ha Middot* has also been advanced more recently as well. On this, see Victor Katz, 2008, *A History of Mathematics: An Introduction*. Third edition. New Jersey: Pearson Education, 156, Fn. 19; and Tony Lévy, 2007, *Mathematics of the Hebrew People*, SpringerReference, 1388.

⁶⁶ Generally speaking, many such earlier history of mathematics sources, particularly the sources by Feldman and Gandz, are limited, particularly with respect to arguments ultimately dependent on the dating of texts. More recent sources are variable in their dating, with some depending on earlier secondary sources and therefore citing Late Antique dating for sources now thought to be medieval. Dating, for example, is ambiguous in “Ancient Jewish Mathematical Astronomy” by Elyahu Beller, in which the author states that *Baraita diShmuel* is likely dated to the time of the Bavli, and certainly prior to 776 C.E. due to the text’s usage of the Jewish year 4536. (Beller, 56; 60-61) More recent sources consider the *Baraita diShmuel* to be post-talmudic in origin. Viz. Y. Tzvi Langermann, 2008, “Astronomy of the Hebrews.” In Helaine Selin, Ed. *Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures*. Dordrecht: Springer, 316.

obvious from context and terminology that this referred to the Greek *gnomon*. (12) Here, Gandz astutely comments on these aspects of Greek mathematical knowledge demonstrated in the Mishnah, Bavli, and the Yerushalmi, though he also takes liberties with his conclusions. That the rabbis were unaware of the full scope of the Pythagorean theorem is not conclusive, and Gandz does not entertain the possibility that they had access to the material, or to mathematicians who could assist with the calculations, but chose not to. For the purposes of this study, the mere fact of their familiarity with the most elementary applications of Greek mathematics is sufficient.

The rabbinic mathematical conundrum most covered by the literature however, is certainly what I term *the problem of Pi*. That is to say, the rabbinic exegesis of π – an irrational number now known to be approximately 3.141592 – as 3, based on their interpretation of 1 Kings 7:23. This problem has been well addressed by Boaz Tsaban and David Garber in “On the Rabbinical Approximation of π ,” (1991), Michael A. B. Deakin and Hans Lausch, “The Bible and Pi” in 1998, as well as the 2007 article by Isaac Elishakoff and Elliot M. Pines, “Do Scripture and Mathematics Agree on the Number π ?,”⁶⁷ and “Solomon's Sea and π ” by Andrew J. Simoson in 2009. These pieces all outline the scope of the problem to varying degrees, pointing primarily to *b. Erubin* 14a, where we read that circles with a circumference of three handbreadths are one handbreadth wide. The Gemara then asks, pointedly, from where this is learned – the source being 1

⁶⁷ A confessional source from an Orthodox Jewish perspective. Unfortunately, Isaac Elishakoff and Elliot M. Pines rely upon Tsaban and Garber, and turn to the esoteric formulation provided by the Vilna Gaon and Rabbi Matityahu Hakohen Munk, as well as Jewish mysticism to make their point. Moreover, the article focuses on determining the “true” calculation of π found in 1 Kings. Nevertheless, I include it as it is among the few sources available on the topic, and helps to situate the scope of the problem of π at its biblical source.

Kings 7:23. (I will return to this interpretation and its implications in chapter three.)

Tsaban and Garber keenly point out that in the Gemara, Rabbi Yohanan does not reply “This is a mathematical fact,” but that it seems clear that he is aware that the value of 3 is incorrect. (Tsaban and Garber, 3) Tsaban and Garber, and Deakin and Lausch each point out that the Babylonians, and even the Egyptians, possessed more accurate estimations of π than the rabbis did hundreds of years later.⁶⁸ Unfortunately, these sources are greatly weakened by reliance upon too many confessional and outmoded sources, including Feldman. The article by Tsaban and Garber is also weakened by unquestioning assumptions, such as the dating of *Mishnat Ha Middot* to the second century C.E. Deakin and Lausch incorporate an argument originally put forward by the Vilna Gaon (Elijah ben Solomon Zalman)⁶⁹ in the eighteenth century – one that is reliant upon *gematria*.⁷⁰ According to this argument for a more accurate reading of 1 Kings 7:23, two numbers, 106 and 111, can both be inferred from scripture, leading to the possibility of a far more accurate estimation of π in the Bavli. Deakin and Lausch, however, simply consider this to be “a most remarkable coincidence.” (Deakin and Lausch, 163-64) Thus, these analyses are unsatisfying in their omissions and frequently confessional assumptions.

Ilana Wartenberg provides a succinct overview of the topic, however, in her 2013 encyclopedia entry, “Mathematics in Judaism,” stating that “The rabbis may have been well aware of a more accurate value developed in Greek mathematics, but they may have

⁶⁸ Archimedes’ calculation was already well known centuries earlier (Efron, 46), and was more accurate than that of the rabbis.

⁶⁹ Deakin and Lausch refer to the attribution of this gematria theory to Rabbi Matityahu Hakohen Munk, however. (163)

⁷⁰ That is, the value of the letters kuf-vav-heh (111) divided by kuf-vav (106), or 111/106.

considered 3 good enough for Talmudic ‘working purposes.’” (Wartenberg, 1212)

Commenting more generally on the mathematical state of affairs in the Hebrew Bible, the Mishnah, and the talmudic literature, she writes:

The analyses of these tracts suggest a basic level of mathematics and little interest within Judaism in mathematics per se, with almost no presence of mathematical abstraction. Ancient Jewish literature adduces concise and practical mathematical information pertinent to daily life religious matters and helps ensure precise adherence to Jewish law (Hebrew: *Halakha*). (Ibid.)

What emerges as key when viewing the available sources together is twofold. The first point is that nearly all of the available scholarship – particularly the earlier research – on this vital topic in the history of mathematics has been conducted either by physicians, contemporary rabbis, and educated laypersons, or by mathematicians with no formal training in Jewish studies. This is clearly a lacuna that the recent uptick of interest in the history of science in Judaism would do well to address. The second point, framing my later analysis of the primary sources, is that scientific and mathematical knowledge was available to the rabbis in their Roman and Sasanian contexts, and based on the primary literature itself, the authors and redactors of the Bavli appeared to be well aware that they did not use the correct calculation for π .⁷¹

My own interest is in the factors that might have contributed to this lack of precision despite awareness of the mathematics. One way of viewing such rabbinic inaccuracies was put forward by Neusner, in his 1988 article, “Why No Science in Judaism?,” in which he attempts to explain “the mind” of Judaism and its “dual Torah”

⁷¹ Noah Efron holds this view as well, suggesting that the question posed in *b. Erubin* 14a regarding the calculations in 1 Kings 7:23 essentially amounted to “Why were these inaccurate calculations deemed acceptable?” (Efron, 46)

which simply “did not generate the kind of thinking that produced science, the division of philosophy known until nearly our own day as natural philosophy.” (Neusner 1988, 308) Here, Neusner attempts to “describe the mind of a social entity” otherwise known as “the mind of Judaism.” (310) As “a mode of thought,” science makes connections in ways that Neusner does not “find in [the] mind exhibited by the formative stages of the canon of the Judaism of the dual Torah.” (320) Here, Neusner is not undermining the internal cogency and connective processes of the Bavli – in fact, he extols them.

However, in his view, they are not congruent with scientific modes of thought. (329)

Moreover, for Neusner, the very structure and content of the Bavli circumscribed epistemological concerns as follows:

That mathematics was held to waste time better spent in Torah-study is only one obvious piece of evidence pointing toward the simple conclusion I have drawn. The simple fact is that the Bavli and associated writings defined both what was worth knowing and what knowing required; the claim was exclusive and those who thought otherwise, in both philosophy in general and natural philosophy in particular, found need to justify and validate doing the work they did, not to mention holding the conclusions that they reached. [. . .] Given the extraordinary power of the Bavli, exercised from its closure to our own day, to shape the mind of Judaism, we must find entirely natural the continuing formative power of that document’s principal modes of thought even today. (Idem., 329-330)

David B. Ruderman (1995), Menachem Fisch (1997), Philip S. Alexander (2002), and Annette Yoshiko Reed (2007) have all addressed Neusner’s claims regarding the “rabbinic mind” and its relationship to science. Ruderman critiques the inadequacy of Neusner’s position, which is ultimately reductionistic of the complex relationship between Judaism and science. As he states, “Such theoretical-typological discussions tend to reduce reality to a single categorization or abstract definition, flattening the differences

of times and places into homogeneous, immutable, and predictable entities called science and Judaism.” (Ruderman, 4)

Fisch holds an opposing view to that of Neusner, as cited by Ruderman (Ruderman, 4, Fn. 7), for while Neusner views scientific thought as incompatible with rabbinic “fixed associations,” Fisch sees the rational approach taken by the rabbis as similar in structure to the scientific approach. (Fisch 1997, 4 *et passim*)

Alexander parses the arguments of both Neusner and Fisch, calling the latter “interesting, but far too essentialist for my purposes.” (Alexander 2002, 226) Moreover, he sees a logical contradiction between Neusner’s views in 1988 and those in one of his later books, in which he describes the Mishnah as compatible with Greco-Roman philosophy.⁷² Although it might be pointed out that on a closer reading, Neusner does in fact briefly comment that he is primarily focusing on the Bavli, and not necessarily the Mishnah,⁷³ the sweeping nature of his comments regarding the mind of the dual Torah do suggest a more global and essentialist perspective of the rabbis’ ability to think scientifically.

For Alexander, the arguments advanced by both Neusner and Fisch are far too abstract, and he points to the evidence for rabbinic interest in science and nature, with the caveat that esoterica such as *Ma’aseh Bereshit* and the rabbinic, cosmogonic interdictions related to it, may have curtailed some scientific inquiry. (Alexander, 226-27)

⁷² Alexander points out that Fisch also comments on this. (Alexander, 226, Fn. 7; Fisch, 197)

⁷³ As Neusner writes “To state matters very simply, the Mishnah, with its propositional and syllogistic argument concern [sic] the nature of things, can have generated natural and social science; the Bavli could not and did not.” (Neusner 1988, 326)

He is, however, like Reed, in perfect accord with Ruderman's statement on Neusner's "flattening" and reduction of reality in order to create the reified categories of science and Judaism. (226)

Reed, like Ruderman, comments on the provocative nature of Neusner's article and the resulting critiques, as well as the opening up of needed discussion on the topic.

As Reed states:

For our purposes, his essay proves helpful inasmuch as it addresses head-on many issues left tacit in other treatments of 'science' and Judaism. Also notable, in my view, is the principle of selectivity that Neusner applies to the evidence, as it relates to the broader question of how cultural specificities factor into our discussions of "science" and "religion." (Reed 2007, 465)

In addition to underlining the obvious generalizations found in the 1988 article, Reed also points to Neusner's binary contrast between "religious"/ethical Jewish modes of thinking and "scientific"/philosophical Greek thought. (465) This, she likens to the Hellenistic vs. Jewish dichotomies found in some Christian, theological literature used in order to bolster Christianity's claim to being a synthesis of both.⁷⁴ Reed further notes an inverted take on the Hellenistic-Jewish dichotomy – one which extols the virtues of Judaism as ethical and religious. This, however, essentially leads to the "flattening" described by Ruderman. (466)

For our purposes, these arguments bracket questions related not only to the ways in which the Tannaim, Amoraim and redactors of the Bavli thought about science, but to their ways of thinking about the relevance or irrelevance of scientific data, which

⁷⁴ This summons to mind Veltri's concerns regarding the reification of the term "Hellenistic" itself, which "can refer to Greek 'influences' as far away as Bactrian India and Egypt in the Graeco-Roman period . . ." (Veltri 1998, 306)

ultimately underscores questions of decision-making and decision-*makers*, and of course, the rabbinic authority to decide. In agreement with the authors presented here, I do not share Neusner's essentialist view of "the rabbinic mind," or even the mind of "the Bavli", which is in itself difficult to qualify or quantify. (For example, which textual layers of the discourse are relevant to this research? Which rabbinic texts are included and which are excluded?)

However, like Reed, I appreciate the questions raised by Neusner's inquiry and the ensuing discussions in the literature. Neusner's focus on process and the very concept of "modes of thought" – as opposed to scholarly listings of historical minutiae – have led to intense critique. However, to abandon an emphasis on the ways in which the rabbis thought for fear of historical reductionism or essentialism would be a loss. Assuming, of course, that time, place, text, and context are part of the examination, perhaps both approaches can find their way to the table.

1.3 Celestial Control: Astrolatry, Astral Magic, Astrology, and Cosmogony

"Abaye said: The laws of sorcerers are like those of the Sabbath: some actions are punished by stoning, some are exempt from punishment, but forbidden, while others are fully permitted. Thus, if one actually performs magic, he is stoned; if he only performs illusion, he is exempt, yet it is forbidden. What is fully permitted? The type of actions performed by R. Hanina and R. Oshaya, who spent every Sabbath night studying the Laws of Creation; they used these to create a third-grown calf, and ate it."

-*b. Sanhedrin* 67b

The topics of astrolatry, astral magic, cosmogony and astrology in the rabbinic context overlap significantly in three primary respects – the first is that they are all, of course, related to the heavenly realms, astronomically speaking.⁷⁵ The second is that they are all subject to the waxing and waning exercise of rabbinic authority, and are very tightly controlled, as evidenced by bans upon and critiques of these practices, as well as exceptions to these curtailments made for rabbis of elite standing. And the third is that they are all subject to the mediation of cosmic power, and hence Divine authority. In this section, I examine the literature spanning the secondary literature relating to these *topoi* to frame my own text analyses in chapter four, which demonstrate a recurrent, clear pattern of the imposition of deontic authority in the Bavli over epistemic expertise and the empirical, and a concern with honour shown to both the rabbis and God.

The sub-field of Jewish magic has begun to pick up steam in recent years thanks to the research of scholars including Bohak, whose 2008 volume, *Ancient Jewish Magic*, cited earlier, was the first large project of its kind since the publication of Ludwig Blau's 1898 work, *Das altjüdische Zaubermwesen*.⁷⁶ This was followed, in 2011, by the co-edited volume by Bohak, Yuval Harari and Shaul Shaked, *Continuity and Innovation in the Magical Tradition*. Prior to these publications, and others of their kind, a certain distancing and

⁷⁵ For an in-depth analysis of the heavenly realms in early and rabbinic Judaism, see J. Edward Wright, 2000, *The Early History of Heaven*. New York and Oxford: Oxford University Press. Although there is overlap between the concept of heaven as God's realm and the celestial bodies, these are differentiated in this study to maintain a focus on the astronomical topics.

⁷⁶ The book *Semitic Magic: Its Origins and Development*, by R. Campbell Thompson (London: Luzac) followed soon afterward, in 1908. Though it aims to present a categorized treatment of magic, its emphasis is ultimately mythical, which may explain why it has been glossed over by scholarship. The excellent volume by Joshua Trachtenberg, *Jewish Magic and Superstition, A Study in Folk Religion*. 2004 Reprint. Philadelphia: University of Pennsylvania Press, is a valuable source, describing Jewish folk traditions organized by topic; however, it primarily treats the medieval period. (Trachtenberg, xi; Bohak 2008, 9)

marginalizing tendency toward magic and astrology expresses itself in the literature, and this appears to have been a factor in the relative lack of scholarly interest in these topics for decades prior to the turn of the twenty-first century. Kocku Von Stuckrad points this out in his 2011 volume, *Astral Magic in Ancient Jewish Discourse*, referring to the phenomenon of historians not having taken astrology seriously “due to ‘pagan’ associations.” (Von Stuckrad 2011, 246) We note similar comments in the foreword, by Moshe Idel, to a reprinted edition of Joshua Trachtenberg’s 1939 volume, *Jewish Magic and Superstition: A Study in Folk-Religion*, (Trachtenberg, x) and in Bohak’s *Ancient Jewish Magic*, where the author states:

Given the almost total neglect of Jewish magic in previous scholarship – with Blau’s book on rabbinic magic and Trachtenberg’s on medieval Jewish magic as the major exceptions – one might begin a book on ancient Jewish magic with a detailed analysis of what earlier students of Jewish history and culture have said about Jewish magic, and especially what they have not. Such a survey would try to understand why the general outlook of most Jewish scholars was so hostile to the Jewish magical tradition that it mostly denied its very existence and ignored its abundant remains, and why even non-Jewish scholars showed so little interest in these remains. (Bohak 2008, 9)

Once the floodgates of scholarship on the topic opened, however, we note numerous magical *topoi* in a literature too vast to adequately summarize. These include rabbinic perspectives of sorcery and witchcraft (including views of women as witches, the adjuration of demons, and rabbinic counteraction of witchcraft), magical incantations and *voces magicae*, Babylonian Aramaic magic bowls, divination, rabbinic performances of exorcism, sympathetic magic, oil magic, amulets and (healing) *segulot*, studies related to the Sasanian magus and magic in the Bavli, wonder-working rabbis, and the practice of magic required within the Sanhedrin itself. Of necessity, I must therefore limit my comments

here to sources emphasizing authority and/or the celestial aspect of magic – that is, astral magic, a topic well-attested in the medieval period, but with limited presence in the scholarship spanning the rabbinic era.

Veltri describes the Roman context, in which “‘magic’ and ‘science’ not only encompassed scientific phenomena and religious practices, but also had legal consequences. Supporters of magic were to be prosecuted and severely punished. In Rabbinic Halakhah and Roman Law the penalty for effective (namely, proved) magical procedures was death.” (Veltri 1998, “Rabbis and Pliny”, 86) Indeed, as Philip S. Alexander writes, magic was viewed as a legal category widely condemned in antiquity, (Alexander 2005, 7) and the view of its broad category of actions by the ruling elite “was at best ambivalent, but usually negative.”⁷⁷ (9)

However, as Naomi Janowitz explains, the classification of an action as “magic” was not always so clear-cut:

When identifying an act as magic, a series of questions must be asked to arrive at a correct classification. The criteria are multifaceted and subjective. The content of these questions will be familiar from Origen and Greco-Roman discussions, but the form will be true to rabbinic modes of argumentation. In rabbinic literature strategies of definition are often as important as the definitions themselves. Learning to declare the unclean clean, presented as a criterion for serving as a judge, is a case in point. A rabbi can forbid an action as magic in one case yet in another case permit a similar action. Based on this strategy it is impossible to construct a simple list of the components of magic. Hence the frustration modern scholars encounter when they try to pinpoint exactly what constitutes “magic” for the rabbis. Such discussions involve a great deal of back-pedaling; after claiming that rabbis forbid any forms of “magic,” it is then necessary to explain why they engaged in or permitted so many practices which look suspiciously like magic. (Janowitz 2001, 20)

⁷⁷ This general category, which encompasses astral magic, was seen, in the Bavli, as referring to the list of banned activities in Deuteronomy 18. (Alexander 2005, 10) There is overlap in the definition of magic in the Hebrew Bible and in rabbinic literature – for example, the linkage of idolatry and magic in 2 Kings 21:6, 2 Chronicles 33:6, and *m. Sanhedrin* 7:7. (Janowitz, 21)

The classification of an act as magic involved, a priori, determining whether or not the action was true magic or illusion – that is *ahizat eynayim*, “tricking the eyes” or “holding of the eyes.” (Janowitz, 22, Alexander 2005, 10; Levinson 2010, 57) Joshua Levinson calls attention to the fact that this perceptual category of certain types of magic being mere illusion, or *magicas vanitates*, was common in Late Antiquity. (2010, 58) As Janowitz describes the matter, in *b. Sanhedrin* 65a-67b, a true sorcerer is liable whereas one who creates illusion is not. (Also see *m. Sanhedrin* 7:11) Here, she cites the example in *b. Sanhedrin* 65b of Rabba creating a man. However, as he was not able to respond to Rabbi Zera’s questions about the process, the man was deemed an illusion. (Janowitz, 22) Also cited is the story in *b. Sanhedrin* 65b in which Rabbi Eliezer ben Hyrcanus showed Rabbi Akiva how he was able to magically fill a field up with cucumbers and harvest them. This, writes Janowitz, was permitted, as the episode was used for the purposes of study. (22) Moreover, with respect to other rules of classification, generally speaking, if the action helped or healed someone, it was not viewed as magic (*b. Sanhedrin* 67b). As well, if an act was performed by a woman, it was more likely to be considered witchcraft, as demonstrated in *b. Sanhedrin* 67b (“most women are involved in witchcraft”).⁷⁸ (23)

⁷⁸ On this association between women and magic in rabbinic literature, and the perception that their witchcraft posed a threat to the order of the community, see Simcha Fishbane, 1993, “Most Women Engage in Sorcery”: An Analysis of Sorceresses in the Babylonian Talmud.” *Jewish History* 7:1, 27-42; Rebecca Lesses, 2001, “Exe(o)rcising Power: Women as Sorceresses, Exorcists, and Demonesses in Babylonian Jewish Society of Late Antiquity.” *Journal of the American Academy of Religion* 69:2, 343-76; Michele Murray, 2007, “The Magical Female In Graeco-Roman Rabbinic Literature.” *Religion and Theology* 14:3, 284-309; Eadem., 2008, “Female Corporeality, Magic, and Gender in the Babylonian Talmud.” *Religion and Theology* 15:3, 199-224; Kimberly Stratton, 2005, “Imagining Power: Magic, Miracle, and the Social Context of Rabbinic Self-Representation.” *Journal of the American Academy of Religion* 73:2, 361-93; Eadem., 2007, “Caution in the Kosher Kitchen: Magic, Identity, and Authority in Rabbinic Literature.” Chapter 5 in *Naming the Witch: Magic, Ideology, and Stereotype in the Ancient World*. New York: Columbia University Press.

In essence, magic was viewed as a danger, performed by dangerous ‘others’, which explains the reasoning behind rabbinic permission to fight magic with rabbinic magic. (Veltri 1998, “Rabbis and Pliny,” 86) This, the rabbis did as a means of social control in the rabbinic period, using – and permitting – rabbinic magic when needed. In addition to the permission to perform wonders of healing, and to allow magic when useful, such as in order to teach (as in the case of the magical cucumbers), magic was permitted when “social control – or, to put it bluntly, the rabbis’ own authority – was at stake.”⁷⁹ (Bohak 2008, 366) Magic was therefore permitted against witches, as well as *minim*, a category of heretic-opponents for the rabbis for whom a definition is not always easy to pin down and which is best left to textual context. (Bohak 2003, 267; Idem., 2008, 398)

Another term widely used to refer to the set of suspicious or banned practices is “the ways of the Amorite,” mentioned earlier.⁸⁰ (Janowitz, 23; Veltri 1998-99 “The Other Physicians”, 37-38; Idem., 1998, “Rabbis and Pliny”, 63; Kern-Ulmer, 293-4) In his 1963 article, “On Honi the Circle-Maker: A Demanding Prayer,” – examining a famous rabbinic story to be analyzed in chapter four – Judah Goldin points out that “Emori” may in fact be a metathesis of “*darkhei ha-romi*”, meaning “ways of the Roman.” (Goldin 1976, 117) These forbidden practices represent a wide range of customs banned with no

⁷⁹ On this type of magical combat see Joshua Levinson, 2010, “Enchanting Rabbis: Contest Narratives between Rabbis and Magicians in Late Antiquity.” *Jewish Quarterly Review* 100, 54–94; Gideon Bohak, 2003, “Magical Means for Handling Minim in Rabbinic Literature.” In Peter J. Tomson and Doris Lambers-Petry, Eds. *The Image of the Judaeo-Christians in Ancient Jewish and Christian Literature*. Tübingen: Mohr-Siebeck, 267-79.

⁸⁰ Although it is outside of the scope of this study, it is notable that Veltri (1998, 63) points out the similarity of the “ways of the Amorite” and “Greco-Roman practices, which, in Pliny’s *Natural History* are named ‘magic deceits.’” He further describes what he terms “the deep similarities between Jewish and Roman minds. Both Pliny and the Rabbis reflect a pragmatic mentality, intent on examining and judging instructions that could be helpful or harmful for the eventualities of everyday life.” (Veltri 1998, “Rabbis and Pliny”, 63)

particular explanation. Moreover, in other contexts, the rabbis permitted and themselves performed identical or similar practices.⁸¹

Of course, as mentioned earlier, if the practice was shown to heal, it was permitted – by Rabbi Yohanan, see *y. Shabbat* 6:9-10; *b. Shabbat* 67a – and not viewed as “the way of the Amorites.” (Veltri 1998, 310; Idem., 1998-99, 39; Janowitz, 24) This, as Veltri points out, demonstrates that rabbinic Judaism was willing to use even “pagan” practices if they cured the patient.⁸² (Veltri 1998, 310) However, because the list of rules in the Tosefta and later, in the Bavli, regarding these banned ways was so arcane, one had to ask a rabbi to ensure compliance. This, Janowitz writes, “effectively brought the practices within their sphere of power. [. . .] It is no coincidence that the Talmud rules that anyone wishing to be on the Sanhedrin must be able to do magic (*b. Sanh* 17a).” (Janowitz 2001, 24) This point is key to my own arguments, for it highlights the intensity in the Bavli of the need to self-present as being in control of these threatening practices where convenient.

According to Veltri, Pliny’s view of the magi was equivalent to the rabbis’ perspective on the “Amorites” given their practice of “pseudo medicine.” (Veltri 1998,

⁸¹ For example, see Bohak 2008, 274-75 for the rabbinic practice of a private magical ritual that contradicted the bans of “the way of the Amorites”.

⁸² Daniel Sperber comments on the mutual influence of Pagans and Jews as evidenced by Greek and Coptic magic charms from this period in his 1998 article, “Some Rabbinic Themes in Magical Papyri.” *Journal for the Study of Judaism* 16:1, 93. So too does Veltri comment on the interplay during this time, mentioning that “one Marcellus Empiricus transmitted a remedy which he attributed to Rabban Gamli’el.” *t. Shabbat* 7:21, for example, reads that “If a bone got stuck in one’s throat one may put on his head a bone of that sort.” This matches Pliny’s *Natural History* 28, which reads “Should a fish bone stick in the throat, they say it comes out if the feet are plunged into cold water; if however, it is another kind of bone, bits of bone from the same pot should be applied to the head; if it is a piece of bread that sticks, pieces from the same loaf must be placed in either ear.” (1998, 311-12 and 312, Fn. 35) This parallel, according to Veltri, was Roman, and that led to the emergence of a halakhic tradition in Judaism of allowing for the usage of any curative tool, medicine, plant, herb, or custom, that was not overtly idolatrous. (1998, 312)

310; Idem., 2002, 193) Oddly, however, Palestinian sources pre-dating the Bavli do not mention the term “magus” – one which was well known in the Mediterranean region. (Veltri 2002, 192) For Pliny, the magi were foreigners who performed magical acts and were experts in astrology. They were considered exceptionally powerful and dangerous in Rome.⁸³ (193-94) Here, within the context of praxis during the Roman period, the linkage between magic and astrology is clear, and the inclusion of the mishnaic stratum in the Bavli maintains this association.

Moving forward to the Sasanian context, the Bavli names the magi, and has only negative things to say. In *b. Sotah* 22a, the magi are derisively compared to the Tannaim, as they both repeat things that they don’t comprehend.⁸⁴ Moreover, in *b. Shabbat* 75a, the magi are termed astrologers in the context of a legal question as to whether the practices of a magus should be viewed as blasphemous or as sorcery.⁸⁵ (Veltri 2002, 192)

In his 2010 publication, “Talmudic Attitudes Toward Dream Interpreters,” Richard Kalmin discusses the magi as seen by the rabbis from a Persian perspective. Here, Kalmin points to the strongly negative valence, citing *b. Sotah* 22a as well as

⁸³ As Veltri explains, in the *Apology* of Apuleius, “the Magi were considered malefici, producers of evil things.” (1998-99, 42) Moreover, in Targum Pseudo-Yonathan, “*haver haver*”, related to enchantment, is translated along with “*ruten*, the training school of the Magi, also famous for enchanting serpents.” (Ibid.)

⁸⁴ These were likely, according to Richard Kalmin (2010, 93), as well as Shai Secunda (2005, 153) murmurings from the *Avesta*.

⁸⁵ The question of classification is key here, as some types of magic were viewed not as “the ways of the Amorite” but as *avodah zarah*, or idolatry. For example, in *b. Shabbat* 75a, Rav considers a magus to be an idolater. [Brigitte (Rivka) Kern-Ulmer, 1996, “The Depiction of Magic in Rabbinic Texts: The Rabbinic and the Greek Concept of Magic.” *Journal for the Study of Judaism* 27:3, 295-296.]

b. Shabbat 75a, which reads – most tellingly, for Kalmin – that “He who learns a single thing from a magus is worthy of death.” (Kalmin 2010, 93) Most important from our perspective are the rabbinic admonitions against contacting astrologers, as it appears in *b. Pesahim* 113b. Here, they are referred to as Chaldeans. According to Kalmin, “If we trust the reports of observers outside of Iran as well as some reports in Iranian literature [. . .] some of these Chaldaeans were Persian priests.” Here, the Chaldeans and magi were both viewed as threats to the rabbis’ own expertise. (Kalmin 2010, 94) Nevertheless, according to Kalmin, some rabbis did seek the advice of astrologers, as evidenced in the meetings between Samuel and ‘Ablat, recounted in *b. Shabbat* 129a. In this encounter, however, the Jews are seen as protected from astrological influence by means of their virtue – a clear elevation of halakhic rulings deemed central over celestial topics.

Neusner, in his 1966 piece, “Rabbi and Magus in Third-Century Sasanian Babylonia,” points to the strong similarities between the roles of the rabbi and the magus, zeroing in on rabbinic interest in astrology and medicine, which were also commonly studied in Babylonia. (Neusner 1966, 169-171) Here, Neusner points to the absorption of astrology into Sasanian rabbinic culture, with the aforementioned caveat that Israel is immune from astrological influence. (172) This last is an interesting and relevant point in itself, as the rabbinic decision to allow astrology in by rendering the practice harmless to Jews by citing national immunity is a clear example of the exercise of deontic authority presented in a unique light – that is, not merely rabbinic but Jewish status accompanied by normative rabbinic practice being protective. As I see it, this highlights the reinforcing

phase of rabbinic Judaism, which has galvanized its power but seeks to maintain adherence to rabbinic authority even when followers have access to other sources of wisdom within the Sasanian context, such as the magi.

Indeed, Secunda also sheds light on the Bavli's views of the magi in his 2005 article, "Studying with a Magus/Like Giving a Tongue to a Wolf." Here, the author makes it clear that Zoroastrian influences pervaded the Bavli, despite much earlier scholarship, which treated it without such context even as the Yerushalmi was interpreted with an awareness of Greek and Latin texts and its Hellenistic context. Indeed, in a 2012 article by Secunda, he underscores the importance of understanding the perception of the Zoroastrian priesthood, and Zoroastrianism itself, among the Babylonian Amoraim, citing the frequent reminders of Yaakov Elman that the Amoraim had a context, and that they regularly came into contact with non-rabbinic Jews and non-Jews alike. (Secunda 2012, 401) Relevant to the source material and argument I will put forward in the coming chapters are Secunda's comments that in the Bavli, both studying with a magus and not performing astrological calculations are forbidden, with the former being "a capital crime." (Secunda 2005, 151) Secunda also points to the rabbinic connection – in both Palestinian and Babylonian contexts – of the magi with magic, and concerns regarding the banned magical practices found in Deuteronomy 18:9-14. (153) Once again, and instructive for our purposes, the clear linkage between magic and astrology counters scholarship that does not view these as intermingled categories.

Finally, in “Rabbis and Their (In)Famous Magic,” J. H. Chajes opens the discussion of “exploring the place of magic in the constitution of rabbinic authority,” addressing the question of how one became a “rabbinic magus” and the nature of his status. Here, Chajes calls the rabbis’ slight subversion of their own authority by appropriating the dangerous, if expert, mantle of the magi “teasingly transgressive.” (61) Nevertheless, the rabbis had a trump card that ensured their success and reputation – their virtue, which they contrasted with the impurity and black magic of the non-Jewish magical practitioners. (71-72)

All of the above sources on rabbinic magic address the question of authority – using categories and terms such as *forbidden vs. permitted*, *minim*, *avodah zarah*, and *kisuf*, and invoking the spectre (whether or not it was ever used) of capital punishment for transgression. Moreover, the creation of the category “Ways of the Amorite,” and making it imperative for a would-be practitioner to consult a rabbi to determine whether or not their activity was permitted or forbidden, served two purposes. As we have seen, it ensured social control. It also allowed the rabbis to permit their own practice of the magical arts where appropriate or useful – for example, in rabbinic healing and wonder-working, thereby further bolstering their status in the community. That they could, as Chajes points out, transgress their own boundaries by creating new ones and moving the line where it was convenient to do so, speaks volumes, and underscores the strong presence of deontic authority in the nexus of astral concerns to be addressed and analyzed in the chapters to come.

The overlap between magic and idolatry – or, for our purposes, astrolatry, the worship of the celestial bodies – frequently leads to the appearance of these categories together in scholarly works, sometimes alongside astrology or cosmogony – and these frequently appear within the context of rabbinic authority formation or maintenance. With this overlap in mind, we turn to an early article by E.E. Urbach (1959), “The Rabbinical Laws of Idolatry in the Second and Third Centuries in the Light of Archaeological and Historical Facts,” in which a particular type of image was particularly reviled by the Tannaim – of the “figure of the sun, a figure of the moon, or a figure of a dragon,” which, if found, must be thrown into the Dead Sea.⁸⁶ (Urbach 1959, 232) Urbach also points to gentiles who put up a statue of Mercury within the rabbinic discussion in *m. Avodah Zarah* 3:14 and *b. Avodah Zarah* 50a of desecrating such idols. (233-34) Of no small importance is the following inclusion of the astral bodies as part of the ban on representation in images as found in *t. Avodah Zarah* v, 2:

R. Eliezer and R. El'azar bar Zadok and others [. . .] held that all features might be copied, except the human countenance. The dissenters also included the sun and the moon, the stars and the signs of the Zodiac in this prohibition, unlike Rabban Gamaliel who had images of the moon in his upper chamber, and in contrast to the ruling of the Baraita that all the signs of the Zodiac are permitted, except the sun and the moon. (Urbach 1959, 235)

As Emmanuel Friedheim points out, in his 2009 piece, “Sol Invictus In the Severus Synagogue at Hammath Tiberias, the Rabbis, and Jewish Society: A Different approach,” the question of rabbinic authority over their communities during the mishnaic and talmudic periods is a key question. Here, he re-addresses the question of

⁸⁶ In *t. Avodah Zarah* 5(6):1. This series also includes “a nursing female image and ‘Sarapis.’” Emmanuel Friedheim identifies the nursing female image as being related to “Nysa-Atargatis, Dionysus, and, indirectly, to the cult of Jupiter Heliopolitanus.” (See 2003, “Who Are the Deities Concealed Behind the Rabbinic Expression ‘A Nursing Female Image?’,” *Harvard Theological Review* 96, 250.)

the appearance of Sol Invictus in the synagogue floor mosaic at Hammath Tiberias, dated to the fourth century, and Na'aran and Beit Alpha, to the sixth century.⁸⁷ At Sepphoris (also with a sixth century dating), Helios is not present, but his chariot is there, accompanied by the stars, sun, and moon. (Friedheim 2009 “Sol Invictus”, 91) The intense scholarly debate surrounding this matter, led by the charge of Erwin R. Goodenough, is relevant to the broader discussion of astrology in rabbinic Judaism, but is outside the purview of this study. The debate is well summarized by Friedheim in this article, in *Rabbanisme en Palestine Romaine* (Friedheim 2006, 109-159), as well as by numerous additional scholars.⁸⁸

For the purposes of my argument here, I focus on Friedheim’s descriptions of the widespread Roman worship of Sol Invictus by Emperors Aurelian (270–275 C.E.), Diocletian (284-305), Julian (361-363), and others. (Friedheim 2009, 96) Here, Friedheim summarizes the rabbinic response to this celestial practice:

A study of the Tannaitic and Talmudic literature regarding the cult of the sun reveals that Palestinian rabbis presented this rite as a contemporaneous phenomenon that must be fought because of its despicable nature and, possibly, because of the cultural and social

⁸⁷ The topic of Late Antique Jewish zodiac mosaics found on a number of synagogue floors is beyond the scope of this study, and is well described elsewhere. For a depth analysis of heavenly realms in early and rabbinic Judaism, see J. Edward Wright, *The Early History of Heaven*. Astronomical/astrological iconography in Late Antique Judaism is a focus at synagogues including Beit Alpha, Sepphoris, and others. On this, see Rachel Hachlili, 1988, *Ancient Jewish Art and Archaeology in the Land of Israel*. Leiden: E.J. Brill; Eadem, 2002, “The Zodiac in Ancient Synagogal Art: A Review”, *Jewish Studies Quarterly* 9, 219-258, and Jodi Magness, 2005, “Heaven on Earth: Helios and the Zodiac Cycle in Ancient Palestinian Synagogues,” *Dumbarton Oaks Papers* 59, 1-52.

⁸⁸ For example, see Rachel Hachlili, 1988, *Ancient Jewish Art and Archaeology in the Land of Israel*. Leiden: E.J. Brill; Eadem, 2002, “The Zodiac in Ancient Synagogal Art: A Review” *Jewish Studies Quarterly* 9, 219-258; Eadem, 2009, *Ancient mosaic pavements: themes, issues, and trends: selected studies*. Leiden: Brill. Jodi Magness, 2005. “Heaven on Earth: Helios and the Zodiac Cycle in Ancient Palestinian Synagogues,” *Dumbarton Oaks Papers* 59, 1-52; J. Glen Taylor (1996); Stephen Fine, 2005, *Art and Judaism in the Greco-Roman World: Toward a New Jewish Archaeology*, 196-205. Lester J. Ness, 1997, “The Zodiac in the Synagogue.” *Journal of Ancient Civilizations* 12, 81-92; Eliezer L. Sukenik, 2007, *The Ancient Synagogue of Beth Alpha*. New Jersey: Gorgias Press.

threat it posed to the Jews of the Land of Israel. Both the sages of the Mishnah and the Amoraim were aware of the religious-cultic significance gentiles attributed to Sol Invictus and of the religious and social danger inherent in the conduct of this god's rite. A few things should be mentioned before we review the sources on which this assumption is based. First, the rabbis knew the Greek name of the sun god, Helios, and almost certainly understood the philological meaning of the Greek term. Second, we should mention something that is sometimes ignored, probably because it is so well-known: the rabbis called idolatry "*avodat kokhavim u-mazalot*," literally, the worship of the stars and the astrological signs. This expression is often used for idolatry in general, and the formulation "*ovdei* [the worshipers of] *kokhavim u-mazalot*" usually refers to all pagans. (Friedheim 2009, 107-108)

Note here Friedheim's assertion that the term *avodat kokhavim u-mazalot* is often synonymous with the category of idolatry. Further, he mentions that astrolatry, particularly solar and lunar worship, were primary components of the Paganism of Roman Palestine between the second and fourth centuries C.E. Indeed, as Friedheim states, "The sages of Yavneh regarded sun worship as one of the prominent characteristics of idolatry."⁸⁹ (108) Indeed, we might not be aware of the full scope of the challenge to the authority of the rabbis and the integrity of the Jewish community of the time, for there is always the possibility that Paganism, particularly worship of the sun, "represented a cult that paralleled, and perhaps even rivaled, Judaism." (110) On a note of special interest where rabbinic authority is concerned, Friedheim points out that although the cult of the sun is mentioned in the Tanakh as a concern, the sun is not singled out as uniquely offensive, but is counted among the admonitions against idolatry. (111-112) As a result, we note a unique and special focus on the part of the rabbis on celestial, or more specifically, solar, worship, as Friedheim explains:

[T]he condemnation and rage the cult of the sun arouses in the Rabbinical literature

⁸⁹ Hence, the tannaitic ruling mentioned earlier "that if someone finds vessels with the image of the sun and the moon, the vessels must be destroyed, with similar comments in the Tosefta "If one found a ring bearing the image of the sun, the image of the moon [. . .] he takes [it] to the Dead Sea." (Friedheim 2009, 109)

appears to be the result of a concrete religious reality during the time of the Tannaim and Amoraim. Furthermore, this was the case during the time of both the Mishnah and the Talmud and was unique within the general stance toward idolatry adopted by the Land of Israel Rabbis. In other words, we do not find the rabbis so angry toward, or intent on retribution against, the cults of Aphrodite, Mercurius, or other pagan rites. Moloch and Peor, were not regarded in such a harsh light, a fact that in itself speaks volumes. (Friedheim 2009, 112-113)

This rage is explained by two historical facts, according to Friedheim – that the solar cult was pervasive, and that Jews were also likely participants in the worship of the sun during the eras of the Tannaim and Amoraim.⁹⁰ This leads Friedheim to conclude that the Palestinian Amoraim did not attend services at the synagogues containing the Helios and zodiacal imagery, and that Jews who did attend did not consider themselves “as subject to the authority of the rabbis of Tiberias, despite the formative role these sages played in the fashioning of the Palestinian Talmud.” (Friedheim 2009, 126-128)⁹¹

We see a similar portrayal of celestial bodies, in this case, the planets, in “The Planets, the Jews and the Beginnings of “Jewish Astrology” (2011), by Reimund Leicht. This article addresses the interplay between astrology and astrolatry in the sources, and addresses the silence with respect to the planets in Second Temple Jewish sources, with some attempt at addressing them during the rabbinic period in the context of Jewish calendar development. In Roman sources, we note that Vettius Valens catalogued the planetary hours in his *Anthologiae*, chapter I:10.⁹² (Leicht 2011 “The Planets”, 277-278)

⁹⁰ Cf. Richard Kalmin, who finds this dichotomy between the rabbis and idolatry to be simplistic, suggesting that rabbinic “anxiety” regarding idolatry by the talmudic period “supplies evidence of attempts by rabbis to convince themselves or other rabbis of the inefficacy of idols.” (Kalmin 2008, 641)

⁹¹ Here, Friedheim claims that the rabbis’ authority was not weak, and that by the late second century C.E., the Patriarchs were viewed as the Jewish leadership. However, most recent scholarship calls this contention into serious question. (Friedheim 2009, 126-128)

⁹² Leicht cites Solomon Gandz here, for Gandz assumes that Jews introduced the order of the planets based on creation in the Hebrew Bible in the second century B.C.E. (Leicht, 278-279, citing Solomon Gandz, 1948-

However, the first real evidence for Jewish awareness of planetary hours (i.e., planets as “rulers of weekdays and hours”) is located in *b. Erubin* 56a, in which Mar Shmuel describes the *tequfot*, with some astrological inclusions reminiscent of the *brontologia* of Qumran, in which “the occurrence of the *tequfot* in the hour of Jupiter will bring forth heavy (Nisan) and hot (Tevet) winds.” (280) Leicht also refers to the planets in the context of planetary astrology in *b. Shabbat* 129b in a listing of auspicious and non-auspicious astrological dates for blood-letting. (283) In another 2011 piece by Leicht, “Planets in Ancient Hebrew Literature,” he describes the rabbinic presentation of the planets in Epiphanius. (Leicht 2011 “Planets In”, 28-30) Here, Leicht describes the trajectory of rabbinic interest in the planets waxing from almost no interest during the Second Temple period to only little more interest during the early tannaitic era. Here, he also notes a strong association between the planets and astrolatry – for example, Leicht points to the statement in *t. Berakhot* 6:6, “that a person who sees ‘the sun, the moon, the stars (*kokhavim*) and the *mazzalot*’ has to say the benediction ‘blessed be the maker of creation’ (*barukh ‘oseh bereshit*).” (Leicht 2011 “Planets In”, 19) Leicht continues by describing a range of tannaitic writings in which the heavenly bodies are clearly associated not with science as such, but with astral worship. (Ibid.) Key to an understanding of concern regarding potential misinterpretation of the correct course of action upon seeing the heavenly bodies is the fact that the blessing exhorts the worshipper to focus on the

49, “The Origin of the Planetary Week or The Planetary Week in Hebrew Literature,” *Proceedings of the American Academy for Jewish Research* 18, 213-254.) However this theory of Jewish contribution, according to Leicht, “is too difficult to assess.” (Leicht, 280)

creator, and not upon the astral bodies themselves. As such, seeing these luminaries must automatically be paired with an acknowledgement of the creator.

In addition to the blessing required in *t. Berakhot* 6:6 on seeing the luminaries, Leicht also points to negative valences in *m. Avodah Zarah* 4:7, which describes “the service of ‘the sun, the moon, the stars (*kokhavim*) and *mazzalot*’”(19). Similar astral associations are noted in *t. Niddah* 5:16, *t. Hullin* 2:18, and in the *Mekhilta de-Rabbi Ishmael, Yitro* 6, among other rabbinic sources. (Ibid.) Here, it is possible either that the *kokhavim* are the planets or that the *mazzalot* and *kokhavim* represent them. (20) In *Gen.Rab.* 10:4, however, we note a definite identification of the *mazzalot* with the planets. (26)

Turning to the Bavli, Leicht describes the same pairing of seeing the moon, stars, and *mazzalot* with reciting the *oseh ma’aseh bereshit* formula. (24) Leicht’s approach reinforces my own understanding and analysis of the texts in question, serving to further tighten the links between astronomy and rabbinic concerns regarding astrolatry. This concern will play itself out in my examination of the primary texts in chapter four. My reading is that this blessing upon seeing the celestial bodies likely emerged out of rabbinic concerns regarding astrolatry. Furthermore, the importance is shown in this text of astronomy and astrolatry being subsumed under the authority of the creator and all creation.

Nevertheless, as we move further into the rabbinic period, rabbinic interest in the celestial sciences seems to have overcome some of the initial “rage” toward even the sun, as described by Friedheim, though concerns and rabbinic anxiety regarding astrolatry persisted into the Sasanian context. Indeed, we eventually begin to find the sun and the

moon appropriated as symbols representing God's dominion in *Gen.Rab.* 6:1.2, with *the moon* being diminished in 6:3.⁹³ However, in 6:3.3, we do note the equation with Rome (Esau) as the sun and Jacob (Israel) as the moon.⁹⁴ Neusner sees this as a polemic against Rome, for within the subtext of the biblical story of Jacob and Esau, we see the inevitability of Israel's salvation and re-emergence at some point in the future when Rome's influence wanes.⁹⁵ (Neusner 1985 *Genesis Rabbah*, 381) As such, we cannot point to a singular view of astrolatry in rabbinic sources, but instead, a series of views that move from negative valence to ways of incorporating the astral bodies into mainstream rabbinic thought based on need and interest, subject to authoritative judgments by the rabbis.

We find this same variability with respect to the rabbis' views of astrology. In *b. Pesahim* 113b and elsewhere, astrologers are referred to as *kaldiyim*, or Chaldeans – highlighting awareness of the Babylonian origins of this practice, and of course, falling within the orbit of magic. However, in the Yerushalmi and in early midrashim, we note the use of *astrologos* and *astrologiya*.⁹⁶ As Veltri describes the matter, astrology is seen as having at least some scientific merit in the Palestinian context – and this is also transmitted as a commentary on the “Ways of the Amorite” in *y. Shabbat* 6:10, in which two of R. Hanina's disciples went to cut wood, and an astrologer forecasted that they

⁹³ A precise dating for *Gen.Rab* is not possible, and would be speculative, though a date prior to the closing of the Bavli is likely.

⁹⁴ Also see *b. Sukkah* 29a and *b. Hullin* 60b.

⁹⁵ According to the commentator, the Maharsha's (Shmuel Eidels, 1555 – 1631) polemic against the Roman solar calendar is evident in *b. Pesahim* 118b, where the number 365 is repeatedly used. My thanks to Dr. Jordan Rosenblum for calling this to my attention.

⁹⁶ 2007, “Astrology”, *Encyclopedia Judaica*. 7th Ed.

would not come back. However, their fate was overturned by their *merit* when they shared food with an old man who informed them that by helping him, they would live out the day. On being asked about his wrongful forecast, the astrologer replied “I am a liar, for my astrological science has fooled me.” (Veltri 1998, 315-16) While astrology is considered a science within this rabbinic context, it is ultimately dependent on the will of God based on the merit of virtuous Jews who followed *halakha*.” (316) Contradicting this positive valence is M.J. Lehmann, in “New Light on Astrology In Qumran and the Talmud,” which cites *y. Shabbat* 6:9 describing a man’s punishment for abstaining from action at a given time due to an astrological forecast. (Lehmann 1975, 600) Even within the same text, therefore, we find an ambivalent stance mediated by the imposition of rabbinic authority for different reasons, and apparently depending on very specific contexts and rationales – the first is a means of rewarding halakhic observance by having what is otherwise considered a “scientific” influence overturned. The second presents a wholly negative stance on astrology, culminating in punishment imposed by the rabbinic authorities.

The *locus classicus* of the rabbinic debate surrounding astrology, however, takes place in *b. Shabbat* 156a-b. In 156a, we note entries in R. Joshua b. Levi’s record book regarding the astrologically-conferred characteristics of individuals born on particular days of the week. That is, the imposition of *mazal*, or destiny, by means of heavenly bodies such as the sun, the moon, Mercury, Venus, Jupiter, and other celestial objects.

R. Joshua's pro-astrological stance, and that of R. Hanina, are countered here by that of R. Yohanan, who asserts *אין מזל לישראל* Here, the debate is not primarily one regarding the validity of astrology and *mazal*, but pertains to whether it is “the constellation of the day” or “that of the hour” that determines a person's fate. This discussion is of importance to my further discussion of this *sugya* in chapter four, for the debate displays ambivalence in the text, and this ambivalence highlights rabbinic concerns regarding the astral mediation of destiny over and above their own authority to establish a non-deterministic fate for Israel contingent on observing *halakhab*. Indeed, this point essentially establishes another exception for the rabbis, allowing them to use astrology where appropriate, but also calling for legal control over those who would also practice it, giving them immunity to the empirical, celestial forces in exchange for their adherence to deontic rabbinic authority.

This immunity to *mazal* is based on an interpretation of Jeremiah 10:12, which urges the Israelites not to learn the way of the nations or to be dismayed at the signs of heaven as the nations are. We also see clear echoes of Deuteronomy and the Deuteronomic school of thought here. That is, astrology and *mazal* are subsumed within the practices of the foreign ‘other’, and do not belong within normative Jewish tradition. Indeed, as James Charlesworth expresses the matter, “a serious breach with the biblical concept of God (especially the idea of divine providence) and of humanity (notably the belief in the freedom of choice) is made by the claim that human character is determined by the position of the Sun, Moon, and planets.” (Charlesworth 1987, 931) In his own

2008 analysis of *b. Shabbat* 156a-b in “Astrology in the Talmud,” Gregg Gardner points to the evidence that the Stammaim redacted several sections of this *sugya*, attempting to reinforce God’s dominion over the celestial bodies. (Gardner 2008, 325) Moreover, according to Gardner, they redacted the text to make it clear that Jews who do not follow the *mitzvot* have no immunity from the heavenly bodies. (338)⁹⁷ Jeffrey L. Rubenstein also analyzes *b. Shabbat* 156a-b (2007, “Talmudic Astrology”), and here, he cautions that we must be careful to avoid presenting a simplistic dichotomy between Judaism and its host culture and to avoid reifying “rabbinic Judaism” and “astrology.”⁹⁸ (Rubenstein 2007, 139-140) This is consonant with my presentation of overlapping astral phenomena in this study; again, we frequently find that some or all of the categories of astrology, astrolatry, astral magic, and even cosmogony are referred to together.

On a final, telling note prior to examining cosmogony, we turn to another piece by Rubenstein, “Astrology and the Head of the Academy.” (2012) Whereas the varied sources mentioned here may leave the reader with a mixed view of rabbinic attitudes toward astrology, this source illuminates the science of astral influence as expressed within the seat of authority and power.⁹⁹ Here, Rubenstein examines the process of

⁹⁷ Again, I take no stance on the specifics of the redaction history of the Bavli or its timing.

⁹⁸ Rubenstein notes that the “tensions” found in *Shabbat* 156a-b can be situated the Sasanian context and a similar debate among Zoroastrian theologians. (Rubenstein 2007, 109) However, according to Veltri, it was not possible to reject all foreign knowledge as idolatrous, including astrology. After all, astrology and medicine were both included in the listing of the ways of the Amorite in the *Yerushalmi*. Once again, as with magic, Veltri describes the rabbinic willingness to accept or reject astrology based on its pragmatic function – not merely because the Torah contained a listing of banned practices. This is supported by *b. Megillah* 16a, which equates scientific knowledge among Jews and gentiles alike with wisdom. (Veltri 1998, 317)

⁹⁹ And there is without question ambivalence even within given rabbinic texts themselves – in the form of internal debate and outright inconsistency.

selecting the Head of the Academy in the time of the Stammaim,¹⁰⁰ pointing to requirements in the form of Torah knowledge, wealth, and lineage. However, he also points to evidence for another factor – astrology. (Rubenstein 2012, 302) Rubenstein locates this evidence in *b. Berakhot* 64a, *b. Ta’anit* 21a, *b. Bava Batra* 12b, and *b. Shabbat* 156b. In these, the destiny of sages is forecast by means of astrology. In some cases, this destiny is to become the Head of the Academy. (302-303) Rubenstein explains this means of appointment as unsurprising given the fact that “in antiquity there was no difference between (what we would call) astrology and astronomy.” (312) Indeed, as we have already noted, astrology was viewed as a science – the primary point of dissent among the rabbis being whether or not Jews were subject to celestial influence. (Ibid.) However, Rubenstein also points out that, more broadly speaking, the association between astrology and power would also have been key, as it carried with it “enormous influence” in various spheres of life, politics included. (313-14) Moreover, this was key in the Sasanian context given the presence of astrological experts both among the rabbis and within their Persian host culture.

Turning to cosmogony, Norbert Samuelson addresses the broad theme of creation by commenting on the Hellenistic, Stoic themes present in the writings of the early rabbis, and, more broadly, in Jewish sources from times outside our period of interest. In so doing, he underlines the general questions brought to the hermeneutical fore by interpreters, the rabbis among them. These include:

¹⁰⁰ Although this is technically beyond the time of the Amoraim, the key role of the anonymous redactors in shaping the Bavli renders an analysis of this kind revealing for our purposes.

What are “the deep,” “tohu and vohu,” and the “divine wind”? What is a “day”? Is it a period of time or a spatial division? What is the “light” created on the first day, how does it differ from the lights of the stars created on the fourth day, and where is the original light now? What is a “raqiyah”? In what does it consist and how does it function to separate the earth from the sky? What is life (nefesh chayah)? What is a “human” and what does it mean that he was created male and female? Finally, how do “work” (melachah) and “rest” differ and how does that difference affect Jewish worship on the seventh day? Note that on any of the ways that the rabbis interpret these creation texts, their meaning integrates physical accounts with judgments about both moral and liturgical purpose. (Samuelson, “Creation in Judaism”, 522)

Indeed, these are all key questions connected with the interpretation of *Gen.Rab* and Bereshit itself in the rabbinic context. As Samuelson concludes, however, the rabbinic interpretation of creation texts “integrates physical accounts with judgments about both moral and liturgical purpose.” (522) We see this type of purpose within the admonitions of *m. Hagigah* 2:1, in which *Ma’aseh Bereshit*, the workings of creation, “must not be expounded before two or more persons.” (P.S. Alexander, 183) As cited in Alon Goshen Gottstein, the Mishnah reads:

Laws of illicit sexual relations are not to be expounded by three people together, nor *Ma’aseh Bereshit* by two, nor *Ma’aseh Merkabah* by one alone, unless he was wise and understood on his own accord. Whoever looks into four matters, it would be better for him had he not come into the world: What is above and what below, what is before and what after. [. . .]Whoever has no regard for the honor of his Creator-it would be better for him had he never come into the world. (Goshen Gottstein, 186)

Once again, as mentioned earlier, Goshen Gottstein points to the common assumption that *Ma’aseh Merkabah* and *Ma’aseh Bereshit* are connected in form and function based on their inclusion in this Mishnah. However, as he demonstrates, these domains are not shown to be directly related in rabbinic literature. (Goshen Gottstein, 196) As he concludes:

Testimony of the connection between *Ma’aseh Bereshit* and *Ma’aseh Merkabah* is, therefore, weak and is dependent on the context of the Mishnah in Hagigah. The claim that there is no connection between the two realms is reinforced through an examination of sources in

which we would expect to find an association or juxtaposition between *Ma'aseh Bereshit* and *Ma'aseh Merkabah*, yet any such connection is absent. (Goshen Gottstein, 197)

For Goshen Gottstein, then, *Ma'aseh Bereshit* is not marked as esoteric, whereas *Ma'aseh Merkabah* is. Hence, the only connection between the two is the honour of God. (200) He therefore concludes that the former “is not part of ancient Jewish esoteric teaching,” and that the reason for the interdiction of expounding *Ma'aseh Bereshit* is linked to the relation between *tohu va-bohu* and the created world, and to “the honor of Creation and its Creator.” (201)

In his 1992 article, “Pre-Emptive Exegesis: Genesis Rabba’s Reading of the Story of Creation,” Philip S. Alexander describes the ban on *Ma'aseh Bereshit* as elucidated in *m. Hagigah* 2:1, describing its interplay with *Gen.Rab*, the latter of which – and this, in apparent agreement with Goshen Gottstein – does not mark itself as “esoteric.” (Alexander 1992, 234) However, Alexander does not see a breach of the strictures of *Hagigah* here despite its elaboration on Genesis, which appears to amount to *expounding* – rather, *Gen.Rab.* provides an interpretation of the limitations of *m. Hagigah* 2:1. (234-35) Indeed, as Alexander sees the matter:

But the redactor of Genesis Rabba shrewdly realizes that in order to exclude such unacceptable readings it is not sufficient simply to enunciate a general prohibition in the manner of Mishnah Hagiga 2:1. Midrash abhors a vacuum, so it is necessary to occupy the exegetical space of the biblical text with an acceptable reading, in order more effectively to exclude the unacceptable. This is achieved by the traditions assembled in Genesis Rabba 1:1-8:1. The compilation is fundamentally polemical in character, and its purpose is to present a rabbinized reading of the Story of Creation in which that story is shown to express some of the basic values and to illustrate some of the central themes of the rabbinic world-view. (Idem., 236)

In this analysis of the interdictions of *Hagigah* and the reading of the interdictions by *Gen.Rab.*, Alexander calls this reading “implicitly polemical and is intended to elbow

out certain unacceptable readings.” (243) Further, he states that the sensitivity of the rabbis regarding the exegesis of creation – which he sees as surprising given both its semblance of the exoteric and its centrality to rabbinic theism – may well have been due to the very centrality of the doctrine that God created the world. As Alexander concludes, “no divergence could be tolerated” in this respect, and more to the point, whereas “Debates on the minutiae of the *halakbah* could well be for the sake of heaven; debates on the creation of the world could not, since they ran the serious risk of creating schism.” (245) This provides a frame for my contention that cosmogony is marked as a special celestial topic that galvanizes the centrality of deontic authority for the rabbis. This argument is further strengthened by a context where rabbis of prestige who are “wise” and “understand of their own accord” are permitted to delve into the banned material. Here, it is their prestige and hence, their self-presented inheritance of the ongoing mantle of creation that qualify them to peer into pre-existence.

Reed comments on Alexander’s “pre-emptive exegesis” in her 2011 article “From ‘Pre-Emptive Exegesis’ to ‘Pre-Emptive Speculation?’ *Ma’aseh Bereshit* in *Genesis Rabbah* and *Pirquei deRabbi Eliezer*.”¹⁰¹ To Alexander’s analysis, Reed adds a number of points, foremost among them the equation of the knowledge of the secrets of creation with the knowledge of Torah. (Reed 2011, 121) As she also states, “much of the discussion of the

¹⁰¹ Reed links authority and cosmology in another of her articles, “‘Who Can Recount the Mighty Acts of the Lord?’ Cosmology and Authority in *Pirquei deRabbi Eliezer* 1-3.” *Hebrew Union College Annual* 80, 115–41. Though it is beyond our scope, it bears mentioning here. Similarly, I refer the reader to the 2014 piece, by Katharina Keim, “Cosmology as Science or Cosmology as Theology? Reflections on the Astronomical Chapters of *Pirke DeRabbi Eliezer*.” In Sacha Stern and Charles Burnett, Eds. *Time, Astronomy and Calendars in the Jewish Tradition*. Leiden: Brill, 41-64.

danger of inquiry into *ma'aseh bereshit* in the Mishnah and GenR, etc., revolves around the possibility that someone could inquire so far into creation and the cosmos, so as to risk dishonoring the Creator.” (123) By extension, I read these comments, taken together, as suggesting that as long as a rabbi was known to possess knowledge and expertise in Torah, he was also immune to the dangers of inquiry into creation. As a corollary to this, by definition, his deontic authority by virtue of his station is both supported by his Torah knowledge and by his reputation as a keeper of these cosmogonic secrets. This greatly reduces the appearance of insulting God’s honour by making inquiries into what came before creation.¹⁰²

That cosmogony is linked to deontic authority is evidenced by the interdictions and limitations surrounding creation texts – as in *m. Hagigah* and *Gen.Rab.* – as well as traditions that claim not only that the Torah pre-dates the world, but that God essentially planned the creation by means of a Torah blueprint. (Fine 1998, 527) In their self-presentations in the Bavli, this blueprint is then handed to the rabbis to implement on Earth. So too is there a link between cosmogony and magic, found in *b. Sanhedrin* 65b, in which two rabbis created a calf by means of magic based on their study of “the Laws of Creation.” This puzzling cosmogonic feat is said to be permissible, as the creation magic was employed for the purposes of study – much as we noted in the story of the magical cucumber sowing and harvest in *b. Sanhedrin* 65b. Ultimately, however, we note similar patterns of tight rabbinic controls over cosmogony as well as astrolatry, astral magic, and

¹⁰² Peering behind the cosmogonic curtain, as it were, also invites questions regarding Greek conceptions of creation and the dangers of a belief in a steady-state, pre-existent cosmos. However, this matter is outside the limits of this study.

astrology, and a recurrent pattern of rabbinic exceptions to these controls and bans in the related celestial literatures we have surveyed here.

1.4 Chronology and Control: The Jewish Calendar and Rabbinic Authority

As the cosmogony of *Ma'aseh Bereshit* is concerned with origins, so does calendar serve to link the Jewish cycle of festival observances with astronomy, God's celestial cycles, and the sacred time established *in the beginning* circumscribed by cosmogony. This cosmic unfolding, so to speak, did not take place without challenges, however. This final section of the review of the literature reveals a pattern of control tactics and authority skirmishes related to rabbinic calendar development. This pattern is shown to be strongly deontic in nature, highlighting individual rabbis' attempts to control festival and new moon timing and adherence.

A wide number of sources on the rabbinic calendar appeared in the scholarly literature in the mid-twentieth century, including "Ancient Jewish Calendation" by Grace Amadon in 1942 and a response to her article, "Ancient Jewish Calendation: A Criticism" by Richard A. Parker in 1944.¹⁰³ Also notable in their time were "The Origin of the Planetary Week or The Planetary Week in Hebrew Literature" by Solomon Gandz in 1948-49, "The Problem of the Molad" and "The Division of the Hour in Hebrew Literature" by Gandz in 1951 and 1952, respectively, and "Intercalation and the Hebrew Calendar" by J.B. Segal in 1957. These simply had as their goal the elucidation and

¹⁰³ Perhaps indicative of the lower esteem in which women were often held during this era, Parker's response to Amadon is, to this reader, beyond patronizing.

explanation of the Jewish calendar, and do not illuminate the themes of authority we seek here, but their contribution to the history of rabbinic calendrics calls for their inclusion here. More recent scholarship, however, frequently moves beyond the technical aspect of calendar to reveal its sociohistorical contexts.

My goal here is by no means a full exposition of calendar development in rabbinic Judaism. On this count, I refer readers to Sacha Stern, who has written what is arguably the best and most complete treatment of this topic in his 2001 volume *Calendar and Community: A History of the Jewish Calendar 2nd Century BCE – 10th century CE*. However, some key sources and theories relevant to the foundation and placement of my own arguments regarding rabbinic authority and calendar are certainly in order.

Sacha Stern asserts that the first century C.E. may have marked “a turning point” for the Jewish calendar, for the calendars of Egypt, Asia, and the coast of the Roman Near East became solar under the Julian calendar. This was taking place during the expansion of the Roman Empire.¹⁰⁴ (Stern 2001, 42) As Stern describes the situation, within this broader cultural context, “the survival of the Jewish lunar calendar would have stood out as remarkably exceptional.” (44) Why, however, did the Jews of the first century C.E. turn to a lunar calendar? Here, Stern suggests the possibility that this may have been a way to set themselves apart from Rome and Hellenistic culture and mark their uniqueness. (45) In the Sasanian context, however, despite their adoption of a solar

¹⁰⁴ At this point, it is important to note Stern’s comment that though we may define a calendar as Jewish based on its community of users, this opens up the question of “who would have qualified as ‘Jews’? (Stern 2001, 25) This touches upon questions of identity that are beyond our scope here, but the matter is no minor one.

calendar in the third century, the fact that an older, lunar, Babylonian calendar was still used until the arrival of Islam would have made the Jewish calendar less distinctive. (46)

Of great import to questions of authority was the matter of calendrical uniformity in Late Antiquity. According to Stern, even rabbinic sources assume that there was a single calendar calling for the observance of festivals on a unitary date. However, the reality was quite different, as calendar diversity was prevalent, though there were ongoing attempts by the rabbis to verify and enforce uniform calendar observances. (156)

Moreover, the fixed calendar that developed during the amoraic era is demonstrated in *m. Megillah* 1:2 which describes the observance of Purim. (171) This fixed calendar – dated to the fourth century by Stern – had not yet reached its final form.¹⁰⁵ (172) As for the traditions that Hillel II fixed the calendar in the 300s, Stern cites no evidence for this; it is perhaps more likely that the move from the empirical to the fixed calendar was gradual in nature, preceded by the development of calendrical rules during the time of the Amoraim. (180-81)

One of the reasons advanced for the move from the Mishnah's empirical calendar to a fixed calendar during the geonic period is referred to by Stern as "The Scientific Progress Theory" – that is, that Late Antique scientific progress supported the move away from a 'primitive' calendar based on the sighting of the new moon to a 'more advanced' calculated calendar that would not be subject to anybody's authority. However,

¹⁰⁵ Its precise dating is unclear; nevertheless, Stern's central point regarding the gradual development of the fixed calendar beginning during this period is well-taken.

there are a number of problems with this theory.¹⁰⁶ First, mathematics and astronomy were already well advanced by the fourth century C.E., with knowledge of the 19 year cycle and other calculations in the Near East. (Stern wonders why it took so long for the Palestinian rabbis to learn of this knowledge; however, I hold that they had access to such knowledge.) Second, the theory does not attend to *halakbah* in the calendar of the Mishnah, and the necessary slowness of change within Jewish law. Third, the idea of a “primitive” mishnaic calendar that needed to be replaced by a “superior system is based on an outdated, nineteenth-century concept of cultural evolutionism that is no longer acceptable.” (227-228)

Although a regular, calculated calendar would have indeed been more predictable, allowing for less disruption and the ability to know the dates of festivals well in advance, there was more astronomical accuracy in the empirical system due to direct observation, with no possibility of mathematical discrepancies. (229) Most important of all, according to Stern, is the rabbinic authority that an empirical system allows for within the Jewish community. Finally, there was the “intrinsic ideological value” of the mishnaic calendar.

As Stern explains:

By controlling the dates of the calendar from month to month, the rabbis perceived themselves as exerting control over the entire cosmos, and even over the Divine order. Thus we are told in a number of sources that God and his angelic court would not sit

¹⁰⁶ Cf. Meir Bar-Ilan, who describes the rabbis’ understanding of astronomy and calendar as conforming to the “scientific progress” model in his 2004 piece, “Astrology in Ancient Judaism”, ‘Astronomy in Ancient Judaism.’ In J. Neusner, A. Avery-Peck and W. S. Green. Eds. *The Encyclopaedia of Judaism V, Supplement Two*. Leiden and Boston: Brill, 2031-2044, stating that the beginning of rabbinic astronomy was non-scientific in nature, and that, over time, the calendrical intercalations performed during the time of the Second Temple (*t. Sanhedrin* 2:2-3) and the reliance on eyewitnesses to the *molad* were replaced by a more scientific approach, as described in *t. Sanhedrin* 2:7), and eventually, to the fixing of the rabbinic calendar. (Bar-Ilan 2004, 2032)

in judgement at the New Year (1 Tishre) until the rabbinic court had sanctified it and declared it the first day of the month. (230)

Stern also analyzes the political role of the Patriarch during the third and fourth centuries, asking whether the theory that they strove for a “rabbinic policy” of a single, unified calendar was correct. Here, he writes that indeed, “[b]esides exercising authority over many aspects of social and religious life in Jewish Palestine, the Patriarch appears to have extended his influence abroad by regularly sending envoys to Diaspora communities.” (237) There is, then, evidence that the Patriarch attempted to align the communities of the Diaspora with the calendrical practices of Palestine. This is first noted in the system of fire beacons, followed by a system of envoys and witnesses, both mentioned in the Mishnah. By so doing, the Palestinian rabbinic court’s calendrical rulings would be disseminated far and wide.¹⁰⁷ Stern acknowledges, and is unconcerned by, the possibility that this was never completely implemented, however. (237) Indeed, in the stories of R. Gamaliel sending his decisions to intercalate the year throughout the Diaspora, what matters to Stern is not the historicity of the story, but the fact “that R. Gamaliel considered himself responsible for ensuring that his decisions be followed by all Diaspora communities.” (238) We also see the exercise of rabbinic authority in a story found in *y. Sanhedrin* 1:2 (*b.* 19a), *y. Nedarim* 7:13 (*b.* 40a), and *b. Berakhot* 63a–b, cited by Stern, in which Diaspora communities were stopped when they attempted to calculate

¹⁰⁷ Here, Stern mentions R. Gamaliel, who “is described as sending letters from Jerusalem proclaiming his decision to intercalate the year; these letters were addressed to his ‘brethren’ in Galilee, the ‘South’ (Judaea), Babylonia, Media, and the ‘whole Diaspora.’” (Stern 2001, 237)

their own calendars and thereby affirm their own authority over times of festival observance:

When Ḥananiah nephew of R. Yehoshua, a mid-second-century sage of Palestinian origin, began setting his own calendar in Babylonia, two sages from Palestine were dispatched by ‘Rabbi’, i.e. the Patriarch, with instructions to put an end to his activities. Their vigorous intervention forced Ḥananiah to cancel his calendrical decisions. (238)

Nevertheless, despite these examples, Stern states that there is no certainty that a unified policy was in place among the rabbis to deliberately influence Diaspora communities to observe the Palestinian rabbinic calendar. (240)

In *Calendar, Chronology and Worship: Studies in Ancient Judaism and Early Christianity* (2005), Roger T. Beckwith critiques Stern’s assumption, in *Calendar and Community*, that the rabbis represented a new religious movement as opposed to being the logical “heirs” of the Pharisees. (Beckwith 2005, 8) Here too, Beckwith takes issue with the notion that the Patriarch wrote to Diaspora communities “to establish his authority over them.” Rather, his view is that the letters regarding the calendar were similar to calendars based on astronomical calculation in that both had the goal of establishing “the unity of the Jewish community.” (Beckwith 2005, 14) Here, Beckwith seems to be moving the trajectory of the Pharisees forward in time, perhaps working to demonstrate the *re-*formation of a cohesive Judaism (that, it should be mentioned, never existed, given the sectarianism prevalent during the Second-Temple period) after the destruction of the Temple in 70 C.E. However, this explanation is unsatisfying; given the numerous rabbinic writings demonstrating the importance of authority to the rabbis in many contexts, but most notably with respect to calendar and other celestial concerns, it seems

highly unlikely that their political motivation would have been unity alone. Political movements have historically tended to galvanize their authority and power base first, and this would have been particularly true within a context of Jewish calendar diversity.

In *Calendars in Antiquity* (2012), Stern turns to the topic of political dissidence and subversion from a calendrical perspective. Here, he points out that there is little evidence in rabbinic literature for control of the Jewish calendar by “city councils” after 70 C.E., and that rabbinic sources instead prefer to highlight rabbinic control. However, Stern cites the *Yerushalmi*, in which a conflict is recorded between civil authorities (who intercept a witness to the *molad*) and the rabbis. (Stern 2012, 343) There is a question, then, as to whether the early rabbis were always successful at maintaining calendrical control. Such struggles between city councils and the rabbinic courts, as well as independent rabbis choosing to intercalate on their own, may in fact, writes Stern, have contributed to the calendrical diversity mentioned earlier. (347)

Stern also refers to the new moon procedure as being of a “contrived, make-believe judicial character” which was not terribly stringent, but nevertheless followed a script. (350) Stern ventures the explanation that this quasi-judicial procedure was “related to the social status of rabbis in Roman Palestine.” He further suggests that the judicial nature of the procedure “was intended as a statement of dissidence from the political authorities that normally controlled the calendar” – that is, the cities and city councils.” (351) In other words, Stern writes, “the rabbinic calendrical court served for the rabbis as a platform for a novel and alternative source of social authority in Jewish Palestinian

society.” (351-52) This subversion and dissidence would likely have dissipated with the adoption of calendrical rules between the third and fifth centuries, however, for these rules and the later fixed calendar replaced the empirical system.¹⁰⁸ (352)

In “Observing the Moon: Astronomical and Cosmological Aspects in the Rabbinic New Moon Procedure” (2014), Reimund Leicht addresses Stern’s comments regarding the “pseudo-judicial” nature of the new moon procedure. Here, however, he diverges, and focuses on the directive to observe the new moon and the way it may have influenced “the development of scientific cosmological and astronomical concepts prevailing in rabbinic Judaism.” (Leicht 2014, 28) Leicht turns to the interrelationships between calendar, astronomy and cosmology, aware – as I am in this study – of the fact that their overlap is only partially expressed. Here, Leicht writes that “[C]alendar calculation does not necessarily influence the cosmological and astronomical ideas prevalent in a specific culture, and one may well ask whether it did so among the Jews in Antiquity.” (28) While Leicht is correct that calendar does not necessarily exert influence upon other categories, the fact that these celestial categories are frequently included one with the other in various primary texts – and in the secondary literature examining these texts – suggests that the themes do cluster. Of course, this fact helps to carry Leicht’s argument as well. Although he doubts that calendar influenced cosmological and astronomical ideas in Antiquity, Leicht also points to the fact that “calendar discussions, astronomy and cosmology obviously cannot be totally disconnected from one another.

¹⁰⁸ Stern covers similar – but not identical – ground in his 2012 article, “The Rabbinic New Moon Procedure: Context and Significance.” In Jonathan Ben-Dov, Wayne Horowitz, and John M. Steele, *Living the Lunar Calendar*. Oxford and Oakville: Oxbow Books, 211-230.

Accordingly, there are good reasons to look out for traces of astronomical and cosmological ideas, concepts or theories that have had repercussions in the rabbinic texts about the sanctification of the new moon as well.”¹⁰⁹ (29)

In describing the procedure as portrayed in *m. Rosh HaShanah* 2:8, *t. Rosh HaShanah* 2:17, *b. Rosh HaShanah* 25a, and other texts, Leicht points out that the rabbis wrestled with the balance between the legal/formal and scientific dimensions of the new moon procedure. (35) Leicht concludes by stating that the rabbis were hesitant to make their “judicial” procedure totally reliant upon scientific knowledge – that is, astronomy. (38) Moreover, Leicht notes a similar hesitation among the rabbis to incorporate astronomical and cosmological ideas in the texts related to the new moon procedure. (39) However, this methodology raises a question – by omitting other rabbinic texts which do combine astronomical and cosmological concerns (and certainly, astrological and cosmological concerns), is this not making a hypothesis about the linkage of the new moon procedure, astronomy, and cosmology dependent on a few rabbinic texts? With this question asked, I also see the importance of the thematic questions posed by Leicht, and anticipate future work in a similar vein.

¹⁰⁹ On an intriguing note within the context of the new moon in ancient Judaism, Mayer Abramowitz (1973) has written “The Sanctification of the Moon: Ancient Rite of Rebellion.” *Judaism* 18, 45-52, in which he puts forward his theory that the *kiddush levanah* ritual, performed after *Ma’ariv* on the first Saturday night of the new month represented “a formula used to train dependable civilians in the proper means of identification for admission to the secret hideouts of the rebels” during the Bar Kokhba revolt (132-135 C.E.). (Abramowitz, 48) This, he writes, might explain the “pagan” overtones of the ritual, which involves jumping, handshaking, and other odd elements. Abramowitz cites internal literary evidence as well as external evidence from the field of archaeology, but ultimately, what the evidence amounts to are literary quotes and a line from correspondence from the Bar Kokhba era – all of which appear contorted to fit the facts. Although it is not inconceivable that such a connection exists, it seems to be a stretch.

In “Halakhic Confrontation Dramatized: A Study of Mishnah Rosh Hashanah 2:8-9,” (2008) Avraham Walfish analyzes the story, recounted in *m. Rosh HaShanah* 2:8-9, of the confrontation between Rabban Gamaliel and R. Joshua concerning the sanctification of the new moon, in which the latter is made to publicly agree with the former. This is a Mishnah I will be turning to in my text analysis, and, as Walfish himself demonstrates, it is a Mishnah about authority, in which the court is seen as an extension of the court of Moses and granted this authority by Torah itself. (Walfish 2008, 12) As Walfish concludes, the authority found in this Mishnah assumes several forms – “the absolute authority of man to sanctify God’s set times and the absolute authority of the High Court.” (39) Additionally, both Steven D. Fraade (2011, 277-79) and Christine Hayes (2006, 132; 2011, 119-146) have addressed this astronomical and calendrical Mishnah from the point of view of the rabbinic construction of legal fictions. On this point, Fraade also underscores the Divine authority claimed by the rabbis to determine festival dates. (Fraade, 278) So too does Hayes describe the crux of the authority struggle between the empirical and legislative authority of the rabbis. As she states:

In short, this Mishnah upholds the power of halakhic authorities to make a legal determination even when that determination is contradicted by physical reality. To reverse decisions because they are out of step with empirical evidence or physical reality is explicitly rejected in this Mishnah as posing a threat to rabbinic authority. (Hayes 2006, 133)

The topic of rabbinic calendrics has been analyzed on its own here based on its astronomical and religious functions, and not within the category encompassing (astral) magic, astrolatry, astrology, and cosmogony. However, there are many levels of overlap between calendar and the above broad category of astral concerns. Throughout the

sources on calendar, there is a subtext, for example, of threat to the calendrical order affecting festival observances; this tension, in turn, must be addressed by means of legal (or “pseudo-legal,” in the case of the new moon procedure) rituals or rulings in order to ensure order – that is, the maintenance of social control. We see this function of authority being exerted throughout the earlier category of celestial concerns as well, alongside the creation of a system in which the rabbis could choose to subvert their own system by creating exceptions to the rules.¹¹⁰

In brief, as we have seen in the secondary literature, celestial concerns of all kinds are most excellent conductors of authority; this is ultimately due to the rabbinic self-presentation of connection to the heavenly realms and God’s authority, creation, and the revealed Torah that was seen as the blueprint for the cosmos. The next three chapters bring these themes into sharper relief, demonstrating that the Divine authority to implement Torah law on Earth, bequeathed to the rabbis according to the Bavli, was subverted and appropriated by the rabbis where it was necessary to support the primacy of their own deontic authority.

¹¹⁰ Note the parallel to the rabbinic transgression of their own established boundaries, and the moving of the line of acceptability with respect to magical praxis, as pointed out by Chajes. (61, 71-72)

Chapter Two: Science and Stewardship – Authority and the Natural World in Rabbinic Literature

“When I see your heavens, the work of your fingers, the moon and the stars
that you have established, what is man that you would remember him?”
-Psalms 8:4-5

2.1 Rabbinic Judaism and Nature: Apologetics, Authority, and Agenda

Prior to examining the dynamic between deontic and epistemic rabbinic authority in *sugyot* focusing on celestial topics in the Bavli, and the mathematical expertise upon which astral sciences are predicated, I must first frame and contextualize this analysis by examining rabbinic attitudes toward both nature and scientific wisdom regarding the created natural world. Here, I also analyze presentations of deontic rabbinic control over the created world in keeping with the self-presentation of rabbis as heirs to the mantle of ongoing creation. Here, I admittedly provide a broad frame, including an overview of rabbinic conceptions of the created world and heavenly cosmography, living creatures, and the prestige associated with natural wisdom itself. I then turn to the analysis of the strongly illustrative *sugya* of the story of the Oven of Akhnai in *b. Bava Metzri'a* 59b, which highlights the imposition of deontic authority over epistemic authority and the empirical world.

Lending support to the connection between cosmogony, the halakhic project, and the relationship between humanity and God, Neusner has stated:

The theological narrative of the Halakhah may be briefly summarized as a whole in a few sentences, in two paragraphs, the one describing the problem facing God in the encounter with Man, the other the solution put forth at Sinai through the Halakhic account of the

regenerate social order Israel is to realize. [. . .] God created nature as the setting for his encounter with humanity. (2001 *Theology*, 374)

Indeed, in many ways, the rabbinic view toward nature in the Bavli may be seen as emblematic of the view of the created cosmos and its empirical laws, and highlighting the treatment of nature in the Bavli demonstrates parallels also found in the astronomical and mathematical-calendrical material, which follow a tellingly similar pattern.

As with other topics, the view of nature in the Bavli is steeped in multivocality, redactional layers, and debate. And indeed, rabbinic views of nature are no different, for where these are concerned, the varied interpretations and arguments regarding nature and science highlight the fact that there is no single view of nature to be found in the Bavli.

Efron notes the strong influence of these numerous, often conflicting, interpretations of “natural philosophy”¹¹¹ as it is expressed throughout the rabbinic corpus. This contrasts with, for example, “pre-Socratic or later Greek natural philosophy, in which advocates of one theory sought logically to demonstrate the superiority of their approach, [whereas] in Talmudic arguments one finds little attempt to reach finality.”

(Efron, 42) Moreover, midrashic hermeneutics also had a pervasive influence, described by Efron as follows:

By devaluing the literal meaning of scripture, and devaluing consensus (except about practical matters of law, and even about these, conflicting opinions are often granted legitimacy), the Midrashic tradition defused conflict between holy texts and the opinions of natural philosophers even before it arose. Because of the exegetical flexibility of Midrash, which allowed scripture and other holy texts to be interpreted

¹¹¹ This term has been widely used by Noah Efron as well as scholars of Late Antiquity, though the term *natural philosophy* has of course also come to be associated with Medieval and Modern scholarship. I use the term here to represent the earliest threads of rabbinic science in Late Antiquity, interchangeably with the term *rabbinic science*. Also see Edward Grant, 2007, *A History of Natural Philosophy: From the Ancient World to the Nineteenth Century*. Cambridge and New York: Cambridge University Press.

in ways that differed greatly from the literal meaning of the text, philosophical or empirical findings could never conflict a priori with scripture. When the rabbis wished to harmonize between any particular natural philosophical or scientific opinion and their great religious texts, they found that they could do so handily. This was true of the rabbis in the Talmud, and it has been a feature of Jewish thought about the relationship between Torah and natural philosophy, or between Torah and science, ever since. (Efron, 42-43)

I agree with Efron when he states that this multivocality and lack of a systematic approach to the natural world in rabbinic literature do not allow us to determine whether or not the Talmud, for example, values the study of nature at all. (43)¹¹² Throughout the halakhic material dating to this period, particularly the Bavli, we note the study of the natural world, including astronomy/astrology, chemistry, geography, meteorology, biology and medicine, agriculture and botany, ornithology, and zoology, among other fields. However, these are never presented systematically.

Reed comments on this lack of rabbinic systematization with respect to the natural sciences, including astronomy and mathematics, underscoring the point that this lack means that “even those who wish to consider Rabbinic perspectives on such topics must first engage in anthological endeavors.” (Reed 2013, 239, fn. 140) Here, Reed cites A.O. Shemesh, who brings up the point that whereas non-Jewish books tended to address the natural sciences in their own right, such topics in rabbinic literature were contained in “their religious-halakhic discussions. Consequently, reference to animals in the mishnaic and talmudic literature is random.” (Shemesh 2006, 508). Nevertheless, Shemesh also states that while some tractates address biological topics sparsely, others do focus on these topics far more closely. Here, Shemesh points to a fuller presentation of animals

¹¹² Efron characterizes the varied rabbinic perspectives of the natural world and allied sciences as wavering between scorn, enthusiasm, and indifference. (Efron, 45)

and veterinary medicine in *b. Bekhorot*. To this, I might add that we find similar lengthy treatments of astronomical and related celestial topics in such tractates as *b. Rosh HaShanah* and *b. Shabbat* – related as they are to festival and Shabbat observances and the critical astronomical knowledge required to establish the timing of these observances.

Although there is no uniformity with respect to the valence assigned to nature in the Bavli, the rabbis were clearly interested in and curious about the natural world, addressing far-ranging topics, from the cardinal directions, solstices and equinoxes, and the rising and setting of the sun (*b. Eruvin* 56a) and the seasons and their relationship to solar position (*b. Eruvin* 56a; *b. Pesahim* 94b), to the Sabbatical year (*b. Rosh HaShanah* 2a, 8b-9a; *Makkot* 8b, 21b) and the retention of heat by various materials, such as metal and ceramics (*b. Pesahim* 37a).

The study of living creatures, from insects to humans, was obviously a preoccupation as well.¹¹³ Animals too are well described in rabbinic literature, and are frequently used allegorically to extol virtues and the tenets of *halakhab*, in keeping with a trope frequently used in Late Antiquity.¹¹⁴ In clear exhortational fashion, *b. Eruvin* 100b extols monogamy by pointing to the behaviour of doves, and the value of hard work by describing ants. In *b. Shabbat* 128b, the Gemara tells us that while both kosher and non-kosher animals may abandon their young, a kosher animal may take its young back,

¹¹³ For example, we note rabbinic comments on particularly dangerous insects and arachnids, including Egyptian flies, wasps from Nineveh, and scorpions from Khedyav (*b. Shabbat* 121b), as well as the bite of the white donkey, which was seen as especially dire. (*b. Yoma* 49a)

¹¹⁴ As Ingvild Saelid Gilhus (2006) has pointed out, animals were often portrayed as intermediaries with the gods in the Roman context, as well as symbolically and allegorically by early Christians. *Animals, Gods and Humans: Changing Attitudes to Animals in Greek, Roman and Early Christian Ideas*. London and New York: Routledge, 262.

whereas the non-kosher animal will not. Here, we note virtue and positive valence assigned to the animals themselves by dint of their kosher vs. non-kosher status.

Generally speaking, when not used allegorically in rabbinic literature, animals are frequently described within the context of torts, as well as their practical contributions – in essence, animals are seen as primarily utilitarian.¹¹⁵ Matters related to *kasbrut*, including kosher animal slaughter, were, of course, among these practical rabbinic concerns.¹¹⁶

Despite the random and multivocal texts addressing the natural sciences in the Bavli – made further pronounced by both the multivocality of the texts and layers of redaction – a pattern may be discerned with respect to the usage of celestial tropes in the Bavli to advance deontic rabbinic authority. While a good number of rabbinic statements and debates on nature are simply factual or descriptive, many more fold nature into the broader halakhic or exhortational agenda, particularly when they are related to the created cosmos.

For example, in *b. Rosh HaShanah* 23b-24a, we read that God created both the moon and the rainbow so as not to reveal their concave sides to the sun. In the case of the anthropomorphized moon, this is to avoid humiliating the luminary; in that of the rainbow, the sun does not see its concave side to prevent sun worshippers from

¹¹⁵ While no direct influence can be assumed with respect to rabbinic perspectives on animals, this view would have been consonant with the Stoic view of animals being devoid of a soul, thereby allowing humans to treat them as mere property. (Gilhus, 262)

¹¹⁶ Nevertheless, legal loopholes to avoid transgressing while killing animals are possible, as described in *b. Shabbat* 117b, where an animal and its young fall into a pit, and legal sophistry is used in order to slaughter whichever animal is desired. Concern was also displayed with respect to the suffering of animals in the process of their labours, as well as the laws of kosher slaughter, or shehita. This rabbinic precept of *tzaar ba'alei hayyim*, the prohibition against causing pain to animals, is evidenced throughout the Bavli. One notable example may be found in *b. Shabbat* 28b, where we read that even the stringent laws of the Sabbath may be broken in order to save an animal at immediate risk of drowning.

assuming that the sun is shooting arrows at those who do not worship it. The Gemara reads:

היינו לפני החמה - היינו לצפונה, היינו לאחור החמה - היינו לדרומה אמר אביי: פגימתה לפני החמה או לאחור החמה. אם אמר לפני החמה - לא אמר כלום, דאמר רבי יוחנן: מאי דכתיב (איוב כה) המשל ופחד עמו עשה שלום במרומיו - מעולם לא ראתה חמה פגימתה של לבנה, ולא פגימתה של קשת. פגימתה של לבנה - דחלשה דעתה, פגימתה של קשת - דלא לימרו עובדי החמה גירי קא משדייא.¹¹⁷

Before the sun is the same as to its north, and behind the sun is the same as to its South? Abaye said: Whether the concave side [of the lunar crescent] is in front of the sun or behind the sun. If he says, before the sun, his evidence is invalid, for R. Yohanan said: What of the writing (Job 25)¹¹⁸ “Dominion and fear are with him, He makes peace in his heights?” Never did the sun see the concave side of the (new) lunar crescent nor the concave side of the rainbow. It never sees the concave side of the lunar crescent, so that she should not feel ashamed. It never sees the concave side of the rainbow so that the sun worshippers will not say that He is shooting arrows.

Here, the interpretation of nature clearly serves the exegetical goal of undermining idolatry and advancing rabbinic authority, bringing scripture in to advance the point about “Dominion and fear”. Moreover, I suggest that the quote from Job 25:2, which sees the phrase *עשה שלום במרומיו* interpreted as “He makes peace in his heights,” may easily be translated as “He makes order (or completion) in his high places” – such order being both cosmogonic and emblematic of the ordering principles of rabbinic law.¹¹⁹ These ordering principles are not explicitly stated, but are presented in the pattern that prioritize the Dominion of God over the cosmos, which support the divinely created

¹¹⁷ *b. Rosh HaShanah* 23b London, British Library Harl. 5508 (400), fol. 23b has the variant משום חלישות דעתה (משדייא vs. משריא); New York, Jewish Theological Seminary of America Library Rab. 108 (EMC 319), fol. 23b has this variant: ר' יוחנן מאי דכת' המשל ופחד עמו מעולם לא ראתה חמה פגמתה של לבנה ולא פגימתה של קשת דלא לימרו עובדי גירי קא משדייא

¹¹⁸ Job 25:2

¹¹⁹ So too do we note the close relationship of diverse celestial sciences generally analyzed separately. Here, astrology and cosmogonic order are referred to together.

order. Next, by extension of this authority, the deontic authority of the rabbis, and finally, the lowest status and a negative valence to astrolaters.

We note a similar hermeneutic turn at work in *b. Nedarim* 39b, which sees the sun and the moon defending Moses to God during the war with Korakh – nature in the form of the cosmos rallying to support the lawgiver:

מאי דכתיב: (חבקוק ג) שמש ירח עמד זבולה, שמש וירח בזבול מאי בעיין? והא ברקיע קביעי מלמד, שעלו שמש וירח מרקיע לזבול ואמרו לפניו: רבונו של עולם, אם אתה עושה דין לבן עמרם אנו מאירים, ואם לאו – אין אנו מאירין באותה שעה ירה בהן חיצים וחניתות, אמר להם: בכל יום ויום משתחוים לכם ואתם מאירים, בכבודי לא בשר ודם מחיתם ובכל יום ויום יורין בהן חיצין וחניתות ומאירים מחיתם, בכבוד

What is meant by the writing “The sun and the moon stood in their *zebul*?” (Habakkuk 3:11)¹²⁰ Why were the sun and moon in the *zebul*, when they were placed in the *raqi'a*? This teaches that the sun and the moon moved from the *raqi'a* to the *zebul* and said before Him, Ruler of the world! If you will issue a judgment for Amram’s son, we will shine our light; but if not, we will not shine. In that hour, He shot spears and arrows at them. He said to them: Every day, He rebuked them, men worship you, and you shine. For My honour, you do not protest, but for the honour of flesh and blood you protest. (Since that time) Every day, spears and arrows are shot at them before they are willing to shine their light.

Here, what is notable is that the celestial luminaries stand still in their heaven, or *zebul*, though, as we note in the question “What were they doing in the *zebul*, seeing that they were set in the *raqi'a*?” their ascension to a higher position is a topic marked for analysis. The exegesis here is fine, pointing to the ascension of the sun and moon to a higher heaven in order to plead for “Amram’s son,” which, in this context, is Moses. Though the heavenly bodies were themselves created, and thus, under the dominion of God, they not only move upward in the echelons of power, but approach God to issue an ultimatum – clear defiance of Divine authority. God’s rebuke refers to both astrology

¹²⁰ Here, the Gemara references Habakkuk 3:11. In the rabbinic context, *Zebul* represents one of the seven heavens, as listed in *b. Hagigah* 12b, which are listed as Wilon, Rakia, Shehakim, Zebul, Ma'on, Makon, and Araboth. As the Gemara informs us, “Zebul is the place where the (cosmic) Jerusalem and the Temple and Alter are constructed, and Michael, the great Prince, stands and offers on it an offering, for it is said: I have surely built you a house of habitation (*Zebul*), a place for you to live forever.”

and to Moses, the question ultimately being one of spheres of authority and their priority, and hence, the key position being one that shows honour. Moreover, what is notable here is that as in the story of Honi, to be analyzed in chapter four, the luminaries issue an ultimatum to God, thereby challenging Divine authority – a trope that also appears in a slightly different form in the *sugya* of the Oven of Akhnai, in *b. Bava Metzi'a* 59b, to be analyzed later in this chapter, in section 2.3. Indeed, the rabbinic concern with the honour of their position is key in these texts.

It would be well to consider the rabbinic presentation of the luminaries as emblematic of nature, and indeed, of all creation. In this context, although this is admittedly a speculative argument, the sun and the moon may be seen as stand-ins for creation. In their steadfast defence of the honour of Moses, we see a challenge posed to the created order of things in support of the human lawgiver and his authority. This may also be interpreted in consonance with *b. Bava Metzi'a* 59b; in both cases, the message is *lo bashamayim hi*, that *halakhic decisions* are not the domain of heaven, but are within the purview of human agency, with the rabbis as heirs to the law and its interpretation for the Jewish community. As I demonstrate, this stands even when the natural world and its regular, empirical laws are at issue

Nevertheless, the haphazard presentation of nature, the rabbinic voices that express ambivalence toward nature and its study, and the multiplicity of voices surrounding these topics lead to some apparently striking contradictions. For example, in *b. Berakhot* 58b, we read that “if one sees beautiful creatures and beautiful trees, he says:

Blessed is He who has such things in His world.” However, many more passages suggest that nature is secondary to the creator of nature, to the rabbis’ dominion over the natural world, and to *halakhab*. Indeed, this view of the natural world and its study may be found in *m. Avot* 3:7, aptly described as follows by Hava Tirosh-Samuels:son:

To worship God, Israel should study the Torah and behave according to its commandments as expounded by the authoritative interpreters of the Torah, the rabbinic sages and their heirs through the generations. In rabbinic Judaism, then, the exclusive study of the Torah and the acts that follow from it stand in some tension with the worship of nature. Mishnah Avot 3:7 summarizes the tension between the life of the Torah and the appreciation of nature when it states in the name of Rabbi Jacob: “he who travels on the road while reviewing what he has learned, and interrupts his study and says: 'How fine is that tree, how fair that field!' Scripture regards him as if he committed a grave sin.” The admiration of nature, then, distracts the believer from devotion to God's revealed Torah, which the teachers of Judaism regarded as the sole preoccupation of the ideal Jew. (Tirosh-Samuels, 103)

Indeed, this preoccupation with Torah and Torah law is frequently portrayed as a focus to the exclusion of all else, even the knowledge, admiration, or appreciation of nature itself – let alone its worship, which would represent *avodah zarah*, and stand in clear violation of Torah. This is to say that while the appreciation of the natural world is not expressly forbidden, it is not to be prioritized over Torah study, which is viewed by the rabbis as the source of all wisdom.¹²¹ Indeed, in *b. Sanhedrin* 5b, we read that wisdom should be like a sister, such wisdom is implicitly Torah, not Greek wisdom.¹²² We note this in tannaitic sources as well. For example, in *Sifre Deuteronomy* 34 on Deuteronomy 6:7, we read that Torah should be a primary, and not a secondary focus, and that this should not be intermixed with other knowledge, including outside wisdom. (L. Finkelstein, 61-2, as cited in Labendz, 147)

¹²¹ In *b. Berakhot* 5b, we read אמת - זו תורה Here, Torah is equated with Truth.

¹²² Note the female gendering of *Sophia*/wisdom.

Moreover, as the Gemara tells us in *b. Erubin* 21b-22a, it is only possible to become a master of Torah if one studies from morning to night. In *b. Megillah* 15b, such individuals are seen as virtuous. The inherent value of Torah study is underscored in *b. Shabbat* 83b, which describes the importance of immersing oneself in Torah as much as possible. In *b. Erubin* 65a, one also notes the importance of avoiding distractions while learning; moreover, in *b. Erubin* 54b, Torah is said to make one forget other matters in any case. *b. Berakhot* 17a is even more explicit, making it clear that the study of Torah should be the focus of one's life. The reward for this focus ranges from entry to the World to Come (*b. Qiddushin* 39b, 40a; *b. Bava Metzi'a* 33a), forgiveness of sins (*b. Berakhot* 5a-b), Divine protection from harm (*b. Erubin* 54a), and longevity (*b. Rosh HaShanah* 18a, *b. Yevamot* 105a). By contrast, a person who does not study Torah is said to be devoid of contributions to knowledge and society. (*b. Qiddushin* 40b)

Moving further outward, to the cosmogonic and cosmographic realms, the maintenance of God's creation is said to be dependent on Torah study (*b. Nedarim* 32a), and Torah itself is said to be 3200 times the size of the Earth (*b. Erubin* 21a).¹²³ In essence, Torah and its study represent all the wisdom and knowledge one could ever want or need – and indeed, existence itself is contingent upon it. Nevertheless, there is but one activity that trumps even Torah study, and that is serving rabbinic scholars

¹²³ Though the mystical literature is beyond our scope, this reference to the size of Torah is notable for its resemblance to descriptions of the size and dimensions of God in the *Shi'ur Qomah* literature, as well as similar presentations of the size of celestial creatures (i.e., the *hayyot*), in the targumic Toseftot to Ezekiel 1:1. This raises the question as to the very equation of Torah with the Divine. My thanks to Dr. Ira Robinson for calling this to my attention. For a more detailed analysis of these literatures, see Alinda Damsma, 2012, *The Targumic Toseftot to Ezekiel*. Leiden: Brill.

(*b. Berakhot* 7b) – a point that supports my contention that it is the rabbinic position itself that is extolled above all other forms of authority, even above wisdom itself, be it Torah wisdom or the wisdom and workings of the natural world.

2.2 Epistemic vs. Deontic Authority and Nature: *b. Bava Metzi'a* 59b

Considered the *locus classicus* of rabbinic authority, *b. Bava Metzi'a* 59b, known as the story of The Oven of Akhnai,¹²⁴ dramatically acknowledges and subverts the laws of nature, generally held by the rabbis to have been set into and kept in motion by God. In so doing, the dynamic also sees the rabbis subvert and claim authority over nature and its interpretation. This *sugya* is exceedingly rich, providing an excellent vantage point from which to examine the workings of rabbinic authority when presented with natural or scientific laws that are ultimately in conflict with this authority. Given the similarity of structure between the story of the Oven of *Akhnai* and several key astronomical and related mathematical *sugyot*, I will also use this story to help unpack later astronomical and mathematical source texts in chapter three. This is a key and informative text for the situation and understanding of the place of empirical phenomena and epistemic authority in the Bavli, for as David Kraemer rightly points out, this story “admits that halakha and truth are not synonymous.” (Kraemer 1990, 139) *b. Bava Metzi'a* 59b reads as follows:

וזה הוא תנור של עכנאי. מאי עכנאי? - אמר רב יהודה אמר שמואל: שהקיפו דברים כעכנא זו, וטמאוהו. תנא: באותו היום השיב רבי אליעזר כל תשובות שבעולם ולא קיבלו הימנו. אמר להם: אם הלכה כמותי - חרוב זה

¹²⁴ The story is also told in *y. Mo'ed Qatan* 81c-d, 3:1, albeit with minor differences; the version found in the Bavli is lengthier, and is my focus here.

יוכיח. נעקר חרוב ממקומו מאה אמה, ואמרי לה: ארבע מאות אמה: אמרו לו: אין מביאין ראייה מן החרוב. חזר ואמר להם: אם הלכה כמותי - אמת המים יוכיחו
 חזרו אמת המים לאחוריהם. אמרו לו: אין מביאין ראייה מאמת המים. חזר ואמר להם: אם הלכה כמותי - כותלי בית המדרש יוכיחו. הטו כותלי בית המדרש ליפול. גער בהם רבי יהושע, אמר להם: אם תלמידי חכמים מנצחים זה את זה בהלכה - אתם מה טיבכם? לא נפלו מפני כבודו של רבי יהושע, ולא זקפו מפני כבודו של רבי אליעזר, ועדין מטין ועומדין. חזר ואמר להם: אם הלכה כמותי - מן השמים יוכיחו. יצאתה בת קול ואמרה: מה לכם אצל רבי אליעזר שהלכה כמותו בכל מקום עמד רבי יהושע על רגליו ואמר: לא בשמים היא. - מאי (דברים ל') לא בשמים היא? - אמר רבי ירמיה: שכבר נתנה תורה מהר סיני, אין אנו משגיחין בבת קול, שכבר כתבת בהר סיני בתורה (שמות כ"ג) אחרי רבים להטות. - אשכחיה רבי נתן לאלהיו, אמר ליה: מאי עביד קודשא בריך הוא בההיא שעתא? - אמר ליה: קא חיך ואמר נצחוני בני, נצחוני בני. אמרו: אותו היום הביאו כל טהרות שטיהר רבי אליעזר ושרפום באש, ונמנו עליו וברכוהו. ואמרו: מי ילך ויודיעו? - אמר להם רבי עקיבא: אני אלך שמא ילך אדם שאינו הגון ויודיעו, ונמצא מחריב את כל העולם כולו. מה עשה רבי עקיבא? לבש שחורים, ונתעטף שחורים, וישב לפניו בריחוק ארבע אמות. - אמר לו רבי אליעזר: עקיבא, מה יום מיומים? - אמר לו: רבי, כמדומה לי שחבירים בדילים ממך. - אף הוא קרע בגדיו וחלץ מנעליו, ונשמט וישב על גבי קרקע. זלגו עיניו דמעות, לקה העולם שלישי בזיתים, ושליש בחטים, ושליש בשעורים. ויש אומרים: אף בצק שבידי אשה טפח. תנא: אך גדול היה באותו היום, שבכל מקום שנתן בו עיניו רבי אליעזר נשרף. ואף רבן גמליאל היה בא בספינה, עמד עליו נחשול לטבעו
 אמר: כמדומה לי שאין זה אלא בשביל רבי אליעזר בן הורקנוס. עמד על רגליו ואמר: רבונו של עולם, גלוי וידוע לפניך שלא לכבודי עשיתי, ולא לכבוד בית אבא עשיתי, אלא לכבודך, שלא ירבו מחלוקות בישראל. נח
 הים מזעפו

And this was the oven of Akhnai. Why Akhnai? Said Rav Yehudah in the name of Shmuel: They surrounded it with words as a snake, and demonstrated that it was impure. It has been taught: On that day, R. Eliezer thought up every possible halakhic ruling in the world, but they did not accept them. He said to them: If *halakhah* agrees with me, let this carob tree demonstrate it. The carob tree came out a hundred cubits from its place. Others say four hundred cubits. They said to him, nothing can be proven from a carob tree. Returning to the point, he said to them: If *halakhah* is with me, let the water demonstrate it. The water flowed backward. They said to him, nothing can be proven from water. Again returning to his point, he said to them: If *halakhah* is with me, let the walls of the *bet midrash* demonstrate it. The walls slanted in order to fall. But R. Joshua rebuked them, saying to them: When students of wisdom (i.e., scholars) are debating *halakhah*, what do you have to interfere with the matter? They did not fall in the honour of R. Joshua, and they did not return to upright position because of the honour of R. Eliezer, and they remain slanted. Again, he said to them: If *halakhah* is with me, may the proof come from the heavens. Out of heaven came a *bat kol* that said to them: Why are you against R. Eliezer when *halakhah* is with him in all places (i.e., in this matter)? R. Joshua stood up and said: It is not in heaven! (Deuteronomy 30:12) Why is it not in heaven? R. Jeremiah: That the Torah was already given on Mount Sinai, therefore we do not attend to a *bat kol*, because You have already written in the Torah on Mount Sinai (Exodus 23:2) that you must pay attention to the majority. R. Natan met with Elijah and said to him: What did the Holy One, Blessed be He, do at that hour? He laughed and said: My sons have defeated Me, My sons have defeated Me. It was said: On that day, all objects that R. Eliezer had pronounced clean were burnt in fire. Then they voted and excommunicated him. They said: Who will go to him and let him know? R. Akiva said to them: I will go rather than a man who is not fitting let him know, and therefore cause the entire world to be destroyed. What did R. Akiva do? He dressed himself in black clothing and wrapped himself in black, and sat before him

(R. Eliezer) at a distance of four cubits. R. Eliezer said to him: Akiva, why is this day different from other days? My teacher (master), it seems to me that your colleagues separate themselves from you. Then, he tore his clothing, took off his shoes, stood from his seat and sat on the ground, while tears poured from his eyes. The world was then afflicted. A third of the olives, a third of the wheat, and a third of the barley. There are those who say: Even the dough in women's hands puffed up. A tanna said: It was a great catastrophe that happened that day. For every place that R. Eliezer set his eyes on was burned. Even R. Gamaliel was on a ship when a great wave rose up to drown him. He said, it seems to me that this can be because of nobody other than R. Eliezer ben Hyrcanos. He stood up and said: Ruler of the world! You know that I have not done (i.e., acted) for my honour, and not for the honour of my father's house, but only for your honour, so that conflict will not become greater in Israel. The furious sea rested.

In this *sugya*, which describes an incident said to have taken place at Yavne, R. Eliezer and R. Joshua engage not merely in halakhic argument, but in an authority struggle that addresses a core issue in the rabbinic discourse regarding natural laws believed to have been established by God – and rabbinic authority to make determinations regarding the natural world.

First, we note the appeals of R. Eliezer to natural phenomena through which Divine workings were evident, to support his position regarding the cleanliness of the oven. This was followed by similar appeals by R. Eliezer to attempt to prove *halakhab* by Divine intervention through nature – more specifically, via the violation of natural laws with God's miraculous help – first, a carob tree was torn out of its place in the ground, but this was dismissed by the rabbis, saying “Nothing can be proven from a carob tree” – *.אין מביאין ראיה מן החרוב*. Next, on invocation by R. Eliezer, a stream of water flows backward and the walls of the *bet midrash* begin to fall.

However, in a telling critique that I suggest may be symbolic of a common rabbinic stance toward the natural world and its laws, and by extension, to the sciences and their utility, R. Joshua then rebukes the walls for interfering in a halakhic dispute,

leading them to assume an inclined position honouring both R. Eliezer and R. Joshua, in which position they are said to remain standing. This is clearly deontic authority in action – for here, nature is shown to capitulate to the honour of rabbinic scholars, thereby demonstrating their dominion. From the perspective of the *bet midrash* walls, it did not matter which scholar was correct; the fact that they were well known rabbinic scholars was sufficient to lead them to compromise and essentially bow in honour of the rabbinic station.

Finally, R. Eliezer moves beyond nature and appeals for halakhic proof from God Himself, upon which a *bat kol* sounds out from the heavenly realms, asking why R. Joshua chooses to dispute with R. Eliezer given the agreement of *halakhab* with his position. To this, R. Joshua stands up and exclaims *לא בשמים היא* – “It is not in heaven!” quoting Deuteronomy 30:12.¹²⁵ Here, the legal sophistry used to assert rabbinic authority is both clear and pointed. R. Jeremiah asserts that the Torah given at Mount Sinai states that one must incline after the majority. Therefore a *bat kol* is, paradoxically, to be ignored on God’s own authority. Effectively, this suggests that in this important *sugya*, God’s authority, whether expressed through the natural world or directly from heaven itself in the form of a *bat kol*, takes a back seat to the deontic authority vested in the rabbis by the Torah. This form of authority, described by Sagi, is, once again, predicated on absolute obedience, even when an authority is shown to be wrong. (Sagi, 11) This is a tendency that Norman Lamm and Aaron Kirschenbaum have, in similar fashion, referred

¹²⁵ It is ironic that it is the very same R. Joshua Ben Hanania who has his own epistemic authority in the area of astronomy and calendar overturned in a deontic fashion by the Patriarch, R. Gamaliel, in *b. Rosh HaShanah* 25a (*m. Rosh HaShanah* 2:8-9).

to as “halakhic truth.” (Lamm and Kirschenbaum, 103) In this *sugya*, the place of epistemic authority, as described by Sagi, as well as Berger, takes a clear back seat to deontic authority.¹²⁶

If the story had ended here, as it does in the Yerushalmi,¹²⁷ its lesson would have remained clear. However, to drive the point home, God’s response to this clever rabbinic exercise of authority was to laugh joyfully, saying נצחוני בני, נצחוני בני — “my sons have defeated me, my sons have defeated me.” In effect, this is a father’s tacit approval of his sons’ usurpation of power. As if this were insufficient, and underscoring the importance of making the transfer of power crystal clear, not only was the ruling of the oven’s cleanliness by R. Eliezer overturned by the majority by virtue of rabbinic deontic authority, but everything he had judged to be clean was summarily burnt in fire. Imposing the full exercise of their authority so as to make obvious their victory, they also voted to excommunicate R. Eliezer, thereby stripping him of any vestiges of his own deontic authority.

¹²⁶ Daniel Boyarin offers a reading of this *sugya* that frames this overturning of the authority of R. Eliezer as a breakdown of dialectic. While using different terminology, his description may also be seen as emblematic of deontic authority: “The device of the majority vote, while more democratic perhaps than other possible solutions, is just as indicative of this collapse as any other in Babylonian rabbinic Judaism and thus represents a particular episteme of power/knowledge different even from that of earlier Palestinian Judaism. In the face of the perceived failure of dialectic to produce consensus, a perceived failure that I wish to suggest was endemic around the fourth-century Mediterranean and later, the Jewish text seeks to effect a transfer of authority and of control over discourse from heaven – which now can be seen to mean, at least sometimes, reasoned argument – to earth, the allegedly God-given authority of the majority of rabbis.” (Boyarin, 2007, “Hellenism,” 356).

¹²⁷ *y. Mo’ed Qatan* 81c-d, 3:1

Given the rabbis' choice to overturn not only an existing halakhic position but the laws of nature themselves,¹²⁸ the question then arose as to how to inform R. Eliezer of his excommunication. Their concern regarding the potential destruction of the world should "an unsuitable person" inform him would appear to be due to R. Eliezer's sympathy with nature, and his ability to cause it to respond in concert with God's support of R. Eliezer's epistemic authority. R. Akiva offers to take on the formidable task, drapes himself in black, and sits far away from R. Eliezer, who seems perplexed regarding events, asking Akiva *מה יום מיומים?* – what of today from other days? That is to say, why is today different from other days? R. Akiva then tells him that his colleagues have separated from him, which alludes to his excommunication. At this point, R. Eliezer goes into mourning and cries, and the world is then ravaged by famine as had been feared. Even "the dough in women's hands" is said to have swelled up, attesting to the power of nature asserting itself in the flour prepared from wheat, with discernible allusion to the oven of Akhnai itself.¹²⁹ According to tannaitic tradition, everything that R. Eliezer gazed upon was burned up. It was, in effect, a *natural* disaster in the most literal sense – nature in full revolt.

The resolution of this *sugya*, which can only be called an authority play, is in itself vested in the deontic authority residing in the person of R. Gamaliel, who, travelling by

¹²⁸ God's will may no longer be a factor in the remainder of this *sugya*, given his laughter and expression of approval.

¹²⁹ Nachman Levine points to the literary dimensions of these descriptions, for example, the motif of how things appear to others, as in the statements *כמדומה לי שחבירים בדילים ממך* and *כמדומה לי שאין זה אלא בשביל רבי* – i.e., ". . . it seems to me that your colleagues separate themselves from you" and ". . . it seems to me that this can be because of nobody other than R. Eliezer ben Hyrcanos." (Levine, 38). We have seen other examples of the motif of how things appear to others, for example, in *b. Shabbat* 75a and its concern with the way in which rabbinic expertise is seen by the nations.

ship at the time, and noting the large waves, knew that this was somehow related to R. Eliezer. Here, the wave that was set to drown R. Gamaliel may surely be viewed as a symbol of nature lashing out at deontic authority. It is, however, also ultimately his deontic authority that allows R. Gamaliel to successfully appeal to God in order to halt the natural chaos. In order to do so, it is no coincidence that R. Gamaliel appeals to God's cosmogonic and cosmological roles, clearly calling out to רבונו של עולם – the master of the universe – for assistance. Here, R. Gamaliel points out that his motive is to honour God and to prevent ongoing conflict in Israel, and that his concern is not for himself. That is, this was not a question of epistemic authority vested in his person or expertise, but one of proper concern for others, and for God's created order – the creator being the ultimate deontic authority. At this, the sea – and, presumably, nature – calms down.

The lengthy *sugya* of the Oven of Akhnai has been rightfully analyzed in scholarship¹³⁰ to illustrate the nature and play of rabbinic authority, and for its literary features. It is, however, and for our purposes, more specifically deontic authority that is illustrated throughout the story, both at the beginning and in its resolution. The initial revolt of nature was instigated by the rabbis who ignored natural phenomena, used God's

¹³⁰ See, for example, Norman Simms, 1987, "My Children Have Defeated Me': Authority in Jewish Talmudic Tradition." In Douglas Pratt and Dov Bing, Eds. *Judaism and Christianity - Toward Dialogue*, 57-75. Auckland: College Communications; Gabriel Levy, 2010, "Rabbinic Philosophy of Language: Not in Heaven." *Journal of Jewish Thought and Philosophy* 18:2, 167-202; Christine Hayes, 2006, "Rabbinic Contestations of Authority"; Tzvi Novick, 2007, "A Lot of Learning is a Dangerous Thing: On the Structure of Rabbinic Expertise in the Bavli." *Hebrew Union College Annual* 78, 91-107; Nachman Levine, 2004, "The Oven of Akhnai Re-deconstructed." *Hebrew Studies* 45:1, 27-47; Norman Lamm and Aaron Kirschenbaum, 1979, "Freedom and Constraint in the Jewish Judicial Process." *Cardozo Law Review* 1:1, 99-133; Jeffrey L. Rubenstein, 1999, *Talmudic Stories: Narrative Art, Composition, and Culture*. Baltimore: Johns Hopkins University Press.

Torah to usurp authority and halakhic precedents, and excommunicated R. Eliezer, who had followed proper halakhic procedure. Moreover, its conclusion was effected by R. Gamaliel, who, travelling in the midst of the natural manifestations of this chaos, appealed to the Dominion of God and to the created universe, thereby effectively denaturing the process, so to speak.

The *sugya* may, then, be seen as a commentary – however aware or unaware of its subtext its authors and redactors may have been – on both the nature of rabbinic authority and the primacy of its deontic form – to the extent that it held sway over empirical phenomena themselves. This is significant given the creation of the cosmos and its laws by God by means of Torah blueprint in rabbinic writings. Indeed, the bold self-presentation of the rabbis reminding God (via the *bat kol*) of the scriptural transfer of authority by declaring **לא בשמים היא** (“It is not in heaven!”) is revealing, demonstrating, for all to read, the rabbinic right to veto the laws of nature established by God, as well as epistemic authority.

Reiterating Berger, epistemic authority assumes that knowledge can be verified and refuted if necessary, that such knowledge may be revised as knowledge increases about a topic, and that anybody may, in theory, become an expert. (Berger 1998, 81-82) Here, R. Eliezer may easily be viewed as an embodiment of epistemic authority. He is skilled in halakhic rulings, and is recognized as an expert.

However, the consequence of his expert ruling on the cleanliness and ritual purity of the oven and his challenges to the majority using the natural world are overruled by

the majority, who are swayed neither by natural laws nor their subversion by God to make a halakhic point in support of R. Eliezer. Instead, deontic authority and its truth-claims – even when shown to be empirically wrong – hold sway, and the key attributes of R. Eliezer’s person, his collegial relationships, his halakhic expertise, and even his logic, are all effaced by the burning of the objects he had ruled clean in the past, and by his excommunication, even as the natural world itself protested.

Indeed, for the rabbis as in general, deontic authority is not about observed truth, nor is it about individual expertise. It is about the appeal to Truth by virtue of station or membership. As such, we see highlighted Berger’s view that epistemic authority is not an appropriate model as it applies to the legislative function of the early rabbis as presented in the literature.¹³¹ Indeed, based on numerous examples in the texts, any challenge to, or revision of, their exegesis or legal rulings is not acceptable, and their very status assigns to them the right to rule uncontested over a wide variety of matters. (Berger 1998, 81-82)

With respect to *b. Bava Metz’i’a* 59b and its extended presentation of empirical phenomena found in nature being negated and the epistemic authority of R. Eliezer

¹³¹ The question of whether the rabbis actually exercised deontic authority on a regular basis is less important to the argument found here than the fact that the presentation of their authority remained unflagging between the mishnaic and talmudic periods. Of note, however, is Christine Hayes’ analysis of this question, in which she asks: “Certainly *b. BM* 59b talks the talk, but the real question is: did the rabbis walk the walk? Did they actually exercise their authority in bold, even radical ways, or did they just talk about it? Have scholars been misled by rabbinic rhetoric?” Her conclusion, which calls for further reading and analysis, is that there is more discomfort with the bold exercise of authority in the later, Babylonian sources than there was in the earlier, Palestinian sources. (Hayes 2006, 124-25). She concludes by presenting an explanation based on a non-hierarchical legal system of Rome, and to the edicts of magistrates, especially the edicts of the Praetor, which could effectively render previous laws unenforceable. Hayes has argued persuasively for similarities between the *taqqanah* and such edicts. The Sasanian context, however, had no such history, leading to discomfort with the implementation of such authority, while continuing to present it in the texts. (138-40)

being overruled, we see deontic authority writ large in the literature and assigned primacy.¹³²

2.3 Discussion: Natural Wisdom and Rabbinic Prestige

The natural world and wisdom related to it in the Bavli stem from a number of sources. In addition to internal, rabbinic perspectives, other sources are Greek, Persian, or even Mesopotamian in origin, though transmission histories cannot always be ascertained. The scholarly debate is ongoing with respect to the question of whether the rabbis of this period engaged with outside knowledge, or shunned it. (Veltri 1998, “On the Influence”, 301) It is true that rabbinic literature presents both positive and negative views of Greek sciences and culture scattered throughout the tannaitic and amoraic literature, however, in keeping with the multivocality of these texts with respect to natural knowledge, there is no single view of foreign wisdom in rabbinic literature. (Efron, 42; Labendz, 146)

Several examples will suffice here. *b. Sotah* 49b makes its view of outside knowledge clear, for the Gemara reads “Cursed be a man who rears pigs and cursed be a man who teaches his son Greek.”¹³³ On the other side of the coin, we note Greek

¹³² Tzvi Novick sees the play of authority slightly differently from Berger, though his notion of knowledge seems akin to the concept of epistemic authority vested in expertise. Novick sees as key “the relationship between rabbinic authority and rabbinic knowledge. For R. Eliezer, knowledge directly and immediately underpins authority. For the Sages, the transition from knowledge to authority is mediated by a sphere of social, dialogical interaction, and the mediating role of this sphere generates expectations of intelligibility and persuasion.” (Novick “A Lot of Learning”, 101)

¹³³ Labendz notes an earlier and representative example within the *midrash halakhab*, in *Sifre Deuteronomy* 304. Quoting Song of Songs 8:8, “We have a young sister, and she has no breasts”, it continues, “Four kingdoms [will] rule Israel, and among them there is neither a sage nor a wise person. (L. Finkelstein, 323, as cited in

wisdom presented in a positive light in *b. Pesabim* 94b, where the non-Jewish view of the relative positions of the sun and the Earth was accepted over the rabbinic view, and in the Jewish blessing said when encountering non-Jews in possession of great wisdom, as noted in *b. Berakhot* 58a.

As Jenny Labendz rightly points out, wisdom amongst the nations is not only acknowledged, but where appropriate, extolled in examples such as this. Moreover, even limitations or prohibitions placed on Jews with respect to such outside knowledge – for example, in the case of astrology and divination – nevertheless demonstrate recognition of external wisdom, which is generally presented as distinct from Torah.¹³⁴ (Labendz, 147-48) I am in agreement with Labendz when she describes the portrayal of the dichotomy between Torah and outside, or Greek, wisdom as ultimately artificial, given the clear presence of so-called “non-Jewish” topics throughout the rabbinic corpus. (149) In this light, the presentations of positive and negative valences pertaining to Greek wisdom in rabbinic texts are not consonant with the evidence we have for transmission

Labendz, 146) Cf. Veltri, who has argued that the rabbinic attitude toward Greek language and culture was essentially positive, and sees bans on their study as being limited to certain times and places. Pointing to such examples of positive valence as *y. Megillah* 1:11 [b. 71b], which calls Greek the original human language spoken prior to Babel, Veltri explains that although the rabbis did not always accept “purely theoretical Greek conceptions,” they generally accepted outside ideas regarding the empirical sciences and the *weltanschauung* underpinning it. This, Veltri has claimed, was owing to rabbinic pragmatism. (Veltri 1998, “On the Influence,” 302-3)

¹³⁴ The view of essential difference between outside wisdom and Torah is further highlighted by Labendz, who points to *Eikhab Rabbah*, generally, though not definitively, dated to the rabbinic period. In 2:13, we read “If someone says to you that there is wisdom among the nations, believe it, as it is written [Obadiah 1:8] “I shall destroy the wise of Edom, and understanding from Mount Se’ir [i.e., there is wisdom and understanding now, though it will be destroyed in the future]. [If someone says to you that] there is Torah among the nations, do not believe it, as it is said [Eikha 2:9] ‘Its king and its ministers are among the nations; there is no Torah.’” (Labendz 148)

of these “non-Jewish” topics to texts including the Bavli.¹³⁵ This is certainly true of topics related to the celestial sciences. Later, in the Sasanian context, the question of learning from outsiders is less positive, as seen in *b. Shabbat* 75a, which cautions against learning from a magus.

Nevertheless, what is clear from the literature is that the early rabbis were often aware of their communal self-presentation and eager to effect its management, both internally and externally. From tannaitic tradition, we know that there were controls over the study of so-called Greek wisdom. For example, the Gemara, in *b. Sotah* 49b, describes the permission given to the household of Rabban Gamaliel several centuries earlier during the tannaitic period, to study Greek wisdom, which is extended due to its “close associations with the Government.” What is implicit here is that others were not permitted to engage in such study. Moreover, the tenor of this statement suggests that these alleged associations were not merely about the exchange of wisdom, but had a diplomatic dimension as well. And in fact, the study of external wisdom came to provide the rabbinic communities with another means to demonstrate their expertise, presenting the rabbis and their communities in a positive light.¹³⁶ This may, I would suggest, be an impulse behind the statement in *b. Shabbat* 75a, which commands someone who knows how to intercalate or perform astronomical calculations to do so in order to display the

¹³⁵ Some questions regarding the absence of certain texts in the Bavli and other rabbinic texts must be left open for the time being. For example, as Veltri points out regarding the tannaitic period, “from the Graeco-Roman point of view, one wonders why Jewish Literature contains no reception of Plato, Aristotle, Hippocrates, Galen, Cicero, and so on.” (Veltri 1998 “On the Influence”, 305-6) Their omission, however, does not *necessarily* imply rejection as much as the prioritization of *halakhab* and related topics.

¹³⁶ This had been the case earlier as well, given the Hellenistic view that Greeks borrowed Jewish wisdom. For example, the diaspora Jew Aristobulos, claimed that “Plato followed our legislation.” (Veltri 1998, “On the Influence,” 304)

knowledge of the Jews to the gentile world, and that he must be shunned if he does not.¹³⁷ This external display is related to mastery over empirical wisdom.

Internally, however, such empirical mastery and epistemic authority is frequently overshadowed by deontic authority, as the power dynamic in *b. Bava Metz'ia* 59b demonstrates. This is perhaps not as contradictory as it sounds. As Berger describes epistemic authority – set apart from deontic authority – it is strongly predicated on belief in an individual's or a group's superior knowledge by another individual or group. Indeed, for Berger, this relational perspective “bears almost all the weight of the claim to authority.” (Berger 1998, 74) And indeed, the sciences, particularly the empirical or hard sciences, as well as the laws of nature themselves, “have an objective truth.” (75) The mastery of these sciences therefore demonstrates epistemic authority both within and from the perspective of outsiders to the rabbinic community.

However, with respect to the legislative function of the rabbis and its relationship to empirical expertise, the picture is cloudier. As Berger describes the matter, epistemic authority is defined by the following characteristics, and is hence, internally weakened in the face of a maximalist revelation:

[. . .] the constant possibility of revision of conclusions, which does not accord well with the character of Rabbinic authority as essentially unchallengeable [. . .] With respect to exegesis, if one maintains a maximalist view of the original revelation, then the Sages' authority is that of loyal transmitters, not truly of *experts* in the typical sense. And if one maintains a more minimalist view of revelation, with the rabbis applying rules of interpretation to the Torah's text, then it is difficult to consider this as expertise when any derivation other than the ones authored by the Sages is deemed legitimate. [. . .] The notion of relying on experts carries with it three very important implications: 1. The knowledge is, in some way, verifiable and, hence, refutable. 2. The knowledge is inherently revisable, as we learn more and know more about a

¹³⁷ I will return to *b. Shabbat* 75a in chapter three.

subject. 3. Anyone is capable, in principle, of becoming an expert (although a group may decide, as a convention, not to dispute its predecessors). *None* of these implications accords well with the aim of granting normative and irrevocable authority to a group of ancient religious scholars: 1. Challenging their exegetical conclusions is a priori inadmissible. 2. Revising or rescinding their legislation in a fundamental and self-conscious way is not permitted. 3. No one could ever attain their stature. (Berger 1998, 81-82)

This is consonant with deontic authority serving to maintain a maximalist view of Torah revelation. However, as presented in *b. Bava Metzi'a* 59b, this maximalist view is adjusted to reflect the rabbinic view that authority is not in heaven. In this light, epistemic authority does not have the force of halakhic correctness, even when the facts themselves can be demonstrated and verified. Rather, it is the stature of the rabbinic station that is elevated in this text, and in other similar texts about the created universe, particularly the celestial sciences.

Chapter Three:
“The Seasonings of Wisdom”: Rabbinic Mathematics, Calendar, and Authority

“It vexes me when they would constrain science by the authority of the Scriptures, and yet do not consider themselves bound to answer reason and experiment.”

-Galileo Galilei, *The Authority of Scripture in Philosophical Controversies*

The rabbinic exertion of deontic authority over empirical expertise is not confined to discussions and debates concerning the natural world. Indeed, it is also expressed in mathematical, calendrical, and astronomical discussions and debates found in the Bavli.

Similarly, while mathematics is not in itself a celestial science, astronomy and calendrical calculations are of course themselves dependent on mastery of certain mathematical skills. As such, the rabbinic understanding and usage of mathematics is critical to any in-depth understanding of their approach to astronomy and calendar, and is also analyzed here. As Meir Bar-Ilan has noted, astronomy itself was closely linked with mathematics in rabbinic literature. Indeed, astronomy represented both “a kind of applied mathematics” and “a way of knowing God, science, and religion.” (Bar-Ilan, “Astronomy In Ancient Judaism”, 2037)

In this chapter, my goal is threefold: 1. Establish the transmission and/or existence of sophisticated mathematics and astronomy in rabbinic host cultures both historically and textually, demonstrating rabbinic access to and awareness of these sciences. 2. Demonstrate the rabbinic devaluation of these sciences, and 3. Establish proof of concept by examining two specific examples – the rabbinic approximation of π

despite awareness of a more precise figure, and the assertion of rabbinic authority over calendrical accuracy, based on both mathematics and astronomy.

In order to accomplish these goals, I first examine historical and inner, textual evidence for the transmission of mathematics and astronomy to rabbinic milieus, followed by the analysis of texts demonstrating their ambivalent reception in rabbinic culture. As I demonstrate, this manifests itself in the presentation of astronomy and mathematics as peripheral when viewed in comparison to more important rabbinic domains key to rabbinic authority, including halakhic topics such as bird offerings and the laws of *niddah*, or family purity, which are elevated in status in the Bavli.

Next, demonstrating proof of concept related to the above, I turn to case examples in the Bavli, related to what I term “the problem of π ” – one which has been addressed by numerous scholars, as noted in chapter one. The following factors have been described as possible explanations for the rabbis’ lax approximation of π : 1. Their purported lack of awareness of, or exposure to, the mathematics involved and 2. Their awareness of a more precise calculation of π , but lack of interest in precision given their focus on more practical halakhic concerns. However, as I will demonstrate, these remain unsatisfying in light of evidence for rabbinic access to a more accurate figure.

Finally, I will turn to additional proof of concept regarding the trumping of mathematical and astronomical accuracy by deontic authority in the Bavli, and in directly related *Mishnayot* related to the Jewish calendar. These include authority struggles noted in the text pertaining to the sighting of the *molad*, and intercalation, which display a keen

interest in upholding the primacy of deontic authority over epistemic authority and empirical evidence. Moreover, this deontic authority is presented in a dramatic, ritualistic show that highlights the importance of the *sugya*.

Concluding the chapter, I discuss the importance of the pattern of deontic authority, and its maintenance, in the mathematical and calendrical texts. This is a pattern that further advances our understanding of the relationship between rabbinic authority and the celestial sciences, as well as the mathematics that support these sciences.

3.1. Mathematical/Astronomical Transmission

In order to better contextualize the reception of mathematics in the Bavli, we must look to both the reception of science and mathematics in the Sasanian context, as well as earlier reception of these domains of knowledge in the Roman context of the Mishnah, preserved in the Bavli, often without significant changes. Indeed, these preserved layers of scientific knowledge are suggestive not only in what they contain, but in what is left uncommented upon, particularly in the Gemara.

The case for specific types of mathematical and astronomical learning among the rabbis cannot be made with accuracy. However, there are two methods by which we can demonstrate rabbinic access to scientific knowledge. First, a necessary and sufficient case can be made for the transmission of scientific and mathematical knowledge to the Roman and Sasanian milieus. Second, we may observe both the presence of this

knowledge in the Bavli and in related literature during this period, and the rabbinic dynamic surrounding them.

It must be recognized that there is much that remains unknown about the precise paths taken by scientific and mathematical knowledge in late antiquity. Moreover, it is well to heed a caution expressed by Catherine Hezser regarding the historicity of rabbinic sources addressing the relationship of the rabbis with Greco-Roman wisdom. As Hezser states, there is always “the possibility of a merely fictional construction or [. . .] an independent development of certain general institutional patterns in different cultural contexts.” (Hezser, “Interfaces”, 164)

What is far more important and valuable in the current analysis is not so much what happened in the historical sense as what the authors and redactors of the text chose to preserve for their community of readers. This is to say, the articulation, preservation and transmission of rhetorical and exhortational truths about the roles that science and mathematics played in rabbinic thought.

3.1.1. Transmission of Scientific Knowledge: Historical Evidence

There is ample evidence demonstrating the transmission of mathematical and astronomical/astrological knowledge from the Babylonian context to that of Greece, as well as the transmission of Greek celestial sciences and mathematics from Greece to other civilizations, including the Roman Empire.¹³⁸ While this is beyond our scope, it is

¹³⁸ On some of the key supporting evidence, see F. Rochberg-Halton, 1988, "Elements of the Babylonian Contribution to Hellenistic Astrology." *Journal of the American Oriental Society* 108:1, 51-62; J. M. Steele, 2011, "Visual Aspects of the Transmission of Babylonian Astronomy and its Reception into Greek Astronomy."

sufficient for our purposes to note that the studies conducted to date establish the transmission of mathematics and astronomy of a high degree of sophistication to Hellenistic Greece and its territories, and thence, to Rome.

The Roman context and its scientific inheritance have been debated in the scholarly literature, and here, we note the often reiterated perception that the Romans were merely the inheritors of Greek mathematical and astronomical wisdom. This view, generally speaking, locates the Roman sciences in the applied realm – encompassing engineering and practical calculation. (Lehoux, *Romans, passim*; S. Cuomo, 143-211) This may be likened to the history of scholarship related to the astronomy of ancient Egypt, which initially made the claim that no such science existed, but which has more recently broken very different ground in the literature, arriving at new conclusions regarding Egyptian astronomy.¹³⁹ It should be of no small interest, then, that we note a remarkably similar unexamined assumption throughout history of science and rabbinic scholarship that the rabbis of late antiquity used mathematics and science for the purely practical, applied ends required by *halakhab*.

Annals of Science 68:4, 453-465; Jan P. Hogendijk, 1996. "Transmission, Transformation, and Originality: The Relation of Arabic to Greek Geometry." In F. Jamil Ragep, Sally P. Ragep, and Steven Livesey, Eds., *Transmission, Transformation*. Leiden and New York: E.J. Brill, 31-64; Bill M. Mak, 2013, "The transmission of Greek Astral Science Into India Reconsidered-Critical Remarks on the Contents and the Newly Discovered Manuscript of the Yavanajātaka." *History of Science in South Asia* 1, 1-20; O. Neugebauer, 1969, *The Exact Sciences in Antiquity*. Mineola, New York: Dover Publications, 172-76.

¹³⁹ See R. A. Parker, 1974, "Ancient Egyptian Astronomy." *Philosophical Transactions of the Royal Society of London. Series A, Mathematical and Physical Sciences*, 276, No. 1257. *The Place of Astronomy in the Ancient World*, 51–65; Hugh Thurston, 1994, *Early Astronomy*. New York: Springer-Verlag, 82-83; Compare Gregg De Young, 2000, "Astronomy in Ancient Egypt." In Helaine Selin, ed. *Astronomy Across Cultures: The History of Non-Western Astronomy*. Dordrecht, Boston and London: Kluwer Academic Publishers, 475-508.

However, as scholars including Daryn Lehoux and S. Cuomo have demonstrated, though the Romans were indeed focused on the engineering feats necessary for the expansion of the Empire, they were by no means mere applied scientists.¹⁴⁰ Indeed, while many practical uses of mathematics and astronomy such as sundials, land-surveying, military strategy, and accounting were part of Roman life, advanced astronomical and mathematical writings from Rome are attested. Moreover, such expertise, which included Greek geometry, was extolled. We note this in the *Astronomy*, by the author Hyginus (ca. second century C.E.), which was addressed to Marcus Fabius, whom Hyginus praised owing to his knowledge of astronomy. The celestial knowledge in this work is profound, encompassing precise definitions and a catalogue of stars based in part on the work of Eratosthenes. Hyginus also takes pains to make a pointed distinction between experts and amateurs in the field of astronomy. (Cuomo, 173) This latter point underscores the high value assigned to mathematical and astronomical expertise and hence, to epistemic authority in the Roman context. S. Cuomo describes astronomical interest among the elite of Roman society as follows:

Astronomical expertise implies that one is able to recognize the stars, even those which are not very bright, assign them to the right constellation, and express their precise number. Apart from Hyginus, we have extensive literary evidence of the astronomical interests of many illustrious Romans: Cicero translated Aratus into Latin, and Germanicus wrote a commentary on the same text. Manilius chose Augustus as dedicatee of his *Astronomy*, which, as well as detailed arithmetical and geometrical procedures, contains an explicit parallel between the hierarchy of the stars and that of human society. (Cuomo, 174)

¹⁴⁰ For a more thoroughgoing look at the Roman sciences, see Daryn Lehoux, 2012, *What Did the Romans Know? An Inquiry Into Science and Worldmaking*. Chicago: The University of Chicago Press; S. Cuomo, 2001, *Ancient Mathematics*. London and New York: Routledge, 143-211.

Turning to the matter of deontic authority, ever-present in Roman politics, there is also evidence that Augustus (63 B.C.E.-14 C.E.) used mathematics to bolster his own prestige. For example, he created numerical records of account prior to his death, including his expenditures for the empire, the number of territories and people within it, as well the number of elite participants in Roman society. Augustus also arranged for the installation of an immense sundial in Rome “whose pediment reminded the public of Augustus’ victory over Antony and Cleopatra.” (Cuomo, 151) Archeologists have since discovered elements dating from the time of Domitian (ca. 51-96 C.E.), which suggests a later restoration. (Ibid.)¹⁴¹ Here, we see but one point of interconnection between epistemic and deontic authority. Each form of authority – and its possessor – had the power to either support or override the agenda of the other, depending upon the epistemological and political contexts of their usage. In the above example, Augustus is said to have supported his authority with empirical wisdom and technology demonstrating the knowledge found in his empire. In the rabbinic context of *b. Bava Metzi’a* 59b, empirical truth is overturned by deontic authority. Moreover, as we have seen in chapter two, there is evidence that Greco-Roman wisdom could also be used to establish perceived rabbinic authority both within the ranks of Jewish scholarship and among Roman authorities.

Our primary focus on the Bavli also highlights its Sasanian context, well described in the research of Yaakov Elman, as well as that of Shai Secunda, and M.J. Geller.

¹⁴¹ According to Pliny the Elder (23–79 C.E.) the sundial of Augustus was created by the mathematician Facundus Novius, and was truly a “thing worthy of being known.” (Cuomo, 151)

Numerous scientific and mathematical texts survive from the period following the Arab conquest of Sasanian Persia, with some Arabic translations of earlier Sasanian texts also coming down to us. As the next greatest power in western Eurasia after Rome itself between ~226 and 654 C.E., the Sasanian Empire has been shown to have been a transmission hub for scientific knowledge between cultures. Far more is known about the elites of Persia during the Sasanian period than about everyday administrative matters and the history of science.¹⁴² Nevertheless, there is sufficient evidence to make it clear both that Greek and Roman science and mathematics made their way to Persia during this period, and that Persian mathematics and astronomy were themselves flourishing.

Moving onto what we know of scientific transmission in Persia, Otto Neugebauer traced the transmission of the sciences between Mesopotamia and India, suggesting an indirect route via Greece and Sasanian Persia. His arguments are well constructed and demonstrate the presence of Greek loan words in Hindu astrology, as well as the presence of Greek epicyclic models in Indian astronomy. Neugebauer also points to the importance of understanding Roman trade routes and the commercial transactions engaged in between India and Egypt during the first century C.E. This contact, which was particularly active between the first and fourth centuries, he points out, is also

¹⁴² Some of this comes from the fourth century Roman writer, Ammianus Marcellinus, who had joined the Emperor Julian in an ill-fated campaign in the 360s C.E. against the Persians. In the extant books (spanning 353-378 C.E.) of his *Res Gestae*, Marcellinus described their kings, aristocrats, courts, feasts, and other matters of importance to the elite of Persian society. However, other than military details, everyday life and government administration in Sasanian Persia were not covered, and Marcellinus presented his portrait using Hellenistic tropes, portraying Persian culture through a Greco-Roman lens. See Ammianus Marcellinus, 1935-39, *Res Gestae*. Translated by John Carew Rolfe. Three vols. London and Cambridge: Loeb Classical Library; E. A. Thompson, 1947, *The Historical Work of Ammianus Marcellinus*. Cambridge: Cambridge University Press. (Reprinted: Groningen 1969); J. den Boeft, J.W. Drijvers, D. den Hengst, H.C. Teitler, 1995-2013. *Philological and Historical Commentary on Ammianus Marcellinus*, vols. 3-10. Leiden: Brill.

supported by archeological evidence, as well as internal references to “the Ionians” in Hindu astronomical texts. This expression, however, referred to both the Greeks and the Romans. (Neugebauer 1969, 166-67) In brief, his conclusion is that Babylonian science was transmitted “through the medium of Hellenistic astronomy and astrology” and found its way to India either via Persia or Roman maritime trade routes. (167)¹⁴³ Moreover, Neugebauer sees astrology as a key tool in tracing the transmission of Hellenistic thought. (171)

Also central to a fuller understanding of the transmission of astronomy and astronomical mathematics is awareness of the trend toward the reception of Hellenistic texts directly from the Sasanian Persian context, circa 226-652 C.E. Circa 260 C.E., Shahpuhr I (241-272 C.E.) founded Jund-i-Shapur in south-western Iran to house Roman prisoners including engineers, doctors, and other learned experts who had been captured in the war with Valerian. These almost certainly included those familiar with Egyptian, Mesopotamian, and Greek mathematics. (Joseph 2011, 26) Later, in 489 C.E., when the Persian school in Edessa was closed by Zeno, the centre of learning relocated to Nisibis, in Persia. Greek medical expertise, and through it, earlier Egyptian and Babylonian remedies, were also brought to Jund-i-Shapur, a medical training centre.

¹⁴³ Neugebauer also comments on the linkage between astronomy and astrology in the Late Antique context, asserting: “One of the main reasons for the transmission of astronomical knowledge from one nation to another was undoubtedly the spread of the belief in astrology as the one science which gave insight into the causes of the events on earth. It has often been said that astronomy originated from astrology. I see no evidence for this theory. It seems to me much more plausible to assume that one major incentive for the development of astronomy consisted in attempts to achieve regularity in the intercalation of the lunar calendars.” (Neugebauer 1956, 168) Key here is not the question of where or how astronomy originated, but the fact that astronomy and astrology were frequently transmitted together in antiquity. I will further examine the taxonomical implications of this dual transmission in the conclusion.

Later, during the reign of the Persian king Khusro I, a group of Greek Neoplatonist philosophers and other refugees from the Byzantine Empire, persecuted under the rule of Justinian I, who had closed their academy of learning, were invited to settle in Persia when they fled Athens in 529 C.E. Indeed, Khusro I welcomed the influx of Greek philosophy and science. (26-27) As a result numerous Pahlavi translations of Greek and Syriac texts were made, including Neoplatonic works. Beginning with the rule of Shahpuhr I, onward through the reign of Khusro I, there is evidence of these translations, as well as from Sanskrit texts, into Pahlavi, or Middle Persian, some of which likely included astronomical and mathematical texts. (27)

Also notable in the Sasanian context in which the Bavli was composed and compiled would have been the composition of indigenous Persian works of mathematics in Pahlavi, including a handbook of astronomical tables known as the *Zij-I Shah*.¹⁴⁴ Of equal note was the composition, ca. 531-579 C.E., of *The Denkard*, an encyclopedic collection of scientific and mathematical works, including a section classifying six types of healers, including magi, alchemists, and physicians.

On a related point of interest, Neugebauer describes one such transmission later, in the ninth century, by Abu Ma'shar (d. 886) of the 542 C.E. Persian translation of the Hellenistic text *Sphaera Barbarica*, by Teukros of Babylon (circa the first century C.E.). These writings had been translated into several languages, including Hebrew.

¹⁴⁴ On this important Pahlavi work, later preserved in Arabic, see E.S. Kennedy, 1958, "The Sasanian Astronomical Handbook *Zij-I Shah* and The Astrological Doctrine of 'Transit' (*Mamarr*)." This work, which demonstrates Indian mathematical influence according to Kim Plofker (2008. *Mathematics in India*. Princeton: Princeton University Press, 255), predates Kharazmi's *Algebra* and his *Trigonometric Planetary Tables* (circa 830-5 C.E.).

(Neugebauer 1969, 171-72) In 2002, Antonio Panaino further examined this particular transmission of Teukros of Babylon, confirming its translation into Pahlavi, likely during the third century C.E. While the Pahlavi translation vanished, fragments were preserved in Arabic. The *Sphaera* was a key work that served to transmit knowledge of the 36 subdivisions of the zodiac, known as decans, consisting of 10 degrees each, with three decans comprising each constellation. Also transmitted in this work was knowledge concerning the constellations rising on the horizon at the same time as a given decan, known as the *paranatellonta*. (Panaino, 4; Popović, *Reading*, 138) As Neugebauer describes the importance of such transmission of scientific knowledge via Sasanian Persia:

Following the unmistakable traces of very specific astrological doctrines, one can reconstruct the road which connected Hellenistic Mesopotamia with Hellenistic Egypt, with pre-Islamic Persia, and with India. We are obviously entitled to assume that the same road was followed by the transmission of mathematical astronomy even if no more is available to us than the two external ends in Mesopotamia and India. (Neugebauer 1969, 172)

Demonstrating the transmission, translation, and indigenous creation, of mathematical and other scientific texts within the Roman and Sasanian contexts is merely the first step, complemented by the presentation of evidence for this transmission in the rabbinic texts themselves in section 3.1.2.

3.1.2. Transmission of Scientific Knowledge: Textual Evidence

Within the Bavli and related literatures, we note evidence of more than a passing familiarity with astronomy and mathematics, as well as other sciences. Several rabbis, including R. Yohanan ben Zakkai, R. Gamaliel, R. Joshua ben Hanania, Mar Samuel, R.

Eliezer Hisma, and R. Yohanan ben Gudgada, were said to be proficient in astronomy and mathematics, and as we have seen, this knowledge was accessible by the learned within both the Sasanian context and the earlier Roman milieu; here too, we must also consider the Greco-Roman wisdom received and understood by the composers and redactors of the Bavli.¹⁴⁵ To demonstrate the reception of transmitted astronomical and cosmological theory, I turn to two texts that contain overlapping phrasing and terms, the first from *Gen.Rab* 6:8, and the second, in *b. Pesahim* 94b. Although the Midrash and Bavli cannot be directly compared or painted with the same brush, the midrashic passage is included here due to the significant overlap in content, suggesting influence in one direction or the other, or by a third, unidentified source.

In *Gen.Rab* 6:8, we read of confusion as to whether the world is flat or round based on the rising and setting of the sun and moon, and we also note familiarity with Mesopotamian and Ptolemaic scientific knowledge of the topic, with some rabbis preferring Babylonian cosmology and others Ptolemaic:¹⁴⁶

כיצד גלגל חמה ולבנה שוקעים ר' יהודה בר לעאיי ורבנן ר' יהודה אומר מאחורי כיפה ולמעלה רבנן אמרין מאחורי כיפה ולמטה אמר ר' יונתן נראין דברי ר' יהודה בר לעיי דאמר מאחורי כיפה ולמעלן בימות החמה שכל העולם חס והמעיינות צונין סלהון דרבנין דאמרין מאחורי כיפה ולמטה בימות הגשמים שכל העולם צונן והמעיינות פושרים אמר ר' שמעון בן יוחי אין אנו יודעין אם פורחים באויר אם שפין הם ברקיע אם מהלכין הם כדרכן דבר קשה למאד ואי אפשר לבריה לעמוד עליו¹⁴⁷

¹⁴⁵ See W.M. Feldman, *Rabbinical Mathematics and Astronomy*, 9-13.

¹⁴⁶ On this passage, also see Hayim Lapin, 2010. "The Rabbinic Movement". In Judith R. Baskin, Kenneth Seeskin, Eds. *The Cambridge Guide to Jewish History, Religion, and Culture*. Cambridge: Cambridge University Press, 72.

¹⁴⁷ The Soncino has שוקעים ברקיע as well as שוקעים פושרין כולו צונן ומעיינות פושרין, among numerous other textual variations. The Theodor/Albeck MS has צונין, an incorrect plural form of צונן which is correctly pluralized as צוננין in the Soncino and several other MSS. Also note the scribal corruption חס which appears instead of the correct word הם.

How do the spheres of the sun and of the moon set? Based on R. Yehuda bar L'ai and the rabbis: R. Yehuda said: Behind the vault (i.e., of heaven) and above it. The rabbis said: Behind the vault and underneath it. R. Yonatan said: The words of R. Yehuda bar L'ai that it is behind the vault and above in the days of summer when the entire world is hot though the wells are cold and the sayings of the rabbis that it is behind the vault and underneath it in days of rain when the entire world is cold and the wells are tepid. Said R. Shimon b. Yohai: "We do not know if they fly in the air or glide in the firmament or travel on their typical paths. It is a very difficult (problem) and it is impossible for a being to stand upon it (to understand it). (Theodor & Albeck, 48; Strack & Stemberger, 279)

In like fashion, we read the following talmudic parallel in *b. Pesahim* 94b:

חכמי ישראל אומרים: ביום חמה מהלכת למטה מן הרקיע, ובלילה למעלה מן הרקיע. וחכמי אומות העולם אומרים: ביום חמה מהלכת למטה מן הרקיע, ובלילה למטה מן הקרקע. אמר רבי: ונראין דבריהן מדבריינו, שביום מעינות צונגין ובלילה רותחין

The sages of Israel say: During the day, the sun the sun travels on its path underneath the firmament (of heaven) by day and above the firmament at night. And the sages of the nations say: By day, the sun travels on its path under the firmament, and by night, underneath the firmament. Rabbi said: And their viewpoint is preferable to our own, because by day, the wells are cold, but warm by night.

Here, we note that the rabbis in this passage believed that the sun travelled under the firmament by day and above the sky at night, while the non-Jewish sages asserted that the sun travelled under the firmament during the day and under the Earth at night. The statement by Rabbi – that is, R. Yehudah Ha-Nasi – that the view of the sages of the nations is preferable to that of the rabbis is telling in the sense that the Ptolemaic system is clearly deferred to by Rabbi, and, one presumes, by his circle of followers. Here, the Ptolemaic and the Babylonian cosmologies are in opposition. However, the Babylonian cosmology is presented with respect to solar motion itself. In this conception, the firmament, or *raqia*, is above a flat Earth, and the constellations revolve around the dome.

This discussion immediately follows a similar juxtaposition in *b. Pesahim* 94b in which the rabbis view the sphere as fixed with the constellations moving within it, while the sages of the nations state that the sphere revolves around the Earth and the constellations are fixed. This latter, non-rabbinic view was based upon Ptolemy's *Almagest*, following earlier precedent by Aristotle.

A telling parallel may be noted in the treatment of the revolution of the celestial sphere in *b. Pesahim* 94b to the writings of the sixth-century Alexandrian monk Cosmas Indicopleustes, who polemicized against those who believed that the Earth was spherical. The cosmological arguments and terminology are very similar in both the Bavli and the monastic work. Indeed, even the references to the qualities of coldness, moistness, and heat are tellingly parallel. (Cosmas, *Christian Topography* Book I, 15, 21; Slifkin, 5)

This, according to Natan Slifkin, demonstrates the involvement – and I would add, engagement – of both the rabbis and non-Jewish thinkers in the debate pitting the new Ptolemaic model and Babylonian cosmology against each other.¹⁴⁸ (Slifkin, 5) I would further suggest that this engagement would almost certainly have called for some degree of investment in mathematical and astronomical learning in rabbinic milieus, as well as direct access to the writings of Cosmas by the Amoraim or the Bavli's redactors, calling into question previous scholarly assertions, such as that of Meir Bar-Ilan

¹⁴⁸ Despite the popular, non-scholarly nature of his writings, I cite Natan Slifkin, also known The Zoo Rabbi, in this manuscript due to the quality of his research and ideas.

(“Astronomy”, 2038-39) that there is no evidence for direct access to non-Jewish astronomical books by the rabbis.¹⁴⁹

It is difficult to ascertain the precise level of awareness of Ptolemaic astronomy by the rabbis of the Bavli. Nevertheless, it is worth emphasizing that rabbinic responses to these empirical phenomena are expressed as received knowledge in *b. Pesahim* 94b (as well as *Gen.Rab* 6:8), suggesting at least some familiarity with the Ptolemaic system among the rabbis – indeed, a degree of knowledge that was sufficient to override internal rabbinic views regarding the motions of bodies in the cosmos. As Noah J. Efron further explains:

The passage is obscure, but it seems to mean the following: The ‘Sages of Israel’ believed that the sky was a vault suspended above the earth. As they saw it, the sun circled the vault itself. In the day, the sun traveled between the vault and the earth, providing heat and light. At night, it traveled above the vault, which now stood between the sun and the earth, eclipsing heat and light.¹⁵⁰ The ‘Sages of the nations,’ on the other hand, believed that the sun circled the earth. The Talmud endorses this view, which has both observation and reason on its side. (Efron, 44)

Precisely why R. Yehuda Ha-Nasi accepted the Ptolemaic cosmological model, however, is not immediately clear. The suggestion offered by Efron is that the decision was one based on observation and reason, which one surmises is derived from the premise in *b. Pesahim* 94b that the wells are cold during the day, but warm during the night. However, this statement is not merely counterintuitive, but does not in itself illuminate the process by which rabbis were willing to overthrow their own long-held cosmological model, or why. For the time being, this question must be left open.

¹⁴⁹ For a broader overview of the relationship between monastic and talmudic literature, also see Michal Bar-Asher Siegal. 2013. *Early Christian Monastic Literature and the Babylonian Talmud*. Cambridge: Cambridge University Press.

¹⁵⁰ This is further illuminated by Slifkin, who describes the Ptolemaic cosmological conception as one in which a spherical Earth is surrounded by a larger, rotating sphere in which the constellations are fixed. (Slifkin, 4)

What these passages do accomplish most impressively, however, is demonstrate the reception of astronomical and cosmological theory in the rabbinic culture of our target era that was sophisticated for its time. Moreover, the overlapping ideas shared by the *Christian Topography* of Cosmas in the sixth century reveal access to this cosmological and astronomical material, its incorporation into rabbinic debates regarding the Ptolemaic and Babylonian models, and finally, the choice to preserve this astronomical and cosmological knowledge in the Bavli.

Moving from astronomical awareness to mathematical knowledge in the Bavli, we note further textual evidence of a fairly sophisticated received knowledge of mathematics – a tool that is vital to the development of astronomical and calendrical systems of any accuracy. In tractate *Qinnim*, we note complex counting methods pertaining to bird offerings, and elsewhere, we note the presence of game theory related to bankruptcy, as well as combinatorics and probability. (Wartenberg 2013, 1212-13; Aumann, *passim*)

While it is notable that the language used in the Bavli and related literatures to describe mathematics is rudimentary compared to its Greek counterparts, the awareness of Greek, and in some cases, Babylonian, mathematics is nevertheless present. For example, immediately following a discussion of the dimensions of a *sukkah*, incorporating the rounding of π to 3 in *b. Sukkah* 7b, which I will examine in section 3.2.1., we note the following mathematical discussion in *b. Sukkah* 8a:

הני מילי בעיגולא, אבל בריבועא - בעיא טפי. - מכדי, כמה מרובע יותר על העיגול - רביע, בשיתסר סגין - הני מילי בעיגול דנפיק מגו ריבועא, אבל ריבועא דנפיק מגו עיגולא - בעיא טפי, משום מורשא דקרנתא. - מכדי, כל אמתא בריבועא אמתא ותרי חומשא באלכסונא, בשבסר נכי חומשי סגיץ - לא דק. - אימור דאמרינן לא דק פורתא, טובא מי אמרינן לא דק? - אמר ליה מר קשישא בריה דרב חסדא לרב אשי: מי סברת גברא באמתא יתיב? תלתא גברי בתרתי אמתא יתבי. - כמה הוו להו - שיתסר, אגן שיבסר נכי חומשא בעינן - לא דק. -

אימור דאמרינן לא דק לחומרא, לקולא מי אמרינן לא דק? - אמר ליה רב אשי לרב אשי: לעולם גברא באמתא יתיב, ורבי יוחנן מקום גברי לא קחשיב. - כמה הוו להו - תמני סרי, בשיבסר נכי חומשא סגיא - היינו דלא דק, ולחומרא לא דק. רבנן דקיסרי, ואמרי לה דייני דקיסרי אמרי: עיגולא דנפיק מגו ריבועא - רבעא

That is relevant only to a circle, but for a square, a greater perimeter is needed. But consider: How much more is a square greater than its (inscribed) circle? By a quarter. Should it not be sufficient if only sixteen (can sit around it)? That is so in the case of a circle inscribed inside a square, but if a square is inscribed within a circle, a greater circumference is needed because of the projecting corners. But if the square's side is a cubit, its diagonal is about one and two fifths cubits. Should (a circumference of) sixteen and four fifths (cubits) not be sufficient? We were given only an approximate figure (by R. Yohanan). But should we not approximate only when (the difference) is small, and could we assume this when it is large? Said Mar Kashisha the son of R. Hisda to R. Ashi: Do you think that a man takes up one cubit? (In fact) Three men take up two cubits. How much then (for twenty four)? Sixteen cubits. We need here sixteen and four fifths as (R. Yohanan) provided only an approximate number. But should we not say that one should be assumed to provide approximate numbers only when there is legal stringency, but should we assume this when there is no stringency? Said R. Asi to R. Ashi: Always, a man takes up a cubit, but R. Yohanan does not include the space taken up by the men. How much does this amount to (in cubits)? Eighteen, but sixteen and four fifths is sufficient. That is what was meant (when it was said) that he merely approximated. Here, it aims at stringency. The rabbis of Caesaria (and some say the judges of Caesarea) say: The circumference of a circle that is inscribed in a square is one quarter.

In this passage, the square root of two is merely approximated, and this is in keeping with a trend toward doing so in the Bavli, even when there are hints of a more sophisticated mathematical understanding. Indeed, I am in agreement with comments on the question of rabbinic awareness of mathematics by Benedict Zuckerman, as well as Noah Efron, in their detection of a certain note of obfuscation in the Bavli with respect to the sophistication of the mathematical knowledge of the rabbis.¹⁵¹ In *b. Sukkah* 8a, for example, we read that a mere approximation was provided by R. Yohanan, but the question of the role of the law is soon broached in 8a, which alludes to the question of using approximation as opposed to more accurate figures.

¹⁵¹ See Benedict Zuckerman, 1878, *Das Mathematische im Talmud: Beleuchtung und Erläuterung der Talmudstellen mathematischen Inhalts*. Breslau: F.W. Jungfer; Noah Efron, *Judaism and Science*, 46-47.

It is also clear from 8a that the rabbis were well aware of the practice of approximation and the resulting underestimate of the required area for a circular sukkah, and their knowledge of the principles of geometry is evidently sound, as demonstrated by the statement concerning the difference between a circular and a square sukkah, and the mathematical assumptions required for each – הני מילי בעיגולא, אבל בריבועא - בעיא טפי – (“That is relevant only to a circle, but for a square, a greater perimeter is needed.”) Moreover, the discussion in 8a then turns to more sophisticated mathematics, revealing rabbinic awareness of the calculations pertaining to the hypotenuse of a right triangle – with a calculation of $1 \frac{2}{5}$ cubit that comes very close to the value provided by the Pythagorean theorem. (Efron, 46) This transcends the halakhic necessity or mere mathematical utility of determining the number of guests that might be accommodated by a given sukkah. Rather, it is clear that the rabbis enjoy the mathematical debate, and seem to wish to convey the fact that they are aware of mathematics even when they approximate.

Despite the Persian context of the Bavli, it is noteworthy that the mathematical debate found in *b. Sukkah* 8a does not veer away from the Greek mathematics of the Mishnah. Moreover, we also note the Bavli’s reference to the rabbis and/or judges of Caesarea who assert that the circumference of a circle inscribed in a square is a quarter.¹⁵²

¹⁵² On the question of how Hellenized the context of the Bavli might have been, including the influence of so-called Greek wisdom, see Catherine Hezser, 2000, “Interfaces Between Rabbinic Literature and Graeco-Roman Philosophy,” In Catherine Hezser and Peter Schaefer, Eds., *The Talmud Yerushalmi and Graeco-Roman Culture. Vol.2*. Tübingen: Mohr-Siebeck, 161-187; Shaye J.D. Cohen, 1981, “Patriarchs and Scholarchs,” *Proceedings of the American Academy for Jewish Research* 48, 57-85; See also Daniel Boyarin, 2009, *Socrates and the Fat Rabbis*. Chicago: University of Chicago Press, in which Boyarin, through a Bakhtinian lens, affirms Greek

This hermeneutic reliance upon the tannaitic source material does not by any means preclude interest or awareness on the part of the Amoraim of the Bavli in the Sasanian sciences. Indeed, there is textual evidence for the transmission and absorption of Sasanian mathematics in the Bavli as well, presented alongside its Greek counterpart. For example, in *b. Bekhorot* 60a, the Gemara describes the counting of lambs in hundreds or in pairs, with the tenth becoming holy. Here, we read of the rabbinic awareness of decimal notation, which was, according to the text itself, learned from the Persians and incorporated into the mathematics of the Bavli. (Feldman, 17)

תא שמע: מנאן למפרע - עשירי שבמנין הוא קדוש, בשלמא למאן דאמר למנין בהמות הוא קדוש - שפיר,
אלא למ"ד למנין שלו הוא קדוש, עשירי - חד קרי ליה אמר רבא: הואיל ואיתיה במנינא פרסאה, דקרו לעשרה
חד.

Come and hear: If he counted them backward, the tenth of the counting is holy. Now I allow that according to him who says that the holiness of the tenth is determined by the amount of animals, there would be no difficulty. But according to he who states that the holiness of the tenth is based upon his counting, then he calls the tenth the first! Said Raba: The reason is that it happens that in Persian counting, they call ten one.

In the above examples, we note not only familiarity with the Greek and later, Sasanian mathematics, but the incorporation of scientific elements into rabbinic thought. We note this in the evidence for, and hints at, mathematical sophistication in *b. Sukkah* 8a, as well as the awareness, and at least partial acceptance, of Ptolemaic cosmology in *Gen.Rab.* 6:8 and *b. Pesahim* 94b. We further note the incorporation of the Persian decimal system into a rabbinic system in which the tenth lamb is deemed holy. That these examples suggest reception of scientific knowledge from non-Jewish contexts would

influence on the Bavli by viewing it – and the dialogues of Plato – as Menippean satire; Richard Kalmin, 2014, *Migrating Tales: The Talmud's Narratives and Their Historical Context*. Oakland: University of California Press.

appear to be an understatement. The question now becomes not one of rabbinic familiarity with the mathematics, but what they chose to do with it.

3.2. The Reception of Mathematics in the Bavli and Related Literatures: Of Authority and the Empirical

The reception of mathematics by the rabbis in the Roman and Sasanian milieus cannot have been uniform. As was often the case in the eras prior to the development of the Gutenberg press, manuscripts were, if they survived a given era, copied and transmitted from one hand or school to others. Given what we know of the rabbinic calendrical diversity that existed until the ninth-tenth centuries, it would make sense that uniformity of opinion concerning such matters as mathematics and the sciences was also a long way off. Nevertheless, what is most important for our purposes is not the presence of an idealized, homogeneous scientific culture spanning the diverse rabbinic schools and teachers that existed during the time of the composition and redaction of the Bavli, but the evidence for a certain tension between the epistemic authority vested to experts by the empirical sciences and the deontic authority of Torah sages. This is as true within mathematics as it is with respect to astronomy and calendar.

Two examples of this tension manifest themselves in the devaluation of mathematics and calendar (and with it, astronomy) – one in *m. Avot* 3:18 and another in *b. Hullin* 95b:

m. Avot 3:18 (MS Parma):

רבי לשי¹⁵³ חסמא או קנין ופתחי נידה. הן הן גופי תורה.¹⁵⁴ תקופות וגמטרייה. פרפראיות לחכמה

R. Hisma (said): Qinnim [i.e., bird offerings] and Niddah [the laws pertaining to a menstruating woman] are the body of Torah; [The study of the] revolutions of the heavenly bodies] and mathematics are the after courses of wisdom.

b. Hullin 95b:

כולהו שני דרב, הוה כתב ליה רבי יוחנן: לקדם רבינו שבבבל כי נח נפשיה, הוה כתב לשמואל: לקדם חבירינו שבבבל, אמר: לא ידע לי מידי דרביה אנא? כתב שדר ליה עיבורא דשיתין שני, אמר: השתא, חושבנא בעלמא ידע, כתב שדר ליה תליסר גמלי ספקי טריפתא, אמר: אית לי רב בבבל, איזיל איחזייה

During the years of Rav, R. Yohanan used to address him this way in his letters: Greetings to our Master in Babylon! After the death of Rav, R. Yohanan addressed Shmuel this way: Greetings to our colleague in Babylon. Shmuel said, I don't know if I am his master in anything. He wrote and sent [to R. Yohanan] the calculations for the month intercalations for sixty years. (R. Yohanan) said, He only knows mere calculations. So he [Shmuel] wrote and sent [R. Yohanan] thirteen camel (packages) of questions concerning questionable cases related to trefah. (R. Yohanan) said, It appears to me that I have a Master in Babylon; I must go to see him.

Here, we are dealing with two differing contexts, times, and places – the Roman tannaitic *Sitz-im-Leben* and the Sasanian milieu. Nevertheless, the implications of each text are telling. In *m. Avot 3:18*, we read that R. Eliezer Hisma said that whereas bird offerings and the laws of niddah are essential laws (הן הן גופי תורה) — in other words, they are the main body of *halakhab*), astronomy/calendar and mathematics represent פרפראות לחכמה, the after courses, or perhaps better translated, the seasonings of wisdom. Expressed here, if sacrificial birds and *niddah* laws are the main halakhic course, math and astronomy are mere dipping sauces. This is an odd phrasing in one sense, but the fact that the calendrical rules and the mathematics of intercalation had not yet been set in motion

¹⁵³ The text of MS Parma is indistinct here or may be a textual variant; the Soncino edition has אליעזר

¹⁵⁴ The Soncino edition reads הן הן גופי הלכות

within rabbinic culture may be partially explanatory. The implications of this bold statement in the Mishnah, however, suggest that, at the very least, some Tannaim were unimpressed by the celestial sciences, considering them to be tangential to the primacy of Torah. The devaluation of science in *m. Avot* 3:18 in relation to other manifestations of *halakbah* is of special note given the representation of R. Eliezer Hisma as an expert in both astronomy and mathematics (Feldman, 9-13). This strongly suggests that the text assigned primacy to other aspects of Jewish law despite his epistemic authority.

The text of *b. Hullin* 95b presents us with a similar dichotomy. Here too, we see the devaluation of mathematics and calendar, again linked together due to the need to intercalate, and to astronomy due to the ultimate reliance of calendrics upon the heavenly sphere. Whereas R. Yohanan addresses Rav as a Master in Babylon, he later addresses Samuel as a mere colleague in Babylon after the death of Rav, leaving Samuel puzzled as to why he was not privileged to be called R. Yohanan's master. In essence, R. Yohanan will not accept Samuel's authority. His attempt to convince R. Yohanan of his mastery of a halakhic matter was to send him sixty years' worth of intercalations – an impressive feat by any reckoning. R. Yohanan dismisses this display of what can only be termed epistemic authority, stating *אמר: השתא, חושבנא בעלמא ידע* – that Samuel only knows “mere calculations.” Finally, Samuel seems to get the idea, and sends R. Yohanan thirteen camel loads of questions related to cases of *trefah*. Then, and only then, does R. Yohanan acknowledge the deontic authority of Samuel, declaring *אית לי רב בבבל, איזיל איחזייה* – that it is obvious to him that he has a “Master in Babylon” and that he must go to him.

While taking care not to paint both times and places with the same brush, it is nevertheless evident that in both contexts, at least in the rabbinic groups in question, statements are being made regarding the lesser importance of mathematics and astronomy/calendar. In *b. Hullin* 95b, this devaluation moves well beyond a mere statement of devaluation to its application in the dramatic rejection of the epistemic authority of Samuel. This devaluation of his expertise in mathematics and calendar by R. Yohanan continues until Shmuel demonstrates his mastery of at least one halakhic area that R. Yohanan deems important. Here, it is important to note a marked exception to the devaluation of the celestial sciences in the Bavli, for we note the encouragement of the study of astronomy and calendar in *b. Shabbat* 75a, in which it is written that one who knows how to calculate must do so or be shunned. Nevertheless, the context of this statement is that it is followed by a cogent reason – namely, that this commandment to calculate astronomically is motivated by the desire to present rabbinic wisdom to the nations.¹⁵⁵ I might speculate, then, that this commandment referred to the importance of external, communal self-presentation and show in the text, whereas the more negative valence assigned to astronomical calculations remained internal to the Bavli (and Mishnah) due to the relatively higher importance of other domains of *halakbah*.

3.2.1. The Problem of π and Its Consequences

The above devaluation of mathematics and astronomy/calendar in *m. Avot* 3:18 and *b. Hullin* 95b are by no means the only examples of mathematics being demoted and

¹⁵⁵ Essentially playing a public relations function

undermined in rabbinic literature. In this section, I will analyze *m. Ohalot* 12:6, *b. Erwin* 13b-14a, *b. Erwin* 76a, and *b. Sukkah* 7b, all of which demonstrate the exercise of deontic authority over empirical knowledge – in this case, within the domain of mathematics. In many ways, mathematics may be considered to be emblematic of the empirical. Theorems, formulae and calculations are not subject to the vagaries of opinion; rather, outcomes are replicable again and again and there should be no room for interpretation of the numerical. As such, mathematics should be immune from the exercise of authority.

However, as exemplified by the following rabbinic texts, even the calculation of π , the ratio of the circumference of a circle to its diameter, was subject to the exercise of deontic authority. As described in chapter one, while scholars have taken note of the rabbinic approximation of π in these texts, this is generally explained as being due either to the possibility that the rabbis were unfamiliar with the more accurate, and earlier calculations made by Babylonian, Egyptian, and Greek mathematicians, or that approximation was sufficient for practical, halakhic use. However, the pattern present in the texts suggests a more deliberate practice, particularly when set against the broader context of the recurrent tendency toward the devaluation of mathematics and astronomy found in *m. Avot* 3:18 and *b. Hullin* 95b.

Example 1: *m. Ohalot* 12:6

קורה שהיא נתונה מכותל לכותל וטומאה תחתיה. אם יש בה פותח טפח. מביאה את הטומאה תחת כולה. ואם לאו. טומאה בוקעת ועולה. ובוקעת ויורדת. וכמה יהא בהקפה ויהא בה פותח טפח. בזמן שהיא עגולה. הקפה: שלשה טפחים. בזמן שהיא מרובעת. ארבעה. שהמרובע יתר על העגול רביע

[Regarding] a beam placed across from one wall to another wall, and has impurity underneath it, if it is one handbreadth wide, the impurity is transferred to everything beneath it. If it is not (that width) the impurity attaches up and down. How much does its circumference need to be so that its width must be a handbreadth? In a time that it is round, the circumference must be three handbreadths. In a time that it is square, four (handbreadths), since a square is greater (in circumference) by one quarter over a circle's

This example is straightforward, with π being clearly described as equal to three, given its circumference of three with a width of one טפה if the beam is round.

Example 2: *b. Eruvin* 13b-14a

Mishnah (*b. Eruvin* 13b)

רואין אותה כאילו היא פשוטה, עגולה - רואין אותה כאילו היא מרובעת. כל שיש בהיקפו שלשה טפחים יש בו רוחב טפה.

(If) round it is seen as if it were square. . . Whatever has a circumference of three handbreadths is one handbreadth in diameter.

Gemara:

מנא הני מילי? - אמר רבי יוחנן, אמר קרא (מלכים א' ז'): ויעש את הים מוצק עשר באמה משפתו עד שפתו עגל סביב וחמש באמה קומתו וקו שלשים באמה יסב אתו סביב. והא איכא שפתן - אמר רב פפא: שפתו שפת פרח שושן כתיב ביה, דכתיב (מלכים א' ז') ועביו טפה ושפתו כמעשה כוס פרח שושן אלפים בת יכיל. והאיכא משהו - כי קא חשיב - מגואי קא חשיב. תניא רבי חייא: ים שעשה שלמה היה מחזיק מאה וחמשים מקוה

From where are these calculations deduced? R. Yohanan said: our scripture (1 Kings 7) stated: And he made the molten sea of ten cubits from lip to lip, round in all around, and its height was five cubits. And a line of thirty cubits encompassed it all around. But there was the thickness of its lip (brim). R. Papa said: Regarding its lip, it is written in scripture (that it was like) the flower of a lily. As it is written: (1 Kings 7) And it was a handbreadth thick, and the lip of it was made like the brim of a cup, like the flower of a lily. It contained two thousand baths. But was there yet at least a fraction? When (the circumference) was reckoned it was the inner circumference. A teaching of R. Hiyya: The sea that Solomon made contained (the volume of) one hundred and fifty ritual baths.¹⁵⁶

¹⁵⁶ The biblical source here is 1 Kings 7:23: וַיַּעַשׂ אֶת-הַיָּם, מוּצָק: עֶשֶׂר בְּאַמָּה מִשְׁפָּתוֹ עַד-שְׁפָתוֹ עֵגֶל סָבִיב, וְחֲמֵשׁ בְּאַמָּה: וַיִּקְוֶה (וְקוֹה) שְׁלֹשִׁים בְּאַמָּה, יָסֵב אֹתוֹ סָבִיב אֶל-כָּל-עֵגֶל, וְעָבִיו טֶפֶחַ, וְשִׁפְתוֹ כְּמַעֲשֵׂה כוֹס פְּרַח שׁוֹשַׁן אֲלָפִים בַּת יָכִיל. “And he made a molten sea of ten cubits from lip to lip, round in all around, and its height was five cubits. And a line of thirty cubits encompassed it all around.”

The Mishnah here in 13b resembles that of its counterpart in *m. Ohalot* 12:6. Of greater interest is the interpretation of the Gemara, in which 1 Kings 7:23 is cited as the source text for a calculation that the text itself suggests is not sufficiently accurate. מנא הני מילי? (“From where are these calculations deduced?”) is met with the biblical citation, suggesting that here too, deontic authority provided the format for this discussion, with the focus being the biblical source text. The discussion of the brim, or lip, is aptly highlighted by a peek at the mathematical awareness behind the biblical exegesis when R. Papa refers to the inner circumference.

We note similar discussions in *b. Erwin* 76a and *b. Sukkah* 7b – the former addressing the circumference of a round window and the latter, the validity of a round *sukkah*:

Example 3: *b. Erwin* 76a

אמר רבי יוחנן: חלון עגול צריך שיהא בהיקפו עשרים וארבעה טפחים, ושנים ומשהו מהן בתוך עשרה, שאם ירבענו נמצא משהו בתוך עשרה. - מכדי כל שיש בהיקפו שלשה טפחים - יש בו ברוחבו טפח

R. Yohanan said: A round window needs to have a circumference of twenty-four handbreadths. Two and a fraction of which must be within ten (handbreadths from the ground), so that when it is squared, a fraction remains within the ten (handbreadths from the ground.) Consider that any item with a circumference of three handbreadths is approximately a handbreadth in diameter.

Example 4: *b. Sukkah* 7b

אמר רבי יוחנן: סוכה העשויה ככבשן, אם יש בהקיפה כדי לישב בה עשרים וארבעה בני אדם - כשרה, ואם לאו - פסולה. כמאן - כרבי, דאמר: כל סוכה שאין בה ארבע אמות על ארבע אמות - פסולה. מכדי, גברא באמתא יתיב, כל שיש בהקיפו שלשה טפחים יש בו רוחב טפח

R. Yohanan said: A sukkah that was like a furnace (round), if twenty-four men can be seated around its circumference, it is kosher, otherwise it is invalid. According to whom? According to Rabbi who says that any sukkah that is not

four cubits square is invalid. But consider: A man is in the space of one cubit. Wherever there is a circumference (of a circle) that is three handbreadths, its diameter is one handbreadth.

— Ilana Wartenberg is by no means alone in her opinion that the rabbis may have known a more accurate value for π , but that “they may have considered 3 good enough for Talmudic ‘working purposes.’” (Wartenberg, 1212) Indeed, this reading was expressed as early as the 1878, by Benedict Zuckerman, mentioned earlier, who assumed that the rabbis in the Bavli knew the correct calculations. (Zuckerman, 23) We also note this viewpoint expressed by W.M. Feldman, Tsaban and Garber, as well as Noah Efron, who comments on talmudic discussions of mathematics serving practical purposes such as calculating the dimensions of a sukkah, calendrics, or calculating the volume capacity of a mikvah. According to Efron, these needs “rarely demanded great accuracy and, as a result, many of the conclusions reached by the rabbis were inexact.” (Efron, 45) Turning to π as presented in *b. Erubin* 14a, above, Efron underscores the following about the rabbis’ rough estimate of 3, terming the opening question, מנא הני מילי? “blithe” in its hint of disingenuousness:

Valuing the circumference of a circle at three times its diameter is less accurate than the figures calculated two millennia earlier by Babylonian (who arrived at figure of $3 \frac{1}{8}$) and Egyptian mathematicians (who reached the formula 8 divided 9 [$\frac{8}{9}$] squared multiplied by 4, or the equivalent of today’s 3.1605). And of course it is less accurate than the figures arrived at for π by Archimedes (less than $3 \frac{1}{7}$ but greater than $3 \frac{10}{71}$, which by today’s notation would translate to 3.1429) centuries before. The rabbis of the Gemara ask, “Whence are these calculations deduced?” (a blithe question that led commentators reasonably to infer that these rabbis knew the number was off, and were essentially asking, “Why were these inaccurate calculations deemed acceptable?”). They answer that the calculations are based on a biblical passage in 1 Kings 7:23 that describes the “Sea of Solomon” as ten cubits across and thirty around.” (Efron, 46)

Here, the rabbis appear to be questioning their own calculation, hinting at this awareness in their discussion of their figure for π .¹⁵⁷ As such, where it might have been possible to brook a slightly less extreme approximation of π in the rabbinic texts, the gross approximation of 3 calls out for additional scrutiny.

Once again, in keeping with the matter of transmission and significant historical and textual evidence of the rabbinic knowledge of mathematics, we are presented with hints at awareness, in the Bavli, of more accurate calculations, even if they were not brought into the rabbinic calculations in the text for all to see. As such, it would appear that the argument for lack of knowledge cannot hold. Moreover, I must reiterate my point that the argument regarding the need for mere halakhic utility with respect to π is undercut by the devaluation of mathematics and astronomy found in the rabbinic texts *m. Avot* 3:18 and *b. Hullin* 95b, when set against other halakhic topics deemed central. At the very least, we note a possible motive for the ways in which we see mathematics used and recorded in these rabbinic texts – an argument that respects the intellect of the rabbis while also bracketing their apparent demotion of these sciences for our closer examination.

The apparent obfuscation in the texts, then, suggests not mere mathematical utility or calculations sufficient for halakhic uses, but a reasoned decision to record and use

¹⁵⁷ As noted in chapter one, Efron, Feldman, Tsaban and Garber, and Deakin and Lausch all point out that the Babylonians, and even the Egyptians, possessed more accurate estimations of Pi than the rabbis appear to reveal hundreds of years later.

gross approximations.¹⁵⁸ When viewed in concert with the evidence presented above for the transmission and rabbinic awareness of more accurate values and calculations, the context of the rabbinic devaluation of mathematics and astronomy as described in *m. Avot* 3:18 and *b. Hullin* 95b, and the priority placed upon Torah and halakhic truth, the deliberate lack of precision in the rabbinic usage of mathematics is strongly underscored.

3.3. Rabbinic Authority and Calendrics: Of Seasons and “Seasonings”

Unsurprisingly, we note a similar pattern with respect to the empirical and epistemic expertise in rabbinic calendrics. In *m. Avot* 3:18, calendar and mathematics are merely the “seasonings of wisdom”, taking a backseat role to the wisdom inherent in Torah, and we see a very similar dynamic in key texts in the Bavli where the authority to intercalate the year or establish the new month (and hence the timing of festivals) is concerned. Whereas it might be assumed that the *bet din* would have been primarily concerned with astronomical and mathematical accuracy in this regard, in fact, the very opposite is shown to be the case in *b. Rosh HaShanah* 25a (*m. Rosh HaShanah* 2:8-9), as presented here.

This is of no small importance given the broader context of ongoing calendrical diversity until the early medieval period, as highlighted by Sacha Stern (2001, *passim*).

¹⁵⁸ This is in keeping with the rabbinic practice of estimating minima for various halakhic purposes. For example, the minimum amount of matzah to eat on Passover in order to fulfill obligations. (e.g., a mouthful the size of an olive or a date), or the maximum amount of hair (e.g., a *tefakel*) that may be left showing under a headcovering for married women. However, in these cases, such approximations and minima do not replace other known values, but are presented in order to establish norms for observance of *halakhab*.

I might also speculate that the show of deontic authority over the epistemic, and ongoing competitions for calendrical dominion between rabbinic groups, presented in the texts may have represented one of the possible reasons for the slow development of the rabbinic calendar. The text reads as follows:

b. Rosb HaShanah 25a

Mishnah:

וערבית במערב. אמר רבי יוחנן בן נורי: עדי שקר הם. כשבאו ליבנה קיבלן רבן גמליאל. ועוד באו שנים ואמרו: ראינוהו בזמנו, ובלייל עיבורו לא נראה. וקיבלן רבן גמליאל. אמר רבי דוסא בן הורכינס: עדי שקר הן היאך מעידים על האשה שילדה, ולמחר כריסה בין שיניה? אמר לו רבי יהושע: רואה אני את דבריך. שלח לו רבן גמליאל: גוזרני עליך שתבא אצלי במקלך ובמעוטיך ביום הכפורים שחל להיות בחשבונך. הלך ומצאו רבי עקיבא מיצר. אמר לו: יש לי ללמוד שכל מה שעשה רבן גמליאל עשוי, שנאמר (ויקרא כג) אלה מועדי ה' מקראי קדש אשר תקראו אתם - בין בזמנן בין שלא בזמנן, אין לי מועדות אלא אלו. בא לו אצל רבי דוסא בן הורכינס, אמר לו: אם באין אנו לדון אחר בית דינו של רבן גמליאל - צריכין אנו לדון אחר כל בית דין ובית דין שעמד מימות משה ועד עכשיו, שנאמר (שמות כד) ויעל משה ואהרן נדב ואביהוא ושבעים מזקני ישראל, ולמה לא נתפרשו שמותן של זקנים - אלא ללמד שכל שלשה ושלושה שעמדו בית דין על ישראל הרי הוא כבית דינו של משה. נטל מקלו ומעותיו בידו, והלך ליבנה אצל רבן גמליאל ביום שחל יום הכפורים להיות בחשבונו. עמד רבן גמליאל ונשקו על ראשו, אמר לו: בוא בשלום רבי ותלמידי רבי - בחכמה, ותלמידי - שקבלת את דברי

And in the evening in the west. R. Yohanan b. Nuri said, they are false witnesses. But when they came to Yavneh, Rabban Gamaliel accepted them. At another time, two (witnesses) came and said: We saw (the new moon) in its (correct) time, but on the night that it should have appeared it was not seen, yet Rabban Gamaliel (had) accepted their testimony. Rabbi Dosa b. Harkinas said: they are false witnesses. How can witnesses testify that a woman has given birth when the next day her belly is still swollen? R. Joshua said to him: I see (the point of) your words. R. Gamaliel called upon him, saying: appear before me with your staff and your money on the day that should be Yom Kippur according to your calculations. R. Akiva went to him (R. Joshua) and found him in severe distress. He said to him: I have support that everything that R. Gamaliel has done stands (is kosher). As it says (Leviticus 3:4) These are the appointed seasons of God, holy assemblies, which you will announce in their appointed seasons (that is to say) whether or not they are announced at their proper time or not. I have no appointed seasons but these. R. Joshua went to R. Dosa b. Harkinas, who said to him: If we question the legal rulings of the *bet din* of R. Gamaliel, we must question the rulings of every *bet din* that has existed from the days of Moses to the present.

For it says: (Exodus 24:9) then went up Moses and Aaron, Nadav and Avihu, and seventy of the elders of Israel. Why were the names of the elders not mentioned? To demonstrate that every group of three that has acted as a *bet din* over Israel is equal to the *bet din* of

Moses. R. Joshua took his staff and his money in his hand and went to Yavneh before Rabban Gamaliel on the day that he thought Yom Kippur fell according to his calculation. Rabban Gamaliel rose and kissed him on his head. He said to him: Come in peace, my teacher and my student. My teacher in wisdom, and my student because you have accepted my decision.

In this Mishnah, we clearly see the exercise of deontic authority by R. Gamaliel, which overrides the empirical evidence of R. Joshua. Most telling are two statements – the first, by R. Dosa b. Harkinas who responds to the concerns of R. Joshua regarding his empirical reckoning, by stating the following:

אם באין אנו לדון אחר בית דינו של רבן גמליאל - צריכין אנו לדון אחר כל בית דין ובית דין שעמד מימות משה ועד עכשיו

If we question the legal rulings of the *bet din* of R. Gamaliel, we must question the rulings of every *bet din* that has existed from the days of Moses to the present.

Note that as in *b. Bava Metzri'a* 59b, this is not a debate between two rabbis in possession of conflicting forms of empirical evidence, and who are therefore attempting to assert their epistemic authority. Rather, it is a clear case of verifiable empirical astronomical evidence being upstaged by the deontic authority vested in R. Gamaliel and his acolytes, with no argument from science being made. Here, the argument brought by R. Dosa b. Harkinas concerns not astronomy, but the weight of tradition; if the *bet din* of R. Gamaliel is questioned, all rabbinic authority from Moses until their own day must therefore be questioned. This is indeed halakhic truth, dressed in fine rhetoric.

The next statement is by R. Gamaliel himself, and is dramatically staged in the Mishnah, to further rhetorical effect:

עמד רבן גמליאל ונשקו על ראשו, אמר לו: בוא בשלום רבי ותלמידי? רבי - בחכמה, ותלמידי - שקבלת את דברי

Rabban Gamaliel rose and kissed him on his head. He said to him: Come in peace, my teacher and my student. My teacher in wisdom and my student because you have accepted my decision.

Prior to making his statement, R. Gamaliel summons R. Joshua to appear before him at Yavne with his staff and his money on the day that would, according to R. Joshua, be Yom Kippur – a day upon which appearing with these accoutrements would have been forbidden. R. Joshua appears in a submissive position before R. Gamaliel, who rises and kisses R. Joshua on the head, a gesture of kindness to be sure, but also one of dominance. As Michael Philip Penn describes kisses in the Roman context, public kissing was regularly used for show, and often as a demonstration of power. In effect, this form of public display within the Greco-Roman context was as Penn terms it, “ritual kissing.” (Penn, 11)

In addition to kisses among lovers, at reunions, and between friends, we also note the use of a kiss of persuasion – or as Penn describes it, “the ancient equivalent of ‘kissing up.’” (13) These kisses, often bestowed on the head, hand, or feet, might have been “exchanged with peers, political leaders, teachers, rabbis, or priests,” and, most importantly for our purposes, refusing such a public kiss represented “a dramatic display of disapproval and was treated as a serious affront.” (Ibid.) As Penn describes the public, ritual kiss in the Greco-Roman context:

Because modern scholars most often characterize kissing as a private practice, scholarship has isolated the kiss from other Greco-Roman gestures. Reframing the ancient kiss as an action frequently performed in public allows researchers to connect it with a larger system of civic behavior and decorum. There have been numerous studies of public gestures in Greco-Roman society. These often focus on classical oratory techniques, a topic with which many ancient authors seem all but obsessed. That Greco-Roman writers so often speak of gestures in the context of the most powerful of public spaces – the senate chamber, the forum, the imperial court – suggests that an exploration of ancient gesture is not simply an investigation of late antique aesthetics. Greco-Roman society saw gesture as an exercise of power. (Penn, 15)

Applied to the interaction between R. Gamaliel and R. Joshua then, the kiss might be interpreted not merely as a friendly greeting, but as a very public ritual symbol of the authority of R. Gamaliel over the halakhic decision to override the empirical expertise of R. Joshua. In essence, a power play of great show and drama.

Upon ceremonially demonstrating his authority play for all to see, R. Gamaliel then completes the ritual display verbally, declaring “Come in peace, my teacher and my student.” Illuminating the crux of the authority struggle as well as his clear exercise of deontic authority over R. Joshua, R. Gamaliel concludes by explaining his terms –

רבי - בחכמה, ותלמידי - שקבלת את דברי

That is to say, R. Joshua is his teacher in “wisdom,” which is, read in context, scientific and empirical wisdom. However, he is his student, or disciple, as he has accepted his halakhic decision – and, by extension, his authority to make the decision he did. By making this distinction between empirical wisdom and rabbinic authority, R. Gamaliel, and this Mishnah, make clear the power of the *bet din* to override even the sciences of mathematics and astronomy, which can be shown to be demonstrably correct, but which are not necessarily *halakhically* correct.

The import of this deontic power play cannot be underestimated. What it suggests most strongly is a strong need to present the authority of the *bet din* as supreme, over and above even verifiable data. The Gemara further illuminates the authority play and its source in vested tradition. Here, we read the following:

תניא, אמר להם רבן גמליאל לחכמים: כך מקובלני מבית אבי אבא: פעמים שבא בארוכה, ופעמים שבא בקצרה. אמר רבי יוחנן: מאי טעמא דבי רבי - דכתיב (תהלים קד) עשה ירח למועדים שמש ידע מבואו, שמש הוא ידע מבואו, ירח לא ידע מבואו.¹⁵⁹ רבי חייא חזייה לסיהרא דהוה קאי בצפרא דעשרים ותשעה, שקל קלא פתק ביה, אמר: לאורתא בעינן לקדושי בך, ואת קיימת הכא? זיל איכסן אמר ליה רבי לרבי חייא: זיל לעין טב וקדשיה לירחא, ושלח לי סימנא: דוד מלך ישראל חי וקים. תנו רבנן: פעם אחת נתקשרו שמים בעבים ונראית דמות לבנה בעשרים ותשעה לחדש, כסבורים העם לומר: ראש חדש, ובקשו בית דין לקדשו. אמר להם רבן גמליאל: כך מקובלני מבית אבי אבא: אין חדושה של לבנה פחותה מעשרים ותשעה יום ומחצה ושני שלישי שעה ושבעים ושלשה חלקים. ואותו היום מתה אמו של בן זזא, והספידה רבן גמליאל הספד גדול. לא מפני שראויה לכך, אלא כדי שידעו העם שלא קידשו בית דין את החדש

It has been taught: Rabban Gamaliel said to the sages: This has been handed to me from my father's house from my father's father: Sometimes it (the moon) moves (through the heavens) on a short path and sometimes by a long one. R. Yohanan said: What is the reasoning of the Rabbi's house? Because it is written (Psalms 104:19), Who appoints the moon for seasons, the sun knows his setting. The sun knows its setting, but the moon does not know its setting. R. Hiyya once saw the (old) moon in the heavens on the morning of the twenty-ninth day. He took a clump of earth and threw it at it. He said: This evening we want to sanctify you, but you are still here. Go and hide. Rabbi said to R. Hiyya, Go to Ein Tov and sanctify the moon, and send me the sign: David, king of Israel, is alive and endures. Our Rabbis taught: Once, the heavens were covered with clouds and the image of the moon (was seen) on the twenty-ninth of the month. The public was taught to declare the new month, and the *bet din* wanted to sanctify it. But Rabban Gamaliel said to them: I have it from my father's father's house that the new crescent moon (and new month) does not take place until not less than twenty-nine days and a half and two-thirds of an hour and seventy-three *halakim*. On that day Ben Zaza's mother died, and Rabban Gamaliel made a great funeral speech for her, not because she had earned it, but in order that all should know that the *bet din* had not sanctified the new month.

The hermeneutics here are clearly aimed at the rationale to uphold tradition. The Gemara opens with commentary on R. Gamaliel and his further exposition of the source of his authority, here presented as a formula handed down through the generations – כך מקובלני

A further appeal is made to Tehillim (Psalms), reinforcing the appeal to the authority of Tanakh. Closing the pericope, we note a repetition by R. Gamaliel of his

¹⁵⁹ MS Munich, Bayerische Staatsbibliothek, 95, *b. Rosb HaShanah* fol. 25a has פעמים שבא בקצרה – only minor text variants are found among the MSS, such as abbreviated personal pronouns in MS London British Library Harl. 5508 (400), MS Munich, Bayerische Staatsbibliothek, 140, MS Jewish Theological Seminary of America Library Rab. 1608 (ENA 850), and MS Oxford, Bodleian Library, Opp. Add. fol. 23. There are otherwise no significant variants bearing on the argument found here in the intact MSS.

appeal to the authority of his father's father's house – this time, to overturn the empirical observation of the moon, here presented as דמות לבנה or the likeness of the moon, suggesting that it may not have been an accurate observation.

Although both the public and the *bet din* were ready to sanctify the new moon and month, R. Gamaliel again turns to an appeal to the deontic authority of tradition, bracketing the pericope with the identical formula found at its beginning: כך מקובלני מבית אבי אבא. Thus, we are presented with the importance of the formula and its deontic implications over and above the empirical and the will of the people and *bet din*. The coup de grace comes at the end, with a remarkable show of deontic authority to the public, a funeral oration delivered not because of the merit of the deceased mother of Ben Zaza, but specifically to reinforce the point that the *bet din* had not, in fact, sanctified the new moon.

What follows this oratorical display by R. Gamaliel in *b. Rosh HaShanah* 25a is equally telling. For here, following the Mishnah (*m. Rosh HaShanah* 2:8-9), we read that R. Akiva finds R. Joshua in great distress, and asks him why. R. Joshua replies that it is better for a man to be sick in bed for twelve months than to have such a ruling placed upon him. The passage continues:

אמר לו: רבי, תרשיני לומר לפניך דבר אחד שלמדתני. - אמר לו: אמור. - אמר לו: הרי הוא אומר (ויקרא כג) אתם, אתם, אתם, שלש פעמים, אתם - אפילו שוגגין, אתם - אפילו מזידין, אתם - אפילו מוטעין. בלשון הזה אמר לו: עקיבא, נחמתני, נחמתני.

He said to him, Rabbi, may I teach you something that you taught me? He said to him: Speak. He then said to him: The text says (Leviticus 23) you, you, you, three times. You, to indicate that you even if you make an accidental error, you, even if you err deliberately, you, even if you are led astray. He replied to him in these words: Akiva, you have comforted me, you have comforted me.

Here, R. Akiva both supports the decision of R. Gamaliel while also demonstrating the deontic play of authority. R. Joshua, shown to be not merely unhappy with the ruling of R. Gamaliel, but “in great distress,” is comforted by R. Akiva, who specifically states, אפילו מזידין, that even a deliberate act of fixing the festivals incorrectly is permitted and remains binding according to *halakhab*.¹⁶⁰ The signposts here related to deliberately overturning the empirical lend further support to the deontic argument made in these pages.

Of additional, special note is the fact that this *sugya* and the Mishnah it follows parallel the humiliation and emotional devastation of R. Eliezer in *b. Bava Metz'i'a* 59b, whose epistemic authority was very similarly overturned by deontically motivated rabbis, this calendrical confrontation reveals an almost identical pattern, up to and including a visit to the defeated and humiliated parties by R. Akiva, who attempts to keep the peace and comfort both R. Eliezer in *b. Bava Metz'i'a* 59b, and R. Joshua here in the Mishnah, after their respective epistemic-deontic confrontations.

These parallel authority dynamics are illuminating; indeed, the calendrical confrontation of R. Joshua by R. Gamaliel, viewed alongside the calming speech by R. Akiva, may easily be seen as exhortational. Here, R. Akiva's textual exegesis regarding rabbinic permission to fix the new month even if one erred deliberately may be viewed as

¹⁶⁰ This contradicts *y. Horayot* 1:1, noted earlier, which states that the rulings of a sage must only be obeyed if they can be justified/proven. So too, *m. Horayot* 1:1 forbids obedience to a court's ruling if it is known to be in error.

the rough equivalent of the deontic authority marker *lo bashamayim hi* found in *b. Bava Metzi'a* 59b.¹⁶¹

With respect to the dynamics of rabbinic authority set against the context of the Jewish calendar and its history, as described in chapter one, several points are key, and serve to illuminate the deontic play of authority evident in the above texts. As Sacha Stern has explained, there was no single rabbinic calendar in late antiquity. Rather, the calendar developed slowly, beginning with the refinement of various calendrical rules throughout the rabbinic period. As such, in contrast to previous scholarly assumptions that the calendar was fixed in the fourth century, the reality was that it took centuries longer, eventually reaching its current form by the geonic period.

This calendrical diversity led, as we have also seen, to calendrical authority struggles, in which a rabbi would travel from one location to another or send emissaries to do the same in order to intercalate the year and thereby assert his authority – likely implying that he or his representatives were travelling in order to attempt to convince other communities to comply with his judgment and ultimately, with his authority. Given the questions that have been raised and bracketed with respect to the prestige of rabbis who intercalate, one might ask how much authority such travelling rabbis garnered.

Indeed, as Alan Appelbaum states, the power a given rabbi had over the calendar “was

¹⁶¹ See Ron Feldman on the authority of the *bet din* to sanctify the new moon and hence, the Jewish holidays. Describing a relevant scene in *y. Rosh HaShanah* 1:3 (57b) in which God does not know the correct day of *Rosh HaShanah* and must defer to the earthly *bet din* (cf. The baraita preserved in *b. Rosh HaShanah* 8b, which states that the court in heaven does not gather for judgment until the *bet din* on Earth declares the new month). Feldman sees this as demonstrating “an amazing amount of rabbinical chutzpah.” (Ron Feldman, 195) In effect, this is another instance in which the text declares *lo bashamayim hi*.

limited to the emerging rabbinic movement and perhaps not accepted by all elements of it.” (Appelbaum, 15)

Given the lack of calendrical uniformity during the rabbinic period, individual calendrical decisions were subject to the rulings and authority of individual rabbis, with groups of rabbis and their students often observing festivals on different dates from their fellows in other locations. As we have seen in the Gemara in *b. Rosh HaShanah* 25a, R. Gamaliel is shown repeating his appeal to tradition twice, in a formulaic manner. This can only be intended to bolster his own deontic, not epistemic, authority – when he is challenged by the public and the *bet din* with respect to the sanctification date. Here, the Gemara presents its students and readers with a justification of deontic calendrical authority that clearly devalues the role of empirical observation and epistemic authority.

When presented with a *sugya* such as *b. Rosh HaShanah* 25a, we note the play of authority in a fictional, constructed *bet din*, and appeals to deontic authority over calendrical accuracy as preserved in the text. Given what is now known about the existence of competing rabbinic groups, each with their own calendar and calendrical rules, the texts display a sensibility that dovetails with this scenario, both in the Mishnah, and in the Gemara of *b. Rosh HaShanah* 25a¹⁶² Indeed, this dynamic is in keeping with the research of Sacha Stern regarding the pattern of the calendrical authority of the Patriarch, who sent out envoys to Diaspora communities to ensure obedience to his calendar, as

¹⁶² On the mishnaic layer, see also the research of Catherine Hezser on the rabbinic movement as a personal alliance system, in which she turns to network theory to describe interactions and power relations between rabbis who hold these smaller courts. Hezser, 1997, *The Social Structure of the Rabbinic Movement in Palestine*. Tübingen: Mohr Siebeck, 155-156; 228-39; 307-28; 492-94. Although she examines the earlier, mishnaic stratum, this remains of importance due to the preservation of this earlier material in the Bavli.

well as the imposition of power upon communities that attempted to establish their own calendars as seen in *y. Sanhedrin* 1:2 (19a), *y. Nedarim* 7:13 (40a), and *b. Berakhot* 63a-b. Moreover, as we have seen, the calendrical struggles that took place between the *batei din*, city councils, and independent rabbis with circles of followers also highlight the calendrical diversity that Stern describes. (Stern 2012, 347)

As noted in *b. Rosh HaShanah* 25a, power dynamics related to the authority of a given rabbi to sanctify the new months were embroiled in the discourse surrounding the dichotomy between empirical and deontic authority, as highlighted in the telling display by R. Gamaliel toward R. Joshua, followed by his declaration, רבי - בחכמה, ותלמידי - שקבלת את דברי - thus not only reinforcing his deontic authority, but also exhibiting ambivalence toward science, in a spirit reminiscent of the attitudes shown in *m. Avot* 3:18 and *b. Hullin* 95b.

This tendency is only supported and strengthened by the Gemara, where R. Gamaliel appeals to the authority of his father's father's house regarding the timing of the *molad*. This is followed by his dramatic funeral oration for the mother of Ben Zaza, made solely in order to ensure that the public knew that the *bet din* had not sanctified *rosh hodesh*. This show of deontic authority over calendar and astronomical calculations persists in the Bavli, maintaining the earlier stratum. However, it also extends and reinforces the message regarding rabbinic calendrical dominion, perhaps suggesting that there was an ongoing need to present and reinforce rabbinic authority over the calendar during the Sasanian period as well.

3.4 Discussion: Empirical Precision vs. Authority Maintenance

In the texts analyzed above, we note the presence of what I term deontic authority markers – statements and actions designed to establish or uphold the authority of the rabbinic station. This is particularly the case when a charismatic leader is confronted with empirical evidence by an expert in the sciences, and appears to perceive such epistemic authority as a threat to his rabbinic role.

This pattern of the assertion of deontic authority over the sciences is, as we have seen, strongly highlighted in both the mathematical and calendrical confrontation texts we have examined above. Once we assume the availability of mathematical and astronomical knowledge in a given locale, and note the evidence of rabbinic awareness of this knowledge in the text itself, we are left with little that recommends the assumption that the rabbis simply did not have access to or familiarity with the material. Moreover, we gain much by viewing the texts that devalue mathematics and astronomy when they are compared with other aspects of *halakhab*, not separately, within procrustean *topoi*, but alongside each other.

In texts such as *b. Bava Metzi'a* 59b and *b. Rosb HaShanah* 25a, in which the law is not in heaven, and in which even erring deliberately with respect to the sanctification of the new month is permissible due to the authority vested in the rabbis, we note the repetition of tropes that may even be seen as internally transgressive, demonstrating not merely the inheritance of the authority vested by Torah revelation but its replacement

with deontic authority. We see this alongside ongoing statements regarding the primacy of Torah, which thus replaced, becomes rabbinic *halakhab*. Where empirical precision is concerned in the texts in question, then, whether with respect to the general devaluation of mathematics and astronomy, the cavalier treatment of π , or the lack of concern should the new month be sanctified in error or even deliberately, there is a clear and evident pattern in regarding the devaluation of epistemic authority. The import of this pattern to the history of rabbinic astronomy during the Sasanian period suggests itself, but cannot be made with any certainty. What is known, however, is that tight control over these topics and practices was of key importance to the authors and/or redactors of the Bavli.

Chapter Four: Controlled Celestial Knowledge and Practices

“Our Rabbis taught: He who sees the sun at its turning point, the moon in its power, the planets in their orbits, and the signs of the zodiac in their orderly progression, should say: ‘Blessed be He who has done the work of creation.’”

- *b. Berakhot* 59b

In this final text-analytic chapter, I demonstrate the ways in which rabbinic presentations of astral topics that may be seen as presenting more of a challenge in the Bavli serve as markers and mediators of rabbinic deontic authority. By so doing, I highlight a pattern of rabbinic concern in the texts regarding the need to control access. This is shown to be most pronounced in the texts related to creation – the source and wellspring of rabbinic authority as it is presented in the Bavli.

In order to accomplish this, I analyze rabbinic primary texts addressing the intersection of authority and tightly controlled practices related to astronomical topics, broadly speaking. These topics include astrolatry and astral magic, astrology, and forbidden knowledge and writings on creation and the interdictions of *Ma’aseh Bereshit*.

As I demonstrate through my analysis, celestial topics are very tightly bound with the primacy of God’s cosmogony and the unfolding of this created natural world into a structure manifesting itself in Torah law. This has a significant impact upon cycles of Jewish time, and authority over the timing of Jewish festivals within *halakhab* (e.g., calendar), as well as control over worship (e.g., astrolatry), the natural world (e.g., astral

magic), and the question of control/authority over the destiny of Israel (e.g., astrology). In brief, as I demonstrate in this chapter, these celestial topics, representing the created cosmic order presiding over the natural world as a whole, are exceedingly powerful mediators of rabbinic authority.

Here, it must be noted that a tension presents itself with respect to the authority of God and creation and the deontic authority so important to the rabbis, as evidenced in the Mishnah and the Bavli alike. However, the apparent contradiction resolves itself in light of *b. Bava Metzi'a* 59b, which presents the rabbinic dictum that the law is, in fact “not in heaven” even when it began there. Rather, in that *sugya*, in *b. Rosh HaShanah* 25b, and the others analyzed thus far, the authority mediated by the cosmos and creation is shown to be not only inherited by the Rabbis by virtue of the scriptural appeal to Deuteronomy 30:12, but is actively and boldly claimed in these texts.

In this chapter, I analyze significant markers of deontic authority related to astrolatry (*b. Avodah Zarah* 42b-43b; *b. Sukkah* 29a), magic and control over the heavens (*b. Shabbat* 75a; *b. Ta'anit* 23a), rabbinic responses to astrology (*b. Shabbat* 156a-b; *b. Pesachim* 113b; *b. Sukkah* 29a, *b. Berakhot* 64a, and other sources), and rabbinic authority exerted over inquiries into key, controlled aspects of cosmogony (*b. Hagigah* 11b-13a, following the admonitions in *m. Hagigah* 2:1). In these analyses, I point to the especially tight series of controls, bans, and rabbinic exceptions related to these texts, particularly with respect to cosmogony, and highlight the importance of these findings.

4.1 Astrolatry and Astral Magic

The banned practice *par excellence* in Judaism, idolatry is featured and its practitioners denounced in countless rabbinic commentaries. The discourse on idolatry in rabbinic literature, based in large part upon interpretations of Deuteronomy 4:19 and the Deuteronomistic history, was further fueled by the threat of Greco-Roman Paganism, including practices such as the worship of Sol Invictus, as described in chapter one. Moreover, as there was no small amount of rabbinic anxiety regarding both the practice of idolatry by non-Jews in their Roman and Persian host cultures and the attraction that idol worship may have held for Jews. The play of this anxiety and its expression in the texts was frequently manifested in rigid attempts to effect rabbinic control. In effect, attempts to assert magical control were themselves controlled. Indeed, as Moshe Halbertal and Avishai Margalit have demonstrated, idolatry tends to be associated with the exercise of political authority in biblical and rabbinic texts. (Halbertal and Margalit, 220, *et passim*).¹⁶³ While the biblical expressions are beyond our scope, Halbertal and Margalit describe a model of God as ruler that conforms not to a marital model of exclusivity, but to a political model, in which authority may be vested in others as long as too much power is not given to a single individual or station, thereby avoiding haughtiness and idolatry, as described in Deuteronomy 17:20. (220-1) In *Gen. Rab* 38:11a, for example, the Midrash frames the story of the Tower of Babel as an attempt to reach

¹⁶³ This mirrors the aforementioned assertion by Reed that cultures tend to employ scientific pursuits in order to reinforce their power. (Reed 2014, 204).

the heavens and place an idol on the top of the tower so that it appears to be declaring war against God, thereby threatening the exclusivity of Divine power. (222)

Here, it is well to reiterate the point of Emmanuel Friedheim that during the early rabbinic period, between the second and fourth centuries C.E., astrolatry was a key feature of the Pagan beliefs and practices of Roman Palestine. Indeed, for the early rabbis, idolatry was frequently synonymous with astrolatry, the worship of the sun, moon, stars, and zodiac signs, also referred to as *avodat kokhavim u-mazalot*. Perhaps more importantly, its practitioners were frequently referred to as *ovdei kokhavim u-mazalot*, the term for Pagans. (Friedheim 2009, 107-108) Indeed, we frequently note idolatry and astral motifs, including creation, clustered together in rabbinic literature, further highlighting the challenges of separating the *topoi*, and leading to the tendency to see these as part of a broader field. For example, the Mishnah in *b. Berakhot* 54a (i.e., *m. Berakhot* 9:1-2) states that if a person sees a place where idolatry had been eliminated, s/he should say a blessing to that effect. This is immediately followed by the blessing to be said on seeing comets, experiencing earthquakes,¹⁶⁴ thunder, storms, or lightning, which is the blessing on He who brought about creation.¹⁶⁵

¹⁶⁴ Of interest is the historical evidence for severe destruction in the Galilee, including Sepphoris, by three earthquakes, in 306, 363, and 419 CE. See Uzi Leibner, 2009, *Settlement and History in Hellenistic, Roman, and Byzantine Galilee: An Archaeological Survey of the Eastern Galilee*. Mohr Siebeck, 34, 36, 209; Zeev Weiss, 2009, "Stratum II Synagogue at Hammath Tiberias: Reconsidering its access, Internal Space, and Architecture." In Zuleika Rodgers, Margaret Daly-Denton, Anne Fitzpatrick McKinley, Eds. *A Wandering Galilean: Essays in Honour of Seán Freyne*. Brill, 338; Rachel Hachlili, 2013, *Ancient Synagogues - Archaeology and Art: New Discoveries and Current Research*. Leiden and Boston: Brill, 586.

¹⁶⁵ In *b. Berakhot* 59b, we read the same type of formula, focusing on astronomical phenomena, with no reference to idolatry, but clear reference to both cosmogony and astrology, directing one who sees the sun, moon, planets, and signs of the zodiac to say the blessing *oseh ma'aseh bereshit*. This further reinforces the points made here regarding the clustering of the astral themes of astronomy, astrolatry, astral magic,

As Friedheim has further suggested, it is possible that astrolatry, particularly solar worship, presented a serious challenge, possibly representing competition to early rabbinic authority. (2009, 110) Of special note is his conclusion that the Palestinian Amoraim did not frequent the synagogues containing images of Helios and the zodiac signs, and that the Jews who prayed there refused to accept rabbinic authority. (126-8) Indeed, support for interactions between Jews and Pagans in the Galilee during the second century C.E. has been unearthed at Sepphoris (or Zippori), the Jewish capital of the Galilee, by an expedition led by Zeev Weiss, suggesting that Pagans, Jews, and Christians shared the city in relative peace. (Weiss 2010, 167)¹⁶⁶

Moreover, as Weiss points out, there would have been no reason for the Jews of Sepphoris not to benefit from the usage of the forum, the basilica, or the bath house, or to create decorative mosaics.¹⁶⁷ (185) In an earlier analysis of the Hellenization process, Veltri underscores the similarities between Greco-Roman and Rabbinic knowledge and culture, pointing to such *realia* as Roman plays and “bathing culture.” Indeed, as Veltri

astrology, astrology, and cosmogony. This point is central to the analysis to come later in this chapter. Prior to this, in *b. Berakhot* 57b however, the blessing over the removal of idolatry is discussed; this blessing is to be made if one observes a statue of Hermes (the Roman god, Mercury).

¹⁶⁶ As Weiss and his team discovered, a Pagan Roman Temple existed under the ruins of a fifth century Byzantine church, demonstrating the preservation of sacred space over time in Zippori. On this topic, also see Mark A. Chancey, 2002, *The Myth of a Gentile Galilee*. Cambridge: Cambridge University Press; Ze’ev Weiss and Ehud Netzer, 1994, *Zippori*. Israel Exploration Society, 33, 46, 62, *et passim*; Eric M. Meyers, Ehud Netzer, and Carol L. Meyers, 1992, *Sepphoris*. Winona Lake, Ind.: Eisenbrauns; Naftali S. Cohn, 2013, *The Memory of the Temple and the Making of the Rabbis*. Philadelphia: University of Pennsylvania Press; Eric M. Meyers, Ehud Netzer, and Carol L. Meyers, 1989, “Sepphoris: ‘Ornament of All Galilee.’” *Biblical Archaeologist* 49, 4-19; Eric M. Meyers, “Roman Sepphoris in Light of New Archaeological Evidence and Recent Research,” in Lee I. Levine, Ed. *The Galilee in Late Antiquity*. New York and Jerusalem: The Jewish Theological Seminary of America, 329; Mark A. Chancey, 2001, “The Cultural Milieu of Ancient Sepphoris,” *New Testament Studies* 47:1, 127-145; Seth Schwartz, *Imperialism*, 143-45; James F. Strange, Thomas R.W. Longstaff, and Dennis E. Groh, 2006, *Excavations at Sepphoris: Volume One*. Leiden: Brill.

¹⁶⁷ Again, note the political model of idolatry described by Halbertal and Margalit, who, addressing the Roman period, ask how far a religious group that bans idolatry is able to accommodate the Pagan symbols of a host society without crossing its own lines. (Halbertal and Margalit, 234)

concludes, this demonstrates “a spectrum of ‘influences’ or, as I prefer to denote it, the humus in which Rabbinic Judaism developed.”¹⁶⁸ (Veltri 1998 “On the Influence”, 307)

Later, in the Sasanian context, the composition and redaction of the Bavli came to filter these Hellenistic influences as presented in earlier rabbinic texts. As previously noted in chapter one, the resulting mix of Roman and Sasanian influences influenced rabbinic expressions of controlled practices including astrolatry, astral magic, cosmogony, and astrology. Indeed, the treatment of the Mishnah in the Gemara both presents and reinforces earlier discussions and rulings in the Palestinian context and brings new terminology and concerns related to these arcane topics to the forefront. For example, as noted earlier by Veltri, it is in the Bavli where the term “magus” began its usage in the discourse surrounding magic and astrology. (Veltri 2002, 192) This is exemplified in *b. Shabbat* 75a, in which the status and identity of the magi as either sorcerers or blasphemers is discussed.¹⁶⁹ Further, as Shai Secunda notes, 75a “seems to preserve a debate about the very status of Zoroastrianism.” Indeed, it contains a warning against learning from the magi, or amgushta. (Secunda 2013, 71)

¹⁶⁸ Visits to such pagan Roman milieus did not go unchallenged in rabbinic literature, however. On this, see *m. Avodah Zarah* 3:4, in which the philosopher, Proclus, asked Rabban Gamaliel, who was in the bath house of Aphrodite in Acco, why he was bathing there if it was associated with idolatry. To this, Rabban Gamaliel says that one does not reply in a bath house, but outside, he replies that he did not enter the territory of Aphrodite, but that she entered his territory, and that she is only decorative besides. However, as Mireille Hadas-Lebel points out, despite the claims in the text that Aphrodite was merely ornamental, the goddess appears to have played the role of patron, appearing on local currency during the third century. (Hadas-Lebel 1979, 402). See also Christine Hayes, 2007, “The ‘Other’ In Rabbinic Literature”, In Charlotte E. Fonrobert and Martin S. Jaffee, Eds, *The Cambridge Companion to the Talmud and Rabbinic Literature*. Cambridge: Cambridge University Press, 247; Seth Schwartz, 2009, *Imperialism and Jewish Society: 200 B.C.E. to 640 C.E.*, Princeton: Princeton University Press, 167-74; Y. Hirschfeld, 1997, The Roman Baths of Hammat Gader: Final Report. Jerusalem: IES; T. Ilan, 1994, “Matrona and Rabbi Yose”, *Journal for the Study of Judaism* 25, 18-51.

¹⁶⁹ This internal rabbinic debate regarding the taxonomy of the magi will be revisited and examined in greater depth toward the end of this chapter.

In *b. Shabbat* 153b-154a, the importance of idolatry to the rabbinic discourse on culpability and punishment is clear, for it is used as an example of the transgression *in extremis* of Torah law. In 153b, we read “all laws are reduced to idolatry” and this formula is again repeated in 154a, where we read that “the whole Torah is reduced to idolatry.” This is to say, the sin of idolatry is equal to all transgressions. It is notable that the Torah is specifically referred to immediately after a reference to the laws, indicating that the transgression of idolatry is equal to breaking all the laws of the Torah. Here, the point is reiterated and thereby reinforced. There can be no mistake; idolatry is the worst possible sin that can be committed in rabbinic Judaism.¹⁷⁰ The same point is made in *b. Qiddushin* 40a, during a rabbinic discussion of merit, righteous behavior, transgression, and the role of intentionality vs. transgressing unintentionally by action. Here, R. Aha b. Jacob states that idolatry is such a terrible sin that one who rejects it is, by so doing, admitting the validity of the entire Torah. This formulaic statement also appears in *b. Nedarim* 25a,

¹⁷⁰ Also see *b. Eruvin* 69a-b, in which a discussion concludes with the statement that desecrating Shabbat is equal to the sin of idolatry. There is a suggestion elsewhere in the Bavli that this desecration must be of a public nature, thereby profaning the name of God, in order for the desecration to be taken this seriously. The maintenance of public image and respect for the rabbis and God is a recognition, after all, of deontic authority, and I suggest that the rabbis are primarily concerned with shows of public observance and respect for their deontic authority. For example, in *b. Eruvin* 69a-b, we read: “R. Huna stated: Who is regarded as an Israelite in *mumar*? He who desecrates the Sabbath in public; The emphasis on keeping transgression out of the public sphere is similarly discussed in *b. Qiddushin* 40a: “R. Abbahu said on R. Hanina's authority: Better had a man secretly transgress the laws of idolatry than publicly profane God's name, for it is said: As for you, O house of Israel, thus saith the Lord God: Go ye, serve every one his idols, and hereafter also, if ye will not hearken unto me: but my holy name shall ye not profane.” This is immediately followed, in 40a, by: “R. Il'ai the Elder said: If a man sees that his [evil] desire is conquering him, let him go to a place where he is unknown, don black and cover himself with black, and do as his heart desires, but let him not publicly profane God's name. But that is not so, for we learnt: He who is careless of his Master's honour, it were well for him that he had not come into the world.” As I describe in the upcoming analysis of *sugyot* related to celestial magic and rabbinic control over cosmogonic inquiry, the same formula is used in *m. Hagigah* 2:1 and *b. Hagigah* 16a and with respect to the avoidance of inquiring into what came before creation in order to avoid profaning God's name, as well as the statement “it were well for him that he had not come into the world.”

during a discussion of Moses and his presentation of the Torah to the Israelites. Here too, refraining from idolatry is considered to be equal to fulfilling the entire Torah.

This equation also appears in a slightly different form related to the boundaries of Jewish identity in *b. Megillah* 13a, in which it is stated that one who rejects idolatry is called a Jew, with the specific example of Pharaoh's daughter, who was called Jewish because she eschewed idolatry. Here, in a delightful hermeneutic turn, R. Yohanan interprets the biblical verse in Exodus 2:5 in which she went to bathe in the river as meaning that Pharaoh's daughter went there to cleanse herself from the idols of her father's house. Here, the suggestion of her worthiness to serve as adoptive mother to Moses is made evident both through her rejection of the idolatry of her family and her immersion – and hence, purification – in the Nile.

As we have seen previously, astrolatry was generally viewed as the ultimate form of idolatry in rabbinic sources, with special emphasis on, and authoritative condemnation of, the worship of the sun and the moon. While the sun and its Roman – and hence, Pagan associations with the cult of Sol Invictus – held particular importance in this respect, the moon and other astral bodies were also frequently mentioned in the context of astrolatry.¹⁷¹

¹⁷¹ Indeed, the sun, and its Roman symbolism, was a key focus of rabbinic concerns in the Palestinian context through the fourth century. As Friedheim describes the matter: “. . .the condemnation and rage the cult of the sun arouses in the Rabbinical literature appears to be the result of a concrete religious reality during the time of the Tannaim and Amoraim. Furthermore, this was the case during the time of both the Mishnah and the Talmud and was unique within the general stance toward idolatry adopted by the Land of Israel Rabbis. In other words, we do not find the rabbis so angry toward, or intent on retribution against, the cults of Aphrodite, Mercurius, or other pagan rites. Even the most despicable pagan practices, such as the cult of Moloch and Peor, were not regarded in such a harsh light, a fact that in itself speaks volumes.” (Friedheim 2009, 112-113); See also Halbertal, Moshe, 1998, “Coexisting With the Enemy.” In G.N. Stanton and G.G.

In *b. Sukkah* 29a, in keeping with the midrashic connection of the sun with Rome and the moon with Israel described in chapter one, we read that the eclipsed sun is a bad omen for idolaters, and that an eclipse of the moon suggests the same for Israel:¹⁷²

תנו רבנן: בזמן שהחמה לוקה - סימן רע לכל העולם כולו. משל למה הדבר דומה - למלך בשר ודם שעשה סעודה לעבדיו, והניח פנס לפניהם, כעס עליהם ואמר לעבדו: טול פנס מפניהם והושיבם בחושך. תניא, רבי מאיר אומר: כל זמן שמאורות לוקין - סימן רע לשונאיהם של ישראל, מפני שמלומדין במכותיהן. משל לסופר שבא לבית הספר ורצועה בידו, מי דואג - מי שרגיל ללקות בכל יום ויום הוא דואג. תנו רבנן: בזמן שהחמה לוקה - סימן רע לעובדי כוכבים, לבנה לוקה - סימן רע לשונאיהם של ישראל, מפני שישראל מונין ללבנה ועובדי כוכבים לחמה. לוקה במזרח - סימן רע ליושבי מזרח, במערב - סימן רע ליושבי מערב, באמצע הרקיע - סימן רע לכל העולם כולו.

...

ובזמן שישראל עושין רצונו של מקום אין מתיראין מכל אלו, שנאמר (ירמיהו י') כה אמר ה' אל דרך הגויים אל תלמדו ומאותות השמים אל תחתו כי יחתו הגויים מהמה, גויים יחתו, ואין ישראל יחתו. תנו רבנן: בשביל ארבעה דברים חמה לוקה: על אב בית דין שמת ואינו נספד כהלכה, ועל נערה המאורסה שצעקה בעיר ואין מושיע לה, ועל משכב זכור, ועל שני אחין שנשפך דמן כאחד.

Our Rabbis taught: At the time when the sun is eclipsed, it is a bad omen for the entire world. A parable that this matter may be likened to: 'To a human king who made a feast for his workers, and put a lamp out for them. When he became angry with them he told his worker to take away the lamp and have them sit in the dark. It was taught: R. Meir said:

Stroumsa, Eds. *Tolerance and Intolerance in Early Judaism and Christianity*. Cambridge: Cambridge University Press.; Mireille Hadas-Lebel, 1979, "Le paganisme à travers les sources rabbiniques des IIe et IIIe siècles : contribution à l'étude du syncrétisme dans l'empire romain." *Principat* 19:2, 397-485; Emmanuel Friedheim, 2006, *Rabbinisme et Paganisme en Palestine Romaine: Etude Historique des Realia Talmudiques (Ier-IVieme siecles)*. Leiden & Boston: Brill.

¹⁷² In *b. Hullin* 60b and *Gen.Rab.* 6:3, we note hermeneutical attempts to reconcile God's creation of the two great lights in Bereshit with their designations as greater and lesser lights. In *b. Hullin* 60b, R. Shimon b. Pazzi points out this contradiction between *pasukim*. Here, God is said to have asked the moon to make itself smaller, for God commands it to rule by day and night. The anthropomorphized moon points out that the sun must also be used in order to govern the Jewish calendar and keep holidays in season. God attempts to reassure the moon of its status by pointing to great biblical characters who had been considered small and who were thus named after the moon (i.e., Jacob the Small in Amos 7:5; Samuel the Small in 1 Samuel 2:19; and David the Small in 1 Samuel 16:11, 17:14) The moon, however, is inconsolable until God asks it to bring an atonement on the Divine behalf for diminishing the moon. This is further illuminated, so to speak, by *Gen.Rab.* 6:3, in which R. Levi, in the name of R. Jose b. Il'pai, states "It is but natural that the great should count by the great, and the small by the small. Esau counts [time] by the sun, which is large, and Jacob by the moon, which is small." R. Nahman replies "That is a happy augury. Esau counts by the sun, which is large: just as the sun rules by day but not by night, so does Esau enjoy this world, but has nought in the World to Come. Jacob counts by the moon, which is small: just as the moon rules by day and by night, so has Jacob a portion in this world and in the World to Come." Indeed, through these hermeneutical turns, we note the parallel negotiation of rabbinic political and religious power and authority, if only in the rabbinic imagination, and in attempts at collective self-presentation. Here, the association of the celestial luminaries with rulership, rabbinic authority, and Jewish destiny is telling.

Whenever the luminaries are eclipsed, it is a bad omen for Israel since they have learned to become used to being hit. This may be illustrated by the story of a school teacher who comes to school with a belt in his hand. Who is afraid? Someone who is used to being punished daily.

Our Rabbis taught: When the sun is eclipsed, it is a bad omen for star worshippers; when the moon is eclipsed, it is a bad omen for Israel, since Israel calculates by the moon and star worshippers by the sun. If the eclipse is in the east, it is a bad omen for those who dwell in the east. If in the west, it is a bad omen for those who dwell in the west. If in the middle of the firmament (sky), it is a bad omen for the entire world. . . . But at the time when Israel fulfills the will of God, they have nothing to fear. As is said: (Jeremiah 10:2) Thus said God, do not follow the path of the nations, and do not be dismayed at the luminaries of the heavens. The nations are dismayed at them (e.g., astral worshippers) will be dismayed, but Israel will not. Our Rabbis taught: Four things cause a solar eclipse: A head of the *bet din* who died and was not mourned appropriately, an engaged young woman who cried out in the city but nobody rescued her, sodomy, and two brothers whose blood was shed at the same time.

In this *sugya*, we note the trope of punishment for idolaters being associated with the astronomical phenomenon of the eclipse. Of no small importance is the bipartite nature of this rabbinic analysis with respect to the nations. First, we read that a solar eclipse is a bad omen for the entire world: תנו רבנן: בזמן שהחמה לוקה - סימן רע לכל העולם כולו. yet shortly thereafter, we read that the eclipsed sun is a bad omen for idolaters, since they reckon by the sun: תנו רבנן: בזמן שהחמה לוקה - סימן רע לעובדי כוכבים

This treatment by the Bavli of the Palestinian discourse on Paganism reveals much about the great political power of Rome, Pagan astrolatry, and the authority struggles of the early rabbis. It is my contention that it also supports the existence of continued concerns regarding astrolatry in the Sasanian context.

The *sugya* continues, addressing an association between the diminution of the moon with the lesser role of Israel, with clear reference to the punishment of Israel:

רבי מאיר אומר: כל זמן שמאורות לוקין - סימן רע לשונאיהם של ישראל, מפני שמלומדין במכותיהן. משל לסופר שבא לבית הספר ורצועה בידו, מי דואג - מי שרגיל ללקות בכל יום ויום הוא דואג.

R. Meir said: Whenever the luminaries are eclipsed, it is a bad omen for Israel since they have learned to become used to being hit. This may be illustrated by the story of a school teacher who comes to school with a belt in his hand. Who is afraid? Someone who is used to being punished daily.

Notable here is the placement of a reference to the association between Israel and the **מאורות** in the plural form, soon to be followed by a return to the more common trope of Israel being symbolized by the moon. The relevance of this shift to encompass both the sun and the moon, is, however, uncertain from the textual context. Also key is the reference to the punishment of Israel. This statement is more fully framed, however, by cross-reference to the diminished moon in *Gen. Rab.* 6:3, in which God attempts to console the now lesser luminary by pointing to Israel's share in both this world and the world to come, as compared to the lack of the latter for Rome. In essence, with respect to political authority, the rabbinic stance in these texts is that the Jewish people are not powerless – that though they be small in the face of Rome, they have their own power, with more to follow. Moreover, this power is, in large part, deontic in nature. Upon noting a return to the central trope of the eclipse of the sun being a bad omen for idolaters and that of the moon serving as a dire omen for Israel, the text reinforces the question of Jewish status and deontic authority in the face of astrolatry, referring to God's judgment against Egyptian (read: foreign) deities:

ובזמן שישראל עושין רצונו של מקום אין מתיראין מכל אלו, שנאמר (ירמיהו י) כה אמר ה' אל דרך הגויים אל תלמדו ומאותות השמים אל תחתו כי יחתו הגויים מהמה, גויים יחתו, ואין ישראל יחתו.

But at the time when Israel fulfills the will of God, they have nothing to fear. As is said: (Jeremiah 10) Thus said God, do not follow the path of the nations, and do not be dismayed at the luminaries of the heavens. The nations are dismayed at them (e.g., astral worshippers) will be dismayed, but Israel will not.

The reference to Jeremiah 10, a key biblical source related to astrolatry, may easily be seen as an appeal to scriptural, and hence Divine, authority. This backreading, of course, is ultimately a rabbinic commentary upon the situation of the rabbis in Pagan lands. Here, we also note the motif of the protection of Israel from the aforementioned astral omens if they adhere to rabbinic authority and dictates by shunning astrolatry.¹⁷³ Indeed, this motif of the obedience of Israel to rabbinic dictates protecting Jews from astral influences is also present in the astrological discussion of *mazal* in *b. Shabbat* 156a-b.

Finally, the *sugya* turns to the reasons for solar eclipses, which on the whole, are considered to be especially dire omens. First and foremost among these is the following:

תנו רבנן: בשביל ארבעה דברים חמה לוקה: על אב בית דין שמת ואינו נספד כהלכה

Our Rabbis taught: Four things cause a solar eclipse: A head of the *bet din* who died and was not mourned appropriately. . .

This section is particularly compelling, particularly when viewed within the context of astrolatry, and preceded by the rabbinic assurance that Jews can be protected by their obedience. For here, the first explanation offered for an ominous solar eclipse is not the worship of the luminaries, but the lack of honour shown for the authority of the head of the *bet din*! Indeed, it would be reasonable to assume that the listing of offenses that could lead to a solar eclipse – that is, a cosmic event in which the greater luminary established in Bereshit is essentially out of its natural order – would include astrolatry itself given the frame already established by this *sugya*. Instead, we note a list of offenses in which

¹⁷³ See Kimberly Stratton, 2007, “Caution in the Kosher Kitchen” in *Naming the Witch*, for a description of the association between protection from magic (here, I relate this fuzzy category, which I leave undefined) and virtuous self-control – values in the Greco-Roman contexts. This, she states, would have been appealing to the rabbis after the Roman wars. (Stratton, “Caution In”, 158-61) Viewed in this light, *b. Sukkah* 29a displays Palestinian rabbinic tropes.

astrolatry is never mentioned, but that is headed by the transgression of an affront to the deontic authority of the head of the *bet din*. This emphasis upon the primacy of the rabbinic station is reminiscent of the prioritization, in *b. Berakhot* 7b, of serving rabbinic scholars over Torah study as noted in chapter two.

Given the focus of *b. Sukkah* 29a, we might well note the suggestion that the transgressions of astrolatry and disrespect for rabbinic deontic authority are considered equivalent. In brief, what emerges in this *sugya*, which serves as a frame for the admonition against astrolatry, are the themes of the appeal to the authority of scripture, the solar and lunar symbolism of Rome and Israel, punishment and reward, the claim that Jews can avoid an ominous fate by obeying rabbinic law, and the association of eclipses with lack of respect for rabbis. These themes, in turn, are inextricably linked with the broader discourses related to celestial phenomena and rabbinic authority.

The astral bodies themselves are not always the focus, however. Frequently, celestial motifs are presented together with iconic imagery in the texts, thereby demonstrating not merely theory, but directions for a ritualized praxis. We note this pairing and rabbinic concern in *m. Avodah Zarah* 3:3, which states that if one finds utensils on which images of the sun, moon, or a dragon may be seen, one must throw them into the salt sea.¹⁷⁴ Following the Mishnah, in *b. Avodah Zarah* 42b, the Gemara deems images of all the planets to be permitted save for the sun and moon. In *b. Avodah Zarah* 43a, this

¹⁷⁴ i.e., The Dead Sea

is extended to the upper chamber of R. Gamaliel, who had diagrams of the moon on the wall in order to interrogate non-specialist witnesses.¹⁷⁵

The question is raised by the rabbis – are such images permitted? The matter turns to the question of whether the prohibition pertains to finding such an item vs. making it. On this point, the text cites Exodus 20:23, לֹא תַעֲשׂוּן אֱלֹהִי אֲתֵי אֱלֹהֵי כֶסֶף וְאֱלֹהֵי זָהָב לֹא תַעֲשׂוּן לָכֶם – “Do not make any gods besides me. Do not make gods of silver or gold.” The admonition in the biblical verse against making such gods is then equated with astrology, for one “shall not make according to the likeness of My attendants who serve before Me in the heights, as, e.g., the sun, moon, stars and planets!” In 43a, the rabbis conclude that “It was different with R. Gamaliel because others made [the chart] for him.”

Immediately following this discussion of iconic and astral images in the Bavli, we note a description of the imperative of nullifying idolatry in *b. Avodah Zarah* 43a.¹⁷⁶

אמר רבה בר בר חנה אמר רבי יהושע בן לוי: פעם אחת הייתי מהלך אחר ר' אלעזר הקפר בריבי בדרך, ומצא שם טבעת ועליה צורת דרקון, ומצא עובד כוכבים קטן ולא אמר לו כלום, מצא עובד כוכבים גדול ואמר לו: בטלה, ולא בטלה, סטרו ובטלה. ש"מ תלת: ש"מ, עובד כוכבים מבטל עבודת כוכבים שלו ושל חבירו וש"מ, יודע בטיב של עבודת כוכבים ומשמשיה מבטל, ושאינו יודע בטיב עבודת כוכבים ומשמשיה אינו מבטל וש"מ, עובד כוכבים מבטל בעל כרחו.

Rabbah b. Bar Hanah said in the name of R. Joshua b. Levi: One time, I was walking with the great R. Eleazar Hakappar on the road. And he found there a ring and on it was the image of the dragon. And an astral worshipper (idolater) who was a child, but he said nothing to him. An adult astral worshipper passed by and he (R. Eleazar) said to him: Annul it! But he refused to. He hit him until he annulled it. Deduce three things from this: First, an idolater can annul an idolatrous item that belongs to himself or to another idolater. Second, if (he) knows the nature of the idolatrous item and how it is worshipped, he can annul it, but

¹⁷⁵ On this, see E.E. Urbach, 1959, “The Rabbinical Laws of Idolatry in the Second and Third Centuries in the Light of Archaeological and Historical Facts.” *Israel Exploration Journal* 9:4, 229-45.

¹⁷⁶ Also see Gerald Blidstein, 1973-74, “Nullification of Idolatry in Rabbinic Law.” *Proceedings of the American Academy for Jewish Research* 41/42, 1-44; Idem., 1974, “R. Yohanan, Idolatry, and Public Privilege.” *Journal for the Study of Judaism* 5:2, 154-161; Yair Furstenberg, 2010, “The Rabbinic View of Idolatry and the Roman Political Conception of Divinity.” *Journal of Religion* 90:3, 335-366.; יאיר פורסטנברג : ביטול עבודה זרה

if he does not know, he cannot annul it. Third, physical force may be employed to force an idolater to annul the item.

This *sugya* is remarkable and relevant in several ways. First, it is part of the discussion of the prohibited images in *m. Avodah Zarah* 3:3, which encompasses astral imagery, although it is a dragon, or Heb. דַּרְקוֹן, that is on the ring described here. As the image of the dragon was listed alongside the sun and the moon in the Mishnah, I would suggest the possibility that דַּרְקוֹן may refer to the Greco-Roman constellation Draco (Latin, *Dragon*), which was catalogued among the 48 original second century C.E. constellations by Ptolemy in his *Almagest*, or *Mathematike Syntaxis*, book seven. Secondly, at the very outset, we note a marker of deontic authority in the initial reference to ר' אלעזר הקפ"ר בריב"י – “the great R. Eleazar Hakkappar.” This sets the tone for the dramatic action to follow, wherein R. Eleazar strikes a non-Jewish adult to compel the person, who appears to have been a stranger simply walking by, to annul the idolatrous image. This action is further used as an object lesson regarding the permissibility of using force to effect the annulment of idolatry.

Whether or not such violence was historically used by the rabbis against gentiles in this context is an open question; however, a more pointed concern surrounds the question of what the rabbinic authors and redactors wished to achieve by granting their tacit approval for the use of force to compel a non-Jewish stranger to annul an idolatrous image.¹⁷⁷ Indeed, whereas in *b. Bava Metzi'a* 59b and *b. Rosb HaShanah* 25a, rabbis are

¹⁷⁷ This was effected by demonstrating the sanctified nature of the idol or idolatrous image, for example striking it and biting into it. (Blidstein, 12-13; *t. Avodah Zarah* 5:6,7) Having a Pagan urinate or spit on the idol

shown exercising deontic authority upon each other, it is rare to note such authority being imposed upon non-Jews in practice, though its presentation even in theory, as an exhortational device in the text, is nevertheless notable.¹⁷⁸ The greatness of R. Eleazar Hakkappar, emphasized in the text, only serves to further legitimize his use of force against an unwitting stranger on the road. It also, perhaps most tellingly, demonstrates just how heinous a transgression idolatry was, as well as the lengths to which one might go to ensure its nullification.¹⁷⁹ Finally, it might be surmised that the *suḡya* was intended to reinforce this point. Indeed, as Richard Kalmin points out more generally regarding the portrayal of idolatry in the rabbinic literature of both Roman Palestine and Babylonia, the strong language and warnings used likely served a polemical role, having the aim of preventing rabbis and other Jews from becoming involved with idolatry “due to a sincere fascination.”¹⁸⁰ (Kalmin 2008, 657)

Within the earlier Parthian context in Babylonia, the Amoraim lived among Persians who worshipped idols, as was the case in the Palestinian context, where

or image, or sell it, were also possible means of nullification. (Blidstein, 32-33) Yair Furstenberg refers to such nullifying actions as acts of contempt. (Furstenberg 2010, “The Rabbinic View”, 341)

¹⁷⁸ On the question of the Jewish vs. Roman perceptions of the efficacy or value of idols (i.e., frequently astronomical deities, including Sol Invictus, Mercury, etc.) see Moshe Halbertal, 1998, “Coexisting With the Enemy: Jews and Pagans in the Mishnah.” In G.N. Stanton and G.G. Stroumsa, Eds. *Tolerance and Intolerance in Early Judaism and Christianity*. Cambridge: Cambridge University Press, 159-172; Luitpold Wallach, 1946, “A Palestinian Polemic Against Idolatry: A Study in Rabbinic Literary Forms,” *Hebrew Union College Annual* 19, 389-404; see also Mireille Hadas-Lebel, 1979, “Le paganisme à travers les sources rabbiniques. De Gruyter; John G. Gager, 1973, “The Dialogue of Paganism with Judaism: Bar Cochba to Julian,” *Hebrew Union College Annual* 44, 89-118; Jeffrey L. Rubenstein, 1996, “An Eschatological Drama: Bavli *Avodah Zarah* 2a-3b,” *AJS Review*, 1-37.

¹⁷⁹ The act of force against a perceived idolater also mirrors the use of force against the idol or image to nullify it.

¹⁸⁰ Indeed, this fascination is attested in b. *Avodah Zarah* 55a, where we note the comment to R. Akiva by a Jew named that while he knows neither of them believe “in their hearts” in the efficacy of idols, he has seen people appear to be healed by idols and wishes to know how it is done. R. Akiva’s response is that the illness vanished by chance at the time they visited the Pagan temple.

Paganism was ubiquitous. However, with Sasanian rule came an aniconic tendency that relegated rabbinic concern with idol worship to a matter that impinged more on the imagination and on rabbinic anxiety than it did upon daily life. For whereas during the Parthian era, Pagan icons were more publicly visible, one would have to go out of one's way to find an idol during the Sasanian period. (Kalmin 2008, 630, 638, *et passim*)

Nevertheless, as Kalmin points out, rabbinic anxiety is displayed throughout the Bavli with respect to idolatry/astrolatry, the efficacy or lack thereof of idols, and the perceived threat posed by idolatry/astrolatry.¹⁸¹ (639) Moreover, this tendency in the Bavli was further reinforced not only by concerns regarding idolatry in the Persian context, but by the biblical admonitions against forbidden practices, and by rabbinic literature and stories that made their way from the Greco-Roman world to that of the Babylonian Amoraim and redactors.¹⁸² (650) Indeed, this anxiety is also part of the rabbinic ambivalence displayed by the Babylonian rabbis toward astral magic and astrology.

Mirroring its close counterpart, astrolatry, astral magic aims to work with the celestial bodies – whether or not they are, strictly speaking, deified – in order to effect

¹⁸¹ See the ongoing scholarly debate regarding the prevalence of idolatry surrounding the rabbis in the first few centuries of the common era. On this point, Saul Lieberman argues that no idolatry existed at the time, suggesting that there was no reason to engage in polemic. (Lieberman, *Hellenism*, 120-21) Moshe Halbertal and Avishai Margalit take this further, arguing that the biblical fight against, and temptations posed by, idolatry had already vanished by the Second Temple period. (Halbertal and Margalit, 1992, *Idolatry*. Tr. Naomi Goldblum. Cambridge: Harvard University Press, 2.) What is clear regardless of historicity is the presentation of anxiety in the text, regarding which I am in agreement with Kalmin. For a thoroughgoing analysis of the nuanced effects of Pagan, Roman imperialism upon the marginalized, early rabbis between 135 and 350 C.E., see Seth Schwartz, 2001, *Imperialism and Jewish Society 200 B.C.E. to 640 C.E.* Princeton: Princeton University Press.

¹⁸² As Kalmin admits, it is not always easy to determine whether stories about idolatry are of Persian or Palestinian provenance. (650-51) This is, of course, among the challenges when analyzing themes present in the Bavli; nevertheless, the importance of this earlier stratum for the purposes of this study is owing to the preservation and elaboration upon these topics in the Bavli, and its subsequent influence upon the trajectory of the history of science.

control over the natural order. And like astrolatry, magic is considered to be a threat to rabbinic authority unless it is studied or used under tight control. As we read in *b. Nedarim* 32a, a person who does not practice sorcery or divination becomes closer to God, and even the ministering angels aren't able to enter that place.

As we have seen, there is no single rule that may be applied to all practices that appear to be magical during the rabbinic period.¹⁸³ However, one of its primary mechanisms in the Bavli was to effect social control through the self-presentation of rabbis as men of power, thereby consolidating and reinforcing their deontic authority within their Jewish communities. This is exemplified in the frequent use of rabbinic exceptions to their own admonitions against magic, as long as the purposes of such magic were tightly regimented by a series of rabbinic rules. Allowable exceptions to the rule included performing illusions (i.e., *magicas vanitates*), effecting medical cures, teaching and study (e.g., in the story of the magical cucumbers sown by Rabbi Eliezer ben Hyrcanus in *b. Sanhedrin* 65b), and judging (i.e., the rule that members of the Sanhedrin must be skilled in magic in order to properly assess transgressors, as found in *b. Sanhedrin* 17a).¹⁸⁴ Other exceptions that will soon follow in this chapter span both magic and

¹⁸³ Once again, attempting to define magic as opposed to science or religion within the Late Antique context, is an exercise in futility. It invokes layers of “othering” and creates irrelevant, anachronistic distinctions between *topoi*. Turning to J.Z. Smith, we note the locative role of terms related to magicians and magic that banish practitioners beyond the boundary of a group. (Smith 1990, 121) As such, the nature of the usage of magic and related arts such as astrology by the rabbis, as well as the overlap between these domains, such reified definitions as “magic”, “astrology”, and “astronomy” ultimately break down and are not at all useful. Rather, my emphasis is upon noting the ways in which key *sugyot* in the Bavli are illustrative of the case by case exercise of rabbinic power and deontic authority.

¹⁸⁴ As Shai Secunda points out, the “proof-text” for the exception of studying magic is found in Deuteronomy 18:9-11, which “prohibits the ritual practice of *hover haver*—a designation interpreted by some Babylonian Jews as referring to Zoroastrianism. . . . Accordingly, Deuteronomy 18:9–11 may have been seen by

cosmogony presented together in the tacitly permitted creation of an animal or a man using the laws of creation. As Gideon Bohak also points out, and as described in chapter one, there is also a repeated implication in the Bavli that the rabbinic use of magic to thwart witches and non-rabbinic magicians was also allowable. (Bohak 2008, 369) Such a portrayal of the rabbi as a magical wonder-worker in the texts tends to go hand in hand with the assertion of authority – for example, the use of magic on the *bet din* and competitions against other magicians.

Where such external magicians were concerned, admonitions against competitive magical – and astrological – practitioners, therefore, were a component of the Bavli's rhetoric against non-permissible magic. We see this trope at work in *b. Shabbat* 75a, to which I return, and which reads as follows:

והלומד דבר אחד מן המגוש - חייב מיתה, והיודע לחשב תקופות ומזלות ואינו חושב - אסור לספר הימנו. מגושא, רב ושמואל. חד אמר: חרשי, וחד אמר: גדופי. תסתיים דרב דאמר גדופי, דאמר רב זוטרא בר טוביה¹⁸⁵ אמר רב: הלומד דבר אחד מן המגוש - חייב מיתה. דאי סלקא דעתך חרשי, הכתיב (דברים יח) לא תלמד לעשות - אבל אתה למד להבין ולהורות תסתיים. אמר רבי שמעון בן פזי אמר רבי יהושע בן לוי משום בר קפרא: כל היודע לחשב בתקופות ומזלות ואינו חושב - עליו הכתוב אומר (ישעיהו ה) ואת פעל ה' לא יביטו ומעשה ידיו לא ראו. אמר רבי שמואל בר נחמני אמר רבי יוחנן: מנין שמצוה על האדם לחשב תקופות ומזלות - שנאמר (דברים ד) ושמרתם ועשיתם כי היא חכמתכם ובינתכם לעיני העמים איזו חכמה ובינה שהיא לעיני העמים - הוי אומר זה חישוב תקופות ומזלות.¹⁸⁶

Babylonian Jews as prohibiting the recitation of specific Zoroastrian utterances while at the same time permitting their study. Even more interesting, the Bavli employs the same midrashic justification not only to permit the study of foreign, non-Jewish ritual and magical practices, but also to authorize the pronunciation of Jewish divine names in the context of religious instruction. If the Bavli could group the study of Jewish divine names together with foreign practices like Zoroastrian scriptural recitations, this means that in rabbinic culture there had been a blurring of boundaries between different kinds of magic—Jewish and non-Jewish—and, more important, concerning who might possess this secret, forbidden knowledge.” (Secunda 2013, 45)

¹⁸⁵ MS Vatican, Biblioteca Apostolica, Vatican, Italy 108, fol. 75a reads דאמ' מר זוטרא בת טוביא - Here, we note the usage of מר instead of רב and oddly, בת instead of בר - a certain corruption.

¹⁸⁶ MS Oxford Bodleian Library, Oxford University, Oxford, England Opp. Add, fol. 23 has the following lengthy addition prior to חישוב תקופות ומזלות: ושמרתם ועשיתם כי היא חכמתכם ובינתכם לעיני העמים וגו' ישמעון: חישוב תקופות ומזלות

. . .and he who learns a single thing (or word) from a magus is worthy of death; and he who is able to calculate the cycles and planetary courses but does not, one may not converse with him. As to magianism, Rav and Shmuel disagree on this: one says that it is sorcery; the other, blasphemy. It can be demonstrated that it is Rav who says that it is blasphemy. For R. Zutra b. Tobiah said in Rav's name: He who learns a single thing from a magus is worthy of death.¹⁸⁷ Now if you think that it is a sorcerer, it is written: (Deuteronomy 18:9) You shall not learn to do (i.e., the abominable, idolatrous acts of the nations), but you may learn in order to understand and to teach. This proves it! R. Shimon b. Pazzi said in the name of R. Joshua b. Levi based on Bar Kappara: All who know how to calculate the tequfot and constellations, but does not, of him the writings say (Isaiah 5:12): But they do not look at the work of the Lord, or seen the workings of his hands. R. Shmuel b. Nahmani said in the name of R. Yohanan's: How do we know that it is a commandment for humans to calculate the tequfot and constellations? Because it is said (Deuteronomy 4:6) for this is your wisdom and understanding in the view of the nations: what wisdom and understanding is in the view of the nations?¹⁸⁸ Say, that it is the science of astronomical cycles and constellations.

Of particular note here, however, is the juxtaposition of learning from a magus, והלומד דבר אחד מן המגוש, and the knowledge of astronomical calculation, for whereas both concern celestial knowledge, the first merits punishment by death, and the second is a religious *requirement*. Why might this be the case? To unpack this further, it is informative to compare the Persian magi, associated with astrology and magic, and who represented a competing source of wisdom in a Sasanian context, with the rabbis, who present themselves as using their mathematical wisdom to perform astronomical calculations.

This latter function is seen in the texts as both highlighting the cosmogonic and

את כל החקים האלה ואמרו רק עם חכם ונבון הגוי הגדול הזה אי זו היא חכמה ובינה שהיא לעיני העמים הוי אומ' זהו חישוב תקופות ומזלות

¹⁸⁷ Secunda suggests the possibility that Rav's caution against learning a *davar* from a magus refers to a word, not a thing. (Secunda 2013, 74) This is key given the emphasis upon utterances and mumbling that is frequently part of the analysis of rabbinic perceptions of the speech acts and mumbling of the magi – for example, in *b. Sotah* 22a, which I examine in chapters one and four.

¹⁸⁸ Here again, we note the importance of rabbinic epistemic authority in the display of astronomical/astrological knowledge to “the sight of the peoples.”

cosmological workings of God and demonstrating חכמתכם ובינתכם לעיני העמים – the show of the wisdom and understanding of the Jews in the eyes of the nations.¹⁸⁹

However, in addition to the apparent desire to appear skilled at such calculations in the text, the Bavli also highlights the importance of learning and using celestial knowledge only within the rabbinic fold. As Secunda points out, *b. Shabbat* 75a suggests that the concerns listed within it were motivated by competing sources of wisdom in the Sasanian context:

It is reasonable to assume that the offenses listed in this collection were common enough to warrant Rav's attention, and therefore, it is possible to think of this source as a type of evidence, derived negatively, that Jews were indeed learning from Zoroastrian priests. At the same time, at least in the eyes of Rav, studying with the magi was dangerous and had to be combated with some considerable verbal bullying. (Secunda 2005, 151)

On this point, I concur with Secunda when he concludes that magic became a rabbinic practice in order not only to effectively judge magicians, but to solidify rabbinic power.

As described in chapter one, the magi – well described by Pliny – were associated with both magic and astrology.¹⁹⁰ Here, the admonition against sorcery, and more specifically, against learning from a magus, raises more questions than it answers given the frequent rabbinic exceptions for magic granted when it reinforced rabbinic deontic

¹⁸⁹ Apologetics through the demonstration of expertise – a manifestation of epistemic authority – was the clear motivator in this instance, as it was with respect to control over nature itself in magical contests between rabbis and witches, as well as rabbis and magi.

¹⁹⁰ On the astrological relationship between the effect of the planets on body parts for example (i.e., medical uses of the zodiac, or *melothesia*), see Pliny, *Naturalis Historia*, 2.108; A similar description may be noted in Ptolemy, *Tetrabiblos* 3.13-14 with reference to the planets and to the zodiac signs. Also see *CCAG* 7, 216.5; *CCAG* 6, 83:9-13.

authority.¹⁹¹ This censure is especially telling due to the exceptions granted for rabbis who wish to study magic, supported by the *heter* given here: אבל אתה למד להבין ולהורות: תסתיים. – that is, “but you may learn in order to understand and instruct! This proves it.”

I would suggest that this exception may have led to greater numbers than anticipated of Jews – including rabbis – who chose to study with Zoroastrian priests within the Sasanian context.¹⁹² This desire to study with the priests may have been, in part, motivated by their knowledge and usage of the Jewish names of God. As Secunda describes the matter:

In other words, it would seem that the domains of magic, Zoroastrian recitation of the Avesta, and the use of Jewish divine names were related to one another. This suggests a possible motivation for why Jews would want to study with magi in the first place, what they hoped to gain, and how they may have justified their actions. In addition, it also explains why Rav would have reacted so negatively to the phenomenon in the first place, for if Jews were running to the magi to learn efficacious texts, what did this say about the power of Torah, the rabbis, and rabbinic authority? (Secunda 2013, 45)

We see a further suggestion of the view that rabbinic authority is challenged by the magi and foreign magical and astrological practices in *b. Sotah* 22a, in which both the elevation of the deontic authority of the rabbinic station and the clear ‘othering’ of magical practitioners are discussed, with the suggestion that a magus threatens the

¹⁹¹ Shai Secunda has suggested that this caution by Rav regarding learning from the magi may, in part, have been addressed to Jews involved in the production and sale of the Mesopotamian Aramaic incantation bowls, most of which were created by Jews, likely for Persian buyers. (Secunda 2013, 46)

¹⁹² Indeed, the prohibition against magic granted for the purposes of study may have led Jews who learned with magi to believe that they were not violating *halakhab*, if, indeed, they were halakhically observant to begin with. (Secunda 2005, 154) On a note related to the influence of Zoroastrian texts upon the Bavli, Shai Secunda points out a strikingly similar admonition in chapter 19 of the Middle Persian *Herbedestan*, in which Zoroastrians are banned from teaching holy words to non-Iranians. As Secunda states, there is significance in the fact “that the issue was being considered both in rabbinic and Zoroastrian circles at roughly the same time.” (155)

maintenance of honour shown to rabbinic sages. Here, such a magus appears to be a Jew who learns with the magi as well as in rabbinic circles:

אתמר: קרא ושנה ולא שימש ת"ח - ר' אלעזר אומר: הרי זה עם הארץ, ר' שמואל בר נחמני אמר: הרי זה בור, ר' ינאי אומר: ה"ז כותי, רב אחא בר יעקב אומר: הרי זה מגוש. אמר רב נחמן בר יצחק: מסתברא כרב אחא בר יעקב, דאמרי אינשי: רטין מגושא ולא ידע מאי אמר, תני תנא ולא ידע מאי אמר.

It has been relayed: If one has learnt (Tanakh and Mishnah) but did not attend upon sages, R. Eleazar says: Behold, he is an *am ha-arez*. R. Samuel b. Nahmani says that he is a boor; R. Yannai says he is a Samaritan; R. Aha b. Yaakov says that he is a magus. R. Nahman b. Isaac said: The definition of R. Aha b. Yaakov appears the most likely, because it is said: The magus mumbles and does not know what he says; the tanna recites and does not know what he says.

Here, immediately following yet another instance in which attending upon rabbis and showing them honour is mentioned, we note the derision of the מגושא, or magus, who is said to mumble and not understand his own words: רטין מגושא ולא ידע מאי אמר, תני תנא ולא ידע מאי אמר. As Secunda points out, the word רטין is informed by the trilateral root RTN, used here to mean “mumbling”. The root appears in Mandaic, Syriac, as well as Babylonian Jewish Aramaic, and in all cases, it holds a negative valence. (Secunda 2005, 153; Idem. 2013, 72-3) There is also the suggestion that this mumbling by Zoroastrian priests – i.e., reciting the *Avesta* – was seen by Persian Jews as referring to the banned practices of the nations listed in Deuteronomy 18:9-11, which include being a *hover haver*, which is translated as “mumbling” with the ט.ט.ר root in the Babylonian Targum Onkelos, thereby linking the ban with Zoroastrian ritual. (Secunda 2005, 154; Idem. 2013, 73) Moreover, the linkage of the so-called mumbling recitations of the *Avesta* by

the magi with the recitations of the Tannaim suggests some compelling intergenerational and intercultural polemic that is beyond our scope.¹⁹³

Of special note to the blurry boundaries of celestial *topoi* marked as “magical” or “astrological” is the identical formula of attacking epistemic authority both in *b. Sotah* 22a and in *b. Sotah* 12b, in which astrologers are described as not knowing what they are gazing at and not knowing what they are thinking about. This is based on the obvious rabbinic hermeneutics of Isaiah 8:19, in which we read וְכִי-יֹאמְרוּ אֵלֵיכֶם דְּרָשׁוּ אֶל-הָאֲבוֹת וְאֶל-
וְהִידְעוּנִים הַמְצַפְצָפִים – “And when they say to you, seek the mediums and the necromancers that chirp and mutter.” Here, the prognosticators are derided. As *b. Sotah* 12b reads:

והיינו דאמר רבי אלעזר, מאי דכתיב: וכי יאמרו אליכם דרשו אל האבות ואל הידעונים המצפצפים והמהגים? צופין ואינם יודעין מה צופין, מהגים ואינם יודעים מה מהגים

That is what R. Eleazar said: What does the writing mean?: And when they will say to you, seek those that have familiar spirits and the wizards, who chirp and mutter. They foresee and do not know what they foresee; they mutter and do not know what they mutter.

Here, we note the use of the word צופין, from the root צ.פ.ה, “to watch.”¹⁹⁴ This would suggest the observation of the heavens, with the additional implication of foreseeing or forecasting astrologically. Here too, in addition to the clear parallel with *b. Sotah* 22a, we note the devaluation of both the epistemic and deontic authority of the magi – the former in the attack on Zoroastrian knowledge and understanding, and the latter in the derisive tone in which both this *sugya* and that of 22a are cast.

¹⁹³ Also compelling is the reference of Eliezer Shimshon Rosenthal to *habara*, related to *hover haver*, as an alternative Babylonian Aramaic term for a Zoroastrian priest (Eliezer Shimson Rosenthal, 1982, “For the Talmudic Dictionary—Talmudica Iranica,” in *Irano-Judaica* (Hebrew; ed. Shaul Shaked; Jerusalem: Ben Zvi Institute, 38–134 [Hebrew numbering], 71–72. As cited in *Secunda* 2013, 73-4.

¹⁹⁴ In M. Jastrow, the plural form of צופים or צופין relates to watchmen, seers, prophets, or inspired men. (Jastrow, 1269)

4.1.1 Magic and Deontic Authority

Among the more powerful plays of deontic authority related to magic may be found in *b. Ta'anit* 23a, a *sugya* which I contend represents a case of astral magic in which the magician was granted a special exception due to his deontic authority. In chapter two, we noted the rabbinic power play enacted in *b. Bava Metz'ia* 59b and the story of the Oven of Akhnai, in which the laws of nature, the will of God, and epistemic authority were all trumped by deontic rabbinic authority. There, the clear message was that the law was not in heaven, but embodied in the highest rabbinic station. This was followed, in chapter three, by the analysis of *b. Rosh HaShanah* 25a, in which the primacy of deontic authority over empirical observations of the heavens was again upheld, and both computational accuracy and epistemic authority demoted well beneath rabbinic deontic authority. Turning to the controlled practice of astral magic and its power over the heavens, we note a parallel *sugya* following the text of the Mishnah in *b. Ta'anit* 19a (*m. Ta'anit* 3:8) in *b. Ta'anit* 23a, in which we find the well-known story of Honi the Circle Drawer, or *הוני המעגל* (*Honi Ha-M'ageh*), a tale in the Hellenistic tradition of the divine magical man transformed into a rabbinized story describing and extolling miracle and wonder workers known for their piety. Indeed, the themes found in the Honi tradition relate to celestial order and the power of the Divine. Its rabbinic transformation added

the elements of piety and virtue, allowing it to be absorbed. (Green, 621, 624, 636, *passim*)¹⁹⁵

Pre-dating the Tannaim, this story was related by Josephus in *Antiquities* 14.2.1 21, and was said to have taken place during Passover, ca. 65 B.C.E. In the Josephus account, a righteous man named Onias who was known to be loved by God and had once successfully prayed to God to bring rain, is asked by Pharisees, followers of Hyrcanus II, to bring down God's curse upon his brother Aristobulus II and his Sadducee forces during the Hasmonean civil war.¹⁹⁶ When Onias refuses, the group of Jews tries to force him to pray to God to help them. Instead, Onias prays to God not to hear the prayers of either side in the conflict, and as a result, the angry mob stones him and he dies. God then punishes them for this sin by sending a wind storm that destroys all of the crops in the nation.¹⁹⁷

¹⁹⁵ For additional analyses of this story, also see Judah Goldin, 1955, *On Honi the Circle-Maker: A Demanding Prayer*. *Harvard Theological Review* 56:3, 233-37; Joshua Trachtenberg, 2004, *Jewish Magic and Superstition: A Study in Folk Religion*. Reprint. University of Pennsylvania Press; Moshe Simon-Shoshan, 2012, *Stories of the Law: Narrative Discourse and the Construction of Authority in the Mishnah*. Oxford: Oxford University Press, 158; Jacob Neusner, 2005, *The Rabbinic Traditions About the Pharisees Before 70*. Eugene, Oregon: Wipf & Stock Publishers, 180; Jeffrey L. Rubenstein, 2010, *Stories of the Babylonian Talmud*, Baltimore: The Johns Hopkins University Press, 68; Idem, 2002, *Rabbinic Stories*, Mahwah, New Jersey: Paulist Press, 117-18; Julia Watts Belser, 2008, "Between the Human and the Holy: The Construction of Talmudic Theology in Massekhet Ta'anit." Unpublished doctoral dissertation, University of California, Berkeley, 97-137; Menachem Fisch, 1997, *Rational Rabbis: Science and Talmudic Culture*, Bloomington: Indiana University Press, 241; Richard Kalmin, 2002, *The Sage in Jewish Society of Late Antiquity*, New York: Routledge, 141, Fn. 6.

¹⁹⁶ Sons of Alexander Jannaeus and Queen Alexandra Salome; Alexander Jannaeus was, in turn, the son of John Hyrcanus, greatly admired by Josephus. (See Steve Mason, 2001, *Flavius Josephus on the Pharisees: A Composition-Critical Study*. Leiden: Brill, 225) The grandson of John Hyrcanus, Hyrcanus II was installed as High Priest by his mother, Alexandra Salome, after the death of Alexander in 76 B.C.E., and he later succeeded his mother, becoming King of Judea.

¹⁹⁷ The presence of the story of Onias set within the context of the civil war is curious. The name Onias was also that of numerous kings of the Oniad dynasty, one of whom – variously Onias III in Josephus' *The Jewish War* 7:431, and Onias IV in *Antiquities* 13:72-73 – founded a temple at Leontopolis, in Egypt, ca. 145 B.C.E. Josephus held this act by Onias in contempt. Called the Temple of Onias, it is mentioned and recognized in m. *Menahot* 13:10 and b. *Menahot* 109a-b, and is not considered Pagan. There is a ruling that the priests who

Turning to the Gemara following m. *Ta'anit* 3:8, b. *Ta'anit* 23a opens with the need for rain during the month of Adar, and the response of Honi the Circle-Drawer to the call of the people for rain:

מעשה ששלחו לחוני המעגל וכו'. תנו רבנן: פעם אחת יצא רוב אדר ולא ירדו גשמים. שלחו לחוני המעגל: התפלל וירדו גשמים התפלל ולא ירדו גשמים. עג עוגה ועמד בתוכה, כדרך שעשה חבקוק הנביא, שנאמר (חבקוק ב') על משמרתי אעמדה ואתיצבה על מצור וגו'. אמר לפניו: רבונו של עולם בניך שמו פניהם עלי שאני כבן בית לפניך, נשבע אני בשמך הגדול שאיני זו מכאן עד שתרחם על בניך. התחילו גשמים מנטפין, אמרו לו תלמידיו: רבי, ראינוך ולא נמות. כמדומין אנו שאין גשמים יורדין אלא להתיר שבועתך. אמר: לא כך שאלתי, אלא גשמי בורות שיחין ומערות. ירדו בזעף, עד שכל טפה וטפה כמלא פי חבית. ושיערו חכמים שאין טפה פחותה מלוג. אמרו לו תלמידיו: רבי, ראינוך ולא נמות. כמדומין אנו שאין גשמים יורדין אלא לאבד העולם. אמר לפניו: לא כך שאלתי, אלא גשמי רצון ברכה ונדבה. ירדו כתיקנן, עד שעלו כל העם להר הבית מפני הגשמים.

אמרו לו: רבי, כשם שהתפללת שירדו, כך התפלל וילכו להם. אמר להם: כך מקובלני שאין מתפללין על רוב הטובה. אף על פי כן, הביאו לי פר הודאה. הביאו לו פר הודאה. סמך שתי ידיו עליו, ואמר לפניו: רבונו של עולם עמך ישראל שהוצאת ממצרים אינן יכולין לא ברוב טובה ולא ברוב פורענות, כעסת עליהם - אינן יכולין לעמוד, השפעת עליהם טובה - אינן יכולין לעמוד, יהי רצון מלפניך שיפסקו הגשמים ויהא ריוח בעולם. מיד נשבה הרוח ונתפזרו העבים, וזרחה החמה, ויצאו העם לשדה והביאו להם כמהין ופטריות. שלח לו שמעון בן שטח: אלמלא חוני אתה - גוזרני עליך נידוי. שאילו שנים כשני אליהו שמפתחות גשמים בידו של אליהו לא נמצא שם שמים מתחלל על ידך? אבל מה אעשה לך שאתה מתחטא לפני המקום ועושה לך רצונך, כבן שמתחטא על אביו ועושה לו רצונו. ואומר לו: אבא, הוליכני לרחצני בחמין, שטפני בצונן, תן לי אגוזים, שקדים, אפרסקים, ורמונים - ונותן לו. ועליך הכתוב אומר (משלי כ"ג) ישמח אביך ואמך ותגל יולדתיך.

תנו רבנן: מה שלחו בני לשכת הגזית לחוני המעגל: (איוב כ"ב) ותגזר אמר ויקם לך ועל דרכיך נגה אור. ותגזר אמר - אתה גזרת מלמטה, והקדוש ברוך הוא מקיים מאמריך מלמעלה. ועל דרכיך נגה אור - דור שהיה אפל הארת בתפלתך, כי השפילו ותאמר גוה - דור שהיה שפל הגבתו בתפלתך, ושח עינים יושע - דור ששה בעונו הושעתו בתפלתך, ימלט אי נקי - דור שלא היה נקי מלטתו בתפלתך

It happened that the people said to Honi, the circle drawer, etc.

The rabbis taught: Once it happened that the greater part of the month of Adar had passed

serve there are not permitted to serve in the Temple in Jerusalem, though a vow taken there is still binding. Moreover, in 2 *Maccabees*, Onias III is viewed as a good, pious man and supporter of the Ptolemies. However, "he was murdered because he rebuked Menelaus for his abuse of the temple vessels." (Collins, *Between Athens*, 77) According to John J. Collins, the absence of Onias III in 1 *Maccabees* and in Josephus is due to a "pro-Hasmonean *Tendenz*." (78) On a speculative note with respect to Josephus, however, perhaps there is no coincidence in the story elements, namely: two righteous men named Onias who are each murdered (in the story of Onias and the prayer request, by the supporters of Hyrcanus II, and Onias III, by Menelaus and Andronicus, who had Onias assassinated). We also note the execution of Andronicus by the King at the end of the story, which is seen as the punishment of God. (see *II Maccabees* 4:29-39, cf. the punishment of the murderers directly by God in *Antiquities* 14.2.1 21.) Given the support shown by Josephus for the Hasmonians in his writings and his admiration for John Hyrcanus, one wonders whether Josephus was preserving events or rather, whether he was engaging in covert apologetics.

but no rain had fallen. The people sent a message to Honi the Circle Drawer (asking him to) pray for rain to fall. He prayed but no rain fell. He drew a circle and stood inside it in the way of the prophet Habakkuk. As it is said (Habakkuk 2): On my watch I will stand, and set me on the tower. He said (before God): Ruler of the world, your children have turned their faces to me because I am like a son of Your house. I swear by your great name that I will not move from here until you show mercy on your children. Rain began to trickle and his students said to him: Rabbi, we look to you (so that) we won't die. We believe that rain would not have fallen unless it was to release you from your vow. He said: It is not for this that I prayed, but for rain (to fill up) wells, ditches, and caves. (The rain) fell with strong force, until the drops were as large as the opening of a barrel and the sages approximated that no single drop was smaller than a log. His students said to him: Rabbi, we look to you (so that) we won't die. It seems to us that the rain would not fall unless it was to destroy the world. He said before him (God): It is not for this that I have prayed (asked you), but for rain of giving, blessing, and abundance. The rain fell more lightly, until the entire nation (of Israel) went to the Temple Mount due to the rain.

(They) said to him: Rabbi, just as you have prayed for the rain to fall, pray for the rain to stop. He said: It has been given to me (as tradition) that we do not pray due to an abundance of goodness. In spite of this, bring me a thanksgiving bullock for an offering. They brought him a bullock for a thanksgiving-offering and he laid his two hands on it and said: Ruler of the world, your people Israel that you brought out from Egypt cannot (handle) too much goodness or too much punishment. When you were angry with them, they could not stand it. When you showered them with goodness, they could not stand it. May it be your will that the rain stops and that there be relief for the world. The wind blew and the clouds dissipated, and the sun shone. And the nation went to the fields and gathered mushrooms and truffles. Shimon b. Shetah sent him a message: If you were not Honi I would have placed a ban on you! For if the years were like the years of Eliyahu (famine), who had the keys of rain in his hands, would the name of the heavens not be profaned by your hands? But what will I do to you who behaves petulantly before God (HaMakom) and He gives you what you want, just as a son who is petulant with his father who gives him what he wants? He says to him: Father, bring me to bathe in warm water, wash me in cold, give me nuts, almonds, peaches, and pomegranates, and he gives them to him. And of you, the writings say (Proverbs 23):¹⁹⁸ Let your father and your mother be happy, and let she who gave birth to you rejoice.

Our rabbis have taught: What was the message sent to Honi the circle-drawer? (Job 22):¹⁹⁹ You shall issue a ruling on a thing and it will be established for you, and on your paths shall shine light. You shall issue a ruling on a thing: You have decreed below and the Holy one Blessed be He establishes (it) above. And on your paths shall shine light: You have illuminated with your prayer a dark generation. When they caused you to fall, you will say, up. (i.e., there is uplift) You have lifted a fallen generation with your prayer. And the low person He saves. You have saved a humiliated generation with your prayer. He delivers (the person) who is not innocent. You have delivered a generation that is not innocent with your prayer.

¹⁹⁸ Proverbs 23:25

¹⁹⁹ Job 22:28

This *sugya* has been well analyzed in the scholarly literature, but it remains puzzling. While the earliest Palestinian rabbis did claim for themselves the mantle of communal authority, there is no fixed tradition of miracle stories in the Mishnah as such.²⁰⁰ Rather, as William Scott Green describes the setting:

As the new masters of holiness the rabbis claimed for themselves and their piety the religious authority which once had belonged to the priests and the cult. Consequently, any Jew who claimed access to God outside the new rabbinic structure would have seemed to them suspect. Charismatic figures who professed supernatural powers – magicians, miracle-workers, or ‘prophets’ – would have presented a challenge to the emerging rabbinic piety and claims to authority. That the authorities behind Tannaitic literature generally did not ascribe such powers to their rabbinic contemporaries or their Pharisaic predecessors is therefore not too surprising, and the resemblance of this perception of divine power to that of the philosophical schools which rejected miracle-working as an authentication of leadership or divinity is clear. (Green, 625-26)

Here, following *m. Ta’anit* 3:18, Honi is granted a special exception from the usual laws against magic, as well as a pass despite his dishonouring of God. First, he draws a circle on the ground and stands inside it. Next, he tells God that he refuses to move until it rains. When a light rain is sent by God, Honi is still unhappy and demands more, whereupon God complies with a downpour. But in a final power play over nature and the Divine, Honi then requests a softer rain. God then turns down the intensity of the rain to normal levels, and when the people ask him to make the rain stop, Honi makes yet another request, and God once again complies.

Here, Honi’s actions are presented as being beyond the pale, even for a miracle worker. Indeed, Shimon ben Shetach had no reason not to place Honi into *herem* for

²⁰⁰ As cited in Green 1979, 625, Fn. 41, also see Geza Vermes, 1973, Hanina ben Dosa (II), *Journal of Jewish Studies* 24, on charismatic healers in the early rabbinic and pre-rabbinic periods. The tradition of the holy miracle worker does begin to emerge toward the late second and third centuries, however, appearing in full bloom in the Bavli. Nevertheless, this power was ultimately transferred to the rabbis through the authority of Torah. (Green 1979, 641-42)

dishonouring the name of God.²⁰¹ However, rather than punish Honi, Shimon ben Shetach sends him the telling message *גוורני עליך נידוי* - אלמלא חוני אתה - That is, “If you were not Honi I would have placed a ban on you.” However, since Honi appears to have a special relationship with God, allowing him to demand such acts, there is nothing more to be done.²⁰² Shimon ben Shetach recognizes Honi’s special powers and (deontic) status before God, and relents.²⁰³

Indeed, as the Gemara relates most tellingly in its exegesis, Honi drew his circle in the prophetic tradition of Habakkuk 2:1, in which we read *על-משמרתי אעמדה ואתיצבה על-* *מצור ואצפה לראות מה-ידבר-בי ומה אשיב על-תוכחתי*, or “I will stand upon my watch, and set me upon the tower, and will watch to see what he will say to me, and what I shall answer when I am reproved.”²⁰⁴ Here, the word *מצור* may be interpreted as referring to a tower or fortress, but also as a boundary or encirclement. As W.S. Green has stated, the mishnaic story of Honi does not suggest that it is a story about prayer, but rather about

²⁰¹ The leniency of Shimon ben Shetach in this regard is especially notable given his track record of stringency with respect to magical practices. In *y. Sanhedrin* 6:6, we read that his rabbinical court charged eighty women in Ashkelon with the crime of witchcraft and sentenced them to death.

²⁰² Of interest is the connection of Shimon b. Shetach to this story, as he is the uncle of the warring brothers in the account by Josephus.

²⁰³ Shimon ben Shetach was head of the Sanhedrin and brother to Queen Shlomit Zion, also known as Queen Alexandra Salome (ca. 76-67 B.C.E.), who was married to Jannai, that is, Alexander Jannæus (c. 103-76 B.C.E.) of the Hasmonean dynasty. In *b. Berakhot* 48a, we read that he had executed the rabbis, and that there was nobody left to say grace for them. When he mentions this to his wife, Salome, she has him take an oath that if she can bring him a rabbi, he will not hurt him. She then brings her brother, Shimon b. Shetach in and seats him in between herself and her husband, stating that she is paying her brother an honour. To this, Shimon b. Shetach replies that she does not honour him – only Torah does so. Jannai is displeased with his reply, pointing to the fact that R. Shimon does not recognize any authority (that is, the authority of Jannai).

²⁰⁴ In addition, the story, well-known in Rome, of the Roman Senator Gaius Popillius Laenas (ca. 168 B.C.E.), may have informed the story of Onias/Honi. In this story, preserved in Polybius, the Senator drew a line around the Seleucid king Antiochus IV in Alexandria, insisting that the king agree to have his invading troops leave Egypt there and then. Antiochus agreed and thereby averted a war with Rome. (Dunstan, 83-6; Gruen 1986, 658-59) Also see rainmaking by Elijah in I Kings 18, using a magical circle.

“something else.” (Green, 629) My analysis addresses the more likely celestial context for this story.

In both *b. Bava Metzji'a* 59b and *b. Rosh HaShanah* 25a, and here in *b. Ta'anit* 23a, we see the exercise of deontic authority over nature – the heavens, specifically. In all three *sugyot*, the exercise of power over the celestial sphere is key. In all, God is shown to be somehow powerless before, or controlled by, a human with special status. All feature the heavens and statements on the role of the heavens in the face of human deontic authority, and in each *sugya*, we note a statement that underscores the primacy of deontic authority. In *b. Bava Metzji'a* 59b, it is of course, “Lo Bashamayim hi.” We then note the hermeneutics in the Gemara of *b. Rosh HaShanah* 25a supporting R. Gamaliel’s deontic dethroning of astronomical expertise in the Mishnah, “Come in peace, my teacher and my student. My teacher in wisdom, and my student because you have accepted my decision.” And finally, we observe the clear declaration of the recognition of deontic status in the Gemara’s reiteration of the mishnaic statement “If you were not Honi. . .” in *b. Ta'anit* 23a. This too is followed by rabbinic hermeneutics extolling Honi and citing biblical verses upholding his heroic acts of prayer (or something paralleling prayer), which have saved a corrupt generation.

Prima facie, this *sugya* can easily be, and has been, seen as a miracle story about the control over the sphere of weather by means of Honi’s defiant supplication. As such, it might well be asked how closely the story is related to astral magic and celestial *topoi*. Here, the answer may be found in the text itself, for the story of Honi contains certain

elements also found in *b. Avodah Zarah* 55a, on the matter of idolatry, which immediately follows the identification of idolatry as the worship of the sun, moon, stars, and planets in 54b. Here, Rava tells R. Yehuda that there is an idolatrous shrine, and says when the world needs rain, an idol appears to the priests in a dream vision, informing them that if they sacrifice a human, the idol will send rain. They do so, and rain falls.²⁰⁵ This is suggestive, though not conclusive, of a possible transformation of narratives on idolatry and rainmaking into rabbinic miracle stories in the Sasanian context of the Bavli, which, as we have already seen, displays no small degree of anxiety toward idolatry. This possible connection is also strongly suggested by the inclusion in the Gemara of Honi's request for a bullock offering of thanksgiving, which the people provided. While not conclusive of direct influence, this mirrors the activity of the rainmaking shrine, in which an idol requests a sacrifice prior to making the rain fall.

There is further contextual support for the presence of astrolatry in *b. Ta'anit* 23a. Indeed, it is possible to locate the story of Honi against the discourse on astrolatry by noting the elements of the narrative related to rainmaking and hydrology in both the Roman and Sasanian contexts.²⁰⁶ Indeed, the critical nature of the seasonal rains in both

²⁰⁵ Also see Emmanuel Friedheim, *Rabbinisme*, 48-52; R. Kalmin, "Idolatry in Late Antique Babylonia", 649, for discussions of this phenomenon in the Roman and Babylonian contexts, respectively. As Kalmin points out, there are variant readings of this *sugya*, including MS JTS (Ed. Shraga Abramson, 1958, New York: Jewish Theological Seminary, 51a). In addition, some texts do not include the sentence "It appears to them in a dream and says to them, 'Slaughter a man for me and I will bring rain.'" However, Kalmin believes that the sentence is core to the tradition; for example, it may be noted in MS Munich. (Kalmin, "Idolatry in", 645, Fn. 54.)

²⁰⁶ Also see Raphael Patai, 1939, "The 'Control of Rain' in Ancient Palestine." *Hebrew Union College Annual* 14, 251-86; and Idem., 1936, *Mayim: mehkar liyidi'ath ha'aretz ulefolklor 'erez yisra'el bitekufath hamikra vebamishab*. Tel Aviv: Debir; Reuven Kiperwasser and Dan D. Y. Shapira, 2008, "Irano-Talmudica I: The Three-Legged Ass

societies cannot be overestimated, for an unusually dry season would have seen magicians and miracle workers alike being called upon to attempt to remedy the situation and save the agricultural season.

In *m. Ta'anit* 3:8 and *b. Ta'anit* 23a, as we have seen, the deontic authority of Honi as a mediator between the people and God has been demonstrated. However, another element that strongly suggests itself is not referenced in the *sigya*, and its absence may well be questioned. The question of whether the story found in the Mishnah, and earlier, in Josephus, originally contained direct references to the astral bodies cannot be ascertained at this time. Nevertheless, there are hints in the texts that the story of Honi may well be derived from an earlier tradition of astral magic and Pagan rainmaking, now lost, but likely originating in the Hellenistic context. This is further supported by W.S. Green, who points out that circles “were solar symbols in Hellenistic magic, especially in magical rites practiced by members of the mystery cults.” (Green, 634) If this is the case, it could also be speculated that any astral intermediaries or astrolatrous practices that may have played their roles in earlier versions of this story would have likely been redacted for obvious political reasons due to the threat posed by astrolatry and astral magic.²⁰⁷

and Ridyā in B. Ta'anith: Some Observations about Mythic Hydrology in the Babylonian Talmud and in Ancient Iran.” *AJS Review* 32:1, 101-116.

²⁰⁷ Here, the question as to whether Josephus may have omitted stellar references due to his aniconic concerns must be left open. As Jason Ehrenkrook points out, however, although there was some fluidity with respect to the second commandment among first century Jews in Roman milieus, iconic images of God were verboten for Josephus and many others. See Jason Ehrenkrook, 2011, “Sculpting idolatry in Flavian Rome: (An)Iconic Rhetoric in the Writings of Flavius Josephus.” *Early Judaism and its literature*, 33. Atlanta: Society of Biblical Literature.

At the beginning of *m. Ta'anit* 3:8, for example, we note a reference to the sounding of the shofar due to distress on the part of the public, and as a possible herald of fast days. As Ellen Robbins points out:

The shofar seems to be intimately linked to the seventh month as the prelude to the period of winter rains. Making deafening sounds is based on sympathetic magic, according to which imitating the sound of thunder should bring rain. . . Sounding the shofar also characterized the Sukkot festival, which in mishnaic Judaism was explicitly connected with the coming rainy season. . . Like the sound of the shofar, water libations were thought to produce rain by sympathetic magic. (Robbins, "The Pleiades", 332)

Moreover, we note the direct relationship between God and the bringing of rain in *b. Berakhot* 58b-59a and *b. Rosb HaShanah* 11b-12a, in which God uses the stars as intermediaries to affect the weather. In *b. Rosb HaShanah* 11b, we also note reference to the blowing of the shofar at the new moon, and the deliverance of the people from Egypt in the month of Nisan. In 11b, this is followed by reference to Noah and the flood, which was due to the perversion of the ways of humanity. Similarly, in *b. Ta'anit* 23a, we note the reference to Honi as a deliverer of sinful Israel through his piety and prayers for the bringing of rain by virtue of his deontic authority.

These allusions to the presence of earlier traditions are, then, detectable, though the specific astral bodies identified in the texts cannot be fully ascertained. In *b. Rosb HaShanah* 11b-12a, for example, R. Joshua and R. Eliezer discuss the biblical flood and its relation to the *mazal* or "constellation" *kimah*, here identified – as it is in Robbins – as the Pleiades.²⁰⁸ In this *sugya*, both rabbis state that because of humankind's waywardness, God changed creation, causing *kimah* to rise at dawn instead of setting. When God

²⁰⁸ In contemporary terms, the Pleiades (Messier object 45, or M45) are a star cluster, not a constellation. From Earth, they appear to be located within the constellation Taurus. In *b. Bava Metzj'a* 106b, *kimah* is also identified as the tail of Aries, that is, the Pleiades.

removes two stars from *kimah*, the flood is triggered on Earth.²⁰⁹ As Noah Efron states, “What is most remarkable in this passage [*b. Rosh HaShanah* 11b-12a] is the assumption that the flood could only have an astrological cause. God manipulated the stars, but the stars controlled the weather.” (Efron 2007, 61) Moreover, in *b. Berakhot* 59a, the bringing of the flood rains by God’s removal of two stars from *kimah* is also mentioned, and the text indicates that the flood is stopped when God removed two stars from ‘*Ayis*.²¹⁰ These rabbinic traditions regarding the connection of the God of Israel and the stars as intermediaries with respect to the weather may well provide the context for the curious story of Honi.

²⁰⁹ In the rabbinic interpretation of Genesis 7:11 in *t. Ta’anit* 2:13, there is an additional, direct reference to the flood of Noah, for it reads Genesis 9:11, reiterating God’s promise that a flood of that nature will never be brought upon the Earth again.

²¹⁰ The star cluster of שׁוֹר (i.e., ‘*Ayis*) is also mentioned in *b. Berakhot* 59a, when God removes two stars and stops the flood begun when He removed two stars from כִּימָה, i.e., *kimah*. While not central to our discussion, it is notable that although the rabbis identified ‘*Ayis* with “the Bear” constellation, I would suggest that שׁוֹר is actually a cognate of Ὕαδες, that is, *Hyas*, the brother of the Hyades, or Ὕαδες – rainy ones – in Greek mythology, sisters who were turned into stars by Zeus. (See Hyginus, *Poet. Astr.* 2. 21; *Ov. Fast.* 5, 181; Hesiod, *Works and Days* 609 ff.) Indeed, the Hyades’ heliacal rising and setting was associated with the coming of rains in their season. See Cicero, *De Natura Deorum* 2, 43 and Pseudo-Hyginus, *Fabulae* 192, in which the author comments on the error made by the Romans, who referred to the Hyades as *Suculae*, or piglets, owing to their mistranslation of the origin of the name of the Hyades in *hys* (sow, or female pig) rather than in *hyein* i.e., to rain. While the Pleiades were indeed associated with agriculture at planting and ploughing time in September-October, it may easily be seen that the Hyades were far more closely associated with rain, and the beginning of the Greek rainy season around November was marked with the heliacal rising of the Hyades’ five stars. It is possible, then, that כִּימָה, tentatively identified as the Pleiades, and שׁוֹר, which I would argue is almost certainly the Hyades, were somehow viewed as the intermediate stellar mechanisms for starting and stopping the rains. Their close pairing in the sky, in the constellation Taurus the bull, and mythologically, as half-sisters, underscores the equally inextricable relationship between the agricultural season of seed-sowing (i.e., the Pleiades) and the rains required for plant growth (the Hyades). See Hesiod, *Works and Days* 618-23 on the heliacal setting of the Pleiades and its association with the ploughing and sowing season in the Mediterranean, and *Ov. Fast.* 5,164-165; Seneca, *Medea* 311 ff; Virgil, *Aenid* 3, 516 on the Hyades. In Statius, *Silvae* 1, 6. 21, the Hyades are viewed as bringers of rainstorms that overwhelm the earthly milieu associated with the Pleiades. Here, I would suggest that this refers to the agricultural season, which is dependent on the rains that immediately follow. Nevertheless, as in the story of Honi, the desire is for a moderate rain, not a deluge. As such, the Honi tradition may be a reference to an earlier Hellenistic tradition regarding astral magic used to ensure the appropriate levels of rain needed to spur agricultural growth, which was then transformed into a story linked to the biblical flood story and the value of deontic authority and Divinely-rewarded virtue through the medium of rabbinic hermeneutics.

Indeed, the *sugya* in 59a reveals the following hermeneutical turn interpreting Job

22:28:

תנו רבנן: מה שלחו בני לשכת הגזית לחוני המעגל: (איוב כ"ב) ותגזר אמר ויקם לך ועל דרכיך נגה אור. ותגזר אמר - אתה גזרת מלמטה, והקדוש ברוך הוא מקיים מאמריך מלמעלה. ועל דרכיך נגה אור - דור שהיה אפל הארת בתפלתך, כי השפילו ותאמר גוה - דור שהיה שפל הגבתו בתפלתך, ושה עינים יושע - דור ששה בעונו הושעתו בתפלתך, ימלט אי נקי - דור שלא היה נקי מלתו בתפלתך, ונמלט בבר כפיך - מלתו במעשה ידיך הברורין.

Our rabbis have taught: What was the message sent to Honi the circle-drawer? (Job 22): You shall issue a ruling on a thing and it will be established for you, and on your paths shall shine light. You shall issue a ruling on a thing: You have decreed below and the Holy one Blessed be He establishes (it) above. And on your paths shall shine light: You have illuminated with your prayer a dark generation.

Here, I offer the possible interpretation that the light symbolism is not merely a key part of the scriptural justification for Honi's actions, but is repeated within the context of the connection between Earth and heaven, with light – possibly stellar light – serving as a blessing for Honi by illuminating his path. In this *sugya*, Honi's impertinence for compelling God is therefore justified through both the appeal to the authority of the Hebrew Bible, as well as by the emphasis upon his virtue.²¹¹ Honi's special (deontic) status therefore explains why he was not excommunicated. In other words, if Honi is an astral magician, he should be placed in *herem*, but if beloved by God and marked as special, with his actions sanctified by both his God-given authority and the authority of the prooftexts, this smooths over his transgression. This once again underlines the point that the rabbinic valences assigned to astral magic are strongly influenced by and subject to deontic judgments.

²¹¹ As noted in chapter one, J. H. Chajes points out that rabbis who perform magic were able to safeguard their success and reputation by highlighting their virtue, held in stark contrast to the transgressive nature of non-Jewish magic. As such, they could transgress their own established boundaries when it was convenient and met their needs. (Chajes 2011, 71-72) This is a clear marker of deontic authority.

4.2 Astrology and Ambivalence: “No *Mazal* for Israel?”

In keeping with the pattern of interactions with authority established with respect to other celestial topics, astrology is no exception to the pattern of a tightly controlled astral discipline being accepted or rejected depending on its support of rabbinic deontic authority. In the Bavli and related sources, we note no predictable pattern other than this. Indeed, as we have seen in chapter one, the positive or negative valence assigned to astrology is variable. For example, in *b. Pesahim* 113b, the *kaldiyim* are foreigners associated with both magic and astrology, and as such, astrology is banned for Jews may not consult astrologers to remain whole before God because Jews may not consult *kaldiyim*. This is predicated on Deuteronomy 18:13 and its directive, “You shall be perfect with the Lord your God.” Moreover, in *b. Sanhedrin* 65b, citing the Mishnah, we note a negative valence assigned to those who calculate astrologically lucky or unlucky times for travel, purchases, or agriculture. As mentioned earlier, we also note the negative valence assigned to astrology in *b. Sotah* 12b, in which the magi gaze, predict, and ponder without understanding.²¹²

Nevertheless, in *b. Berakhot* 64a, in direct contrast to *b. Pesahim* 113b, R. Yosef refuses to be appointed Rosh Yeshiva due to the cautions of *kaldiyim* that he would be in

²¹² Although the transmission history of *Deuteronomy Rabbah* is complicated, and it was likely not complete until the medieval period, its origins were much earlier, circa 450-800. (Strack and Stemberger, 307-8) In *Deuteronomy Rabbah* 8:6, we read of the third century rabbi Samuel of Babylonia, who studied astrology, yet asserted that it could not be reconciled with Torah, citing Deuteronomy 30:12 in a way that is reminiscent of its citation in *b. Bava Metzi'a* 59b, “It (The law) is not in heaven.”

that role for only two years.²¹³ Moreover, in *b. Shabbat* 129b, the astrologer-physician Samuel did consider astrology to be both valid and important, as we read that the bleeding of patients should neither be done at the new moon, Mondays, Tuesdays or Thursdays, nor on the third day of the month, nor the day before a holy day. We read a similar caution in *b. Pesahim* 112a regarding drinking water on Wednesday and Friday nights. Similarly, in *t. Qiddushin* 5:17, we read that, based on Genesis 24:1, astrology was a blessing given to Abraham. Illustrating the role of the astral bodies as intermediaries between God and life on Earth, in *Gen.Rab* 10:6, R. Simon states that all plant life has a constellation that tells it to grow, and this efficacy is also noted in *b. Shabbat* 119a, *b. Bava Qamma* 2b; *b. Shabbat* 53b; *b. Megillah* 3a; *b. Sanhedrin* 94a; *b. Nedarim* 39b; and *Bava Metzri'a* 30b. However, this is not the stance later in *Gen.Rab*. In 44:10, R. Samuel b. Isaac states that Abram said that his *mazal* opposed him and made it impossible to have children. Hence, the name changes from Abram and Sarai to Abraham and Sarah, so as to obtain a new astrological fate. In 44:12, however, we read that Abraham is a prophet, not an astrologer, for though the stars could control the fate of the nations, Abraham and his offspring were above *mazal*.

According to Rava, in *b. Mo'ed Qatan* 28a, lifespan, children, and livelihood are dependent not on merit or virtue, but purely on *mazal*. Rava brings forth the example of Ravva and R. Hisda, both of whom were able to successfully pray for rain, but the latter

²¹³ As cited in chapter one, see Jeffrey L. Rubenstein, 2012, "Astrology and the Head of the Academy." In Shai Secunda and Steven Fine, Eds. *Shoshannat Yaakov: Jewish and Iranian Studies in Honor of Yaakov Elman*. Leiden: Brill, 301-21, on the powerful role played by astrology in such appointments and in determinations of the fate of a rabbi. (302-303) Indeed, astrology was said to grant one great influence and power in many areas, including politics. (313-14)

lived into old age, married off his children, and had plenty of food, whereas the former died at forty, saw many deaths in the family, and went hungry. However, this is a rare, unqualified opinion, in which the Roman emphasis on virtue was not preserved.²¹⁴

Numerous other sources in the Bavli, however, do preserve this focus on virtue as apotropaic. For example, in *b. Sukkah* 29a, analyzed earlier in the context of astrology, we read of both eclipse omens for Israel and idolaters and a cause of eclipse being lack of respect shown for the head of the *bet din*. Within this *sugya*, we also read of the remedy, which is that if Israel does not learn the ways of the nations, the heavenly influences will not affect them. Similarly, as described in chapter one, *b. Shabbat* 156a-b, the *locus classicus* of astrological debate in the Bavli, brings R. Hanina and R. Yohanan to a stalemate, with the former supporting the notion of *mazal* for Jews, and the latter opposing it. For our purposes, however, it is in *b. Shabbat* 156b that we see the exercise of deontic authority and its primacy writ large:

ומדשמואל נמי, אין מזל לישראל. דשמואל ואבלט הוו יתבי, והוו קאזלי הנך אינשי לאגמא. אמר ליה אבלט לשמואל: האי גברא אזיל ולא אתי, טריק ליה חיויא ומיית. אמר ליה שמואל: אי בר ישראל הוא - אזיל ואתי. אדיתבי אזיל ואתי. קם אבלט, שדיה לטוניה אשכח ביה חיויא דפסיק ושדי בתרתי גובי. אמר ליה שמואל: מאי עבדת? - אמר ליה: כל יומא הוה מרמינן ריפתא בהדי הדדי ואכלינן. האידנא הוה איכא חד מינן דלא הוה ליה ריפתא, הוה קא מיכסף. אמינא להו: אנא קאימנא וארמינא. כי מטאי לגביה שואי נפשאי כמאן דשקילי מיניה, כי היכי דלא ליכסף. אמר ליה: מצוה עבדת נפק שמואל ודרש: (משלי י) וצדקה תציל ממות ולא ממיתה משונה, אלא ממיתה עצמה. ומדרבי עקיבא נמי, אין מזל לישראל. דרבי עקיבא הויה ליה ברתא, אמרי ליה כלדאי: ההוא יומא דעיילה לבי גנא - טריק לה חיויא ומיית. הוה דאיגא אמילתא טובא. ההוא יומא שקלתא למכבנתא, דצתא בגודא, איתרמי איתב בעיניה דחיויא. לצפרא כי קא שקלה לה - הוה קא סריך ואתי חיויא בתרה. אמר לה אבוה: מאי עבדת? - אמרה ליה: בפניא אתא עניא, קרא אבבא, והוו טרידי כולי עלמא בסעודתא. קאימנא, שקלתי לריסתנאי דיהבית לי, יהבתי ניהליה. אמר לה: מצוה עבדת נפק רבי עקיבא ודרש: וצדקה תציל ממות ולא ממיתה משונה, אלא ממיתה עצמה.

²¹⁴ See Veltri on the role of virtuous obedience to *halakha* as conferring protection from astrological influences (1998, 316)

And from Shmuel too (we learn) Israel has no *mazal* (is not subject to the influence of the constellations.) For Shmuel and Ablat were sitting, while some people were going to the lake. Ablat said to Samuel: That man is going but will not come back, (as) a snake will bite him and he will die. Shmuel said: If he is a son of Israel, he will go and come back. While they were sitting down he went and came back. Ablat stood up and threw off his pack and found a snake cut up in two pieces. Shmuel said to him: What did you do? Every day, we collected our bread and ate it. But today, one had no bread, and was embarrassed. I said: I will go and collect (it). When I went to him, I pretended to take (it) from him so that he would not be embarrassed. He said to him: You have done a *mitzvah*. And Shmuel gave a talk: (Proverbs 10)²¹⁵ But *tzedakah* delivers from death, and not from an unusual death, but from death in itself.

And from the teachings of R. Akiva as well: Israel has no *mazal*. R. Akiva had a daughter. Chaldeans (astrologers) told him: On the day she enters the bridal chamber a snake will bite her and she will die. He was exceedingly worried about this. On the day (of marriage) she took a pin, stuck it into the wall and by random chance it pierced the eye of a snake. The next morning, when she removed it, the snake came out after it. Her father asked her: What did you do? She said: A poor man came to our door at night and everybody was busy at the feast [. . .] so I took the portion that was given to me and I gave it to him. He said to her: You have done a *mitzvah*. And R. Akiva went out and taught: But *tzedakah* delivers from death, and not from an unusual death, but from death in itself.

Here, we note two examples that not only illustrate the limits of *mazal* upon Israel, but strongly highlight the more positive valence attributed to the performance of *mitzvot* over the predictive value of astrology. What is key in this text is that this bipartite portrayal of the dictum *אין מזל לישראל* presents a qualified, conditional stance that parallels that of *b. Sukkah* 29a on astrolatry, in which maintenance of Divine protection is directly linked to the performance of the *mitzvot*.²¹⁶ In both parts, non-Jewish astrologers – i.e., magi – foretell death by snakebite, and in both, the doomed parties are saved by Torah observance. The interaction between Ablat, a non-Jew and presumably, an astrologer,

²¹⁵ Proverbs 10:2

²¹⁶ Gregg Gardner argues convincingly that the redactors emphasize the fact that without observance of the *mitzvot*, there is astrological influence upon Jews. (Gardner 2008, 338)

and Samuel, is particularly telling. Here, we read of Ablat's forecast, a caution and a challenge of sorts, which is followed by Samuel's statement, a line in the sand:

אי בר ישראל הוא - אזיל ואתי. אדיתבי אזיל ואתי.

If he is a son of Israel, he will go and come back.

Of course, the man does return, and is shown to have been protected by the *mitzvah* of preserving someone's dignity by pretending to take bread from him when he had none.

In part two, it is R. Akiva who is told by astrologers that his daughter will be bitten and killed by a snake on her wedding day. Unlike Samuel, R. Akiva is worried. However, she too is protected by performing the *mitzvah* of *tzedakah*, or charity. In both cases, we read the following regarding the power of obeying Jewish law:

וצדקה תציל ממות ולא ממיתה משונה, אלא ממיתה עצמה.

But tzedakah delivers from death, and not from an unusual death, but from death in itself.

In the case of both object lessons, astrological influences pale in comparison to the power of God and by the virtue associated with keeping the commandments transmitted and upheld by the rabbis. As Shai Secunda points out, this *sugya* might well “testify to an exchange of astrological and medical knowledge between rabbinic and non-Jewish cultures.” (Secunda 2013, 46) Indeed, as noted earlier, Jews may have learned the *Avesta* from Zoroastrian priests for magical purposes. If this is the case, Secunda concludes, this “would have been part of a wider phenomenon where magic and other sciences like astronomy, astrology, and pharmacology were being exchanged in the marketplace of ideas.” (Ibid.) Viewed in this light, the presence of Ablat and of the unnamed astrologers

in both parts of this object lesson is no great surprise. In each case, the non-Jewish magi present the deterministic viewpoint, which is that astrological influences are binding for all.

However, in their reinforcement of their deontic authority, and by extension, that of all Jews, the rabbis pull out virtue through obedience of Torah as the protective trump card against astrological determinism. Reiterating the view of Gregg Gardner, there is evidence that sections of this *sugya* were redacted to strengthen the presentation of God's rulership over the celestial bodies. (Gardner 2008, 325) The text also makes clear that Jews who do not follow the *mitzvot* have no immunity from the influence of the heavenly bodies. (338) Based on the pattern of exceptions to stringent controls in the texts, I would suggest that this may also have been a convenient means of justifying rabbinic interest and participation in activities marked as forbidden in the Sasanian world, while upholding both their immunity from *mazal* and their deontic authority linked to inheritance of the mantle of creation and Torah, as well as the fulfillment of the commandments.

4.3 Cosmogony: *Ma'aseh Bereshit* and Authority Maintenance

In the Bavli, the creation of the cosmos and humanity may be viewed as the ultimate deontic acts, establishing not only a celestial order, but its microcosm on Earth, with its template being the Torah, and the rabbis as its heirs and guardians. (Fine 1998, 527) Indeed, as previously noted, the persistence of creation is deemed to be dependent

on Torah study in *b. Nedarim* 32a, which the rabbis presented as being within their sole purview. This further demonstrates the role of the rabbinic station in keeping creation in motion, as presented in the Mishnah and Gemara spanning the domain of God's cosmogony and its secrets. Moreover, as the primary texts reveal, connected with this inheritance is a nexus of concerns including the recurrence of the theme of exceptions made to bans on learning controlled material for elite rabbis of deep understanding, and the primacy of ensuring that the honour of God is safeguarded by the rabbis.

Viewed in this light, it is little wonder that cosmogony, that is, the secrets of *ma'aseh bereshit*, is so very tightly controlled in rabbinic literature.²¹⁷ In *Gen.Rab* 10:7, the cosmogonic counterpart to the description of the astrological influence on the world seen earlier in 10:6, we read that even the most seemingly unimportant aspects of creation, such as insects, are part of God's greater purpose.

Following the admonitions in *m. Hagigah* 2:1 that the workings of creation, *Ma'aseh Bereshit*, must not be expounded before two people, "unless he is a sage and understands of his own knowledge," we read the following in the Gemara of *b. Hagigah* 11b:

אמרת ברישא ולא במרכבה ביחיד והדר אמרת: אלא אם כן היה חכם ומבין מדעתו
ולא במעשה בראשית בשנים מנא הני מילי? דתנו רבנן: (דברים ד') כי שאל נא לימים ראשנים - יחיד שואל, ואין שנים
שואלין. יכול ישאל אדם קודם שנברא העולם - תלמוד לומר למן היום אשר ברא אלהים אדם על הארץ. יכול לא ישאל
אדם מששת ימי בראשית
[. . .] מלמקצה השמים ועד קצה השמים אתה שואל, ואין אתה שואל מה למעלה מה למטה, מה לפניו מה לאחור

You say firstly: And not the chariot in the presence of one; and then you say: Unless he is a sage and understands of his own knowledge! And not of the workings of creation in the presence of two. From where (do we learn this)? (Deuteronomy 4) For the Rabbis taught: For asking of the days past; one may ask, but two may not ask. A person might think to inquire regarding the period prior to creation. Talmud teaches: From the day that God created man on the earth. A person might think that not inquire of the six days of creation

²¹⁷ Reiterating my explanation in chapter one, *ma'aseh merkavah* and mystical *topoi* will not be examined here.

[. . .] from one end of heaven unto the other you may ask, but you may not ask what is above, what is below, what is before, and what is after.

Of obvious import to the argument presented here is the abovementioned statement אלא כן היה חכם ומבין מדעתו, that is, “unless he is a Sage and understands of his own knowledge.” This is a clear statement of deontic authority established at the very outset of the discussion. It is also a show of control over access to knowledge marked as falling within the rabbinic domain, encompassing the pattern of ban and exception reminiscent of the rabbinic controls over magic noted earlier in this chapter. Indeed, the rabbis – particularly rabbis of prestige – are therefore specifically excluded from the ban against making these controlled inquiries into cosmogony.²¹⁸ Here, the demarcation between deontic and epistemic authority is finely nuanced. Whereas the realm of rabbinic knowledge is in itself epistemic, and the role of rabbis of such deep understanding is also in part, epistemic, here, it is the matter of control over access to the cosmogonic material that is of particular import, and that establishes a show of deontic authority in the texts.

Indeed, the exception for rabbis who understand their own knowledge, permitting them to delve into cosmogonic secrets, is exemplified by the well-known *sugya* in *b. Sanhedrin* 65b and *b. Sanhedrin* 67b, discussed within the context of permitted vs. forbidden magic. In this *sugya*, R. Hanina and R. Oshaya, who studied creation (i.e., הלכות יצירה in 67b; ספר יצירה in 65b) every Shabbat, are shown to use this knowledge to create a calf, which they then ate. Here, we see yet another example of the linkage between

²¹⁸ It almost goes without saying, then, that non-Jews, Pagans, and idolaters are banned from such inquiries in the text. As we read in *b. Hagigah* 13a, אין מוסרין דברי תורה לנכרי Here, the term נכרי in context, refers to a stranger, or non-Jew, who is not familiar with Torah. However, this is frequently translated as heathen or idolater.

magic and cosmogony.²¹⁹ Similarly, in *b. Sanhedrin* 65b, Rabba creates a man, and the text states that the righteous can be creators if they wish it.²²⁰

Presumably, the fact that such a dramatic act of creation through magic was permitted at all – creation being God’s territory – was a commentary on the deontic authority and stature of both R. Hanina and R. Oshaya, for there is no sign of censure in the text. Nevertheless, caution is expressed in *b. Hagigah* 14b in the story of the orchard, Pardes, for here, the dangers of inquiring into tightly controlled metaphysical knowledge is shown to be dangerous for even the greatest of scholars. In the story of Pardes, the special deontic status of R. Akiva is clearly highlighted, as he alone survives the experience of gazing – purportedly at deeply guarded Divine secrets.²²¹ Moreover, in *b. Hagigah* 14b, R. Akiva is not singled out for his knowledge, but, I would argue, for his great stature, emblematic of deontic authority. This is of particular import given his humble, unlearned origins, and his later status as one of the best known and most respected figures in rabbinic literature.

This reading is further supported by R. Akiva’s role as a comforter in both *b. Bava Metzi’a* 59b, where he is the rabbi chosen by his colleagues to try to calm R. Eliezer after

²¹⁹ This once again falls within the purview of ongoing debates regarding the definitions of “magic”, “science,” and “religion”, which frequently appear clustered together in the Bavli. For example, here, in 67b, cosmogony is discussed within the context of sorcery.

²²⁰ Creation may be viewed as the ultimate act of deontic authority. Here, it is notable that it is not knowledge, an epistemic marker, that serves as shibboleth allowing access to the secrets of creation, but virtue, a deontic marker.

²²¹ According to the account in the Bavli, four great rabbis enter the orchard of Pardes, Ben Azzai, Ben Zoma, Elisha Ben Abuya (Aher), and Rabbi Akiva. Upon gazing at mystical secrets, Ben Azzai dies, Ben Zoma loses his mind, and Aher is said to cut down his plantings (i.e., became a heretic). However, of the four, not only does R. Akiva survive the experience and leave in peace, but becomes the greatest rabbi of them all despite his origins as a simple shepherd – a deontic figure known for his virtue. The account is also found in *t. Hagigah* 2:2 and in *y. Hagigah* 2:1. The Tosefta frames the story as a commentary on pre-qualification to delve into Divine, esoteric knowledge.

his epistemic authority had been overturned, and in *b. Rosh HaShanah* 25a (*m. Rosh HaShanah* 2:8-9), where his appointed role is to serve as an emissary of deontic authority to comfort R. Joshua and reassure him after the parallel ordeal in which his calendrical and astronomical expertise is overturned in favour of the deontic, halakhic decision of R. Gamaliel. Read in this light, I suggest that the story of Pardes not only emphasizes the rabbinic admonition against peering into controlled knowledge, but perhaps most importantly, serves as a backwritten commentary marking R. Akiva as a special, deontic figure by virtue of his status as it evolved in the literature. In brief, he is shown to support the decisions of the head of the *bet din*, and as such, his presence in these *sugyot* is emblematic of the primacy of *halakhic* authority.

Having established the deontic nature of these rabbinic controls over access to cosmogonic knowledge, the question then becomes that of precisely what aspect of the material calls for control. The answer to this is articulated in *b. Hagigah* 11b, where the banned inquiries are shown to concern not creation per se, but the conditions existing beyond its boundaries, viz. *מה למעלה מה למטה, מה לפניו מה לאחור*, that is, what is above, what is below, what before, what after. This is to say that while cosmology and the existing workings of the universe may be studied, inquiry into preexistent matter and other topics that are the domain of God is curtailed.

In *b. Hagigah* 13a, we read about the process of delving into cosmogonic secrets more generally:

עד כאן יש לך רשות לדבר, מכאן ואילך - אין לך רשות לדבר, שכן כתוב בספר בן סירא: במופלא ממך אל תדרוש ובמכוסה ממך אל תחקור, במה שהורשית התבונן, אין לך עסק בנסתרות.

Until now you have license to speak, from now onward you have no license to speak. So it is written in the *Book of Ben Sira*: Do not seek out things that are too difficult for you, and do not seek out things that are hidden from you. Think about the things that have been permitted to you, (but) you have nothing to do with secret things.²²²

However, returning to *b. Hagigah* 11b, we read a far harsher admonition against delving into curtailed secrets, and the consequences for transgressing these tightly controlled realms of cosmogonic study:²²³

כל המסתכל בארבעה דברים, ראוי לו כאלו לא בא לעולם, מה למעלה, מה למטה, מה לפניו, ומה לאחור. וכל שלא חס על כבוד קונו, ראוי לו שלא בא לעולם:

Whosoever speculates about four things [. . .] he is viewed as though he had not come into the world [. . .] what is above, what is beneath, what before, what after. And whomever does not think of the honour of his maker, he is viewed as if he had not come into the world.

Here, the reason provided for not expounding upon *ma'aseh bereshit* is the vital importance of safeguarding the honour of the Creator by not peering too far into the forbidden territory of what came before the cosmogony of Genesis, that is, preexistent matter. Moreover, reiterating my point above, and in chapter one, a rabbi with great Torah knowledge and expertise would be marked as immune from the dangers of such inquiry; in brief, his epistemic authority and the deontic authority of his status would allow him to peer deeply without dishonouring God. As Philip S. Alexander has also demonstrated, by curtailing inquiry in *b. Hagigah* and adding polemical and explanatory

²²² Compare *Ben-Sira*, 3:19-24.

²²³ Also see *b. Hagigah* 12a, which details the creation of light by God on the first day, the luminaries having been set “in the firmament of heaven.” Here, R. Eleazer states that this Godly light was seen everywhere, but when the corrupt generation of the flood arose, God hid the light from them. Rather, he reserved it for the righteous. With respect to the *pasuk* “And God saw the light, that it was good,” the rabbinic hermeneutics here link this goodness with righteousness. The thematic linkage of the flood, righteousness, and light here is compellingly reminiscent of *b. Ta’anit* 23a, in which Honi is rewarded with light shining upon his paths, for he illuminated a corrupt generation that had been in darkness.

material in *Gen.Rab.* 1:1-8:1, unacceptable readings of creation could also be controlled by the rabbis. (Alexander 1992, 243) Moreover, this tight control may also have been formulated to prevent sectarian readings.²²⁴ (245) This too is inextricably connected to God's honour, as well as that of the rabbinic tradition that emphasizes the honour shown toward the rabbinic station itself.

The specific reference to dishonouring God by peering into the secrets behind creation is also reminiscent of several other *sugyot* in which transgression and public dishonour are underscored. In *b. Qiddushin* 40a, for example, as we have seen, we read that if one wishes to transgress the laws, for example, of idolatry, one should dress in black and travel elsewhere to sin. Here too, we read the familiar construction also found in *b. Hagigah* 11b, that with respect to a person who is careless of God's honour, it would be "a mercy if he had not come into the world." In *b. Ta'anit* 23a, the deontic pronouncement is made that were Honi not Honi, he would have been excommunicated, for else, the name of Heaven would have been "profaned" by him. In a similar vein, in *b. Shabbat* 75a, as seen earlier, we read that one who does not calculate the cycles and planetary courses to allow the rabbis to be seen as wise "in the sight of the peoples" should be socially shunned.²²⁵

²²⁴ On legal rulings and their relationship to the construction of sectarianism, see also Christine Hayes, 2011, "Legal Realism and the Fashioning of Sectarians in Jewish Antiquity" In Sacha Stern, Ed. *Sects and Sectarianism in Jewish History. IJS Studies in Judaica* 12. Leiden: Brill, 119–46.

²²⁵ Although it is not a celestial trope, we also see the importance of public observance and that which may be seen by others in *b. Eruvin* 69a-b, where we note the statement by R. Huna, "Who is regarded as an Israelite in *mummar*? He who desecrates the Sabbath in public."

In all of these cases, the matter of insulting or profaning God is shown to be critical, and by extension, we note that it is not only Divine honour that must be safeguarded, but the deontic authority and status of the rabbis. What is seen in public, both by the nations, and, one assumes, by the broader Jewish public, must be in accordance with *halakhab*, and through it, with the Torah blueprint established by God at creation. As well, in these cases, celestial *topoi* play key roles. Here, we note the ways in which the cosmic secrets underpinning creation are both closely guarded and reserved for the elite sages alone to contemplate and expound upon, and to thereby protect rabbinic tradition as well as its proprietary interpretations, its public image, and its honour.

4.4 Discussion: Celestial *Topoi* and Authority in the Bavli

As I have noted throughout this chapter, astrology, astral magic, astrology, and cosmogony are all embroiled in a similar discourse, with a great deal of thematic overlap. I have demonstrated with respect to calendar and related topics, the relationship of these *topoi* with the heavens, cosmogony, and God assigns them particular potency when serving as mediators and conductors of deontic rabbinic authority in the Bavli. I have also highlighted the pattern of the play (and show) of rabbinic control, a concern regarding the honour that must be shown to God, and by extension, to rabbinic scholars, and the stress in the Bavli, across all the celestial topics, upon maintaining a normative, rabbinic approach to these practices unless an exception to a controlled area such as astral magic, astrology, or cosmogony is granted to an elite rabbi. Such a rabbi is, generally speaking, a rabbi of high ranking (e.g., Honi, a strongly deontic figure by virtue

of his being), one who judges other magicians (e.g., members of the *bet din*), or knows of his own knowledge, and can hence peer into the secrets of cosmogony and what came before creation without dishonouring God in so doing.

The tightly monitored celestial topics in this chapter are, I have demonstrated, especially strong mediators of deontic authority, for they span the rabbinic self-presentation in the Bavli of controlling celestial domains related directly to God's Torah mandate. These include attempts to control Jewish involvement in astrolatrous practices, to ensure that any magical practices performed are done by the right people within a rabbinic – and not a Persian – context, to incorporate astrology into normative rabbinic practice in ways that support deontic authority and rabbinic destiny (e.g., the astrological forecast of the head of the *bet din*), and to carefully pre-qualify any rabbi – or follower – who would make inquiries into the most closely guarded realm of all – that of God's cosmogony.

Chapter Five: Conclusion

“For I suppose it is clear to everyone that astronomy at all events compels the soul to look upwards, and draws it from the things of this world to the other.”

-Plato, *Republic*, Book VII

5.1 Astronomy and Rabbinic Authority: A Summary

In this analysis, I have demonstrated that the play of authority within and surrounding celestial discourses in the Bavli tends to lean toward and reinforce rabbinic deontic authority within a carefully monitored set of halakhic norms, and minimize the influence of epistemic authority even when it is demonstrably accurate. This is the case in most discussions of rabbinic astronomy, calendar and related mathematics, as well as astrolatry, astral magic, astrology, and most remarkably, cosmogony. This demonstrated pattern also incorporates a strong trope related to maintaining the prestige and honour of rabbis, prioritizing service to Torah scholars over the study of Torah itself. Moreover, this trope also manifests itself in dramatic shows of authority, as noted in *b. Bava Metzi'a* 59b and *b. Rosh HaShanah* 25a, in which both of the rabbis who disagree with the deontic imposition of authority are not only overruled, but utterly humiliated. I would further speculate that these rabbinic self-presentations in the Bavli preserve the earlier Hellenistic strata in order to illustrate the ongoing importance of maintaining adherence to halakhic primacy and deontic authority in the Sasanian context as well.

As I have also shown, all of these celestial *topoi* ultimately stem and unfold from God's creation of the cosmos in the rabbinic imagination – a convenient and powerful trope used to reinforce deontic authority. The claim to deontic authority that looms large in the rabbinic imagination may be thematically traced back to the Hebrew Bible to the creation of the heavens and the Earth by God in Genesis (Bereshit), as well as the giving of the Torah and the authority to interpret it as bequeathed to the rabbis. Hence the tight controls over knowledge marked as *Ma'aseh Bereshit* as presented in *b. Hagigah* 11b-13a. Indeed, as Berger asserts, the authority of the rabbis was grounded in and ultimately predicated on this divine aspect. (Berger, 94) To this, I would also add that the creation of the heavens and the Earth was equally key to rabbinic attempts to consolidate, and later, reinforce, their elite status in the texts – particularly in the face of sources of celestial wisdom existing elsewhere in Jewish communities, and externally, in the Sasanian context. Hence, astral topics can be seen to be especially powerful mediators of deontic rabbinic authority by virtue of the rabbis' belief in their inheritance of the mantle of the cosmogonic Torah and its interpretation through time. This belief, and its implications for the history of the celestial sciences in Judaism, may be viewed first in the Roman context, in which the rabbis were first attempting to establish themselves as authority figures within Judaism. We also see it emerge in full bloom later, in the Bavli, our focus, in which the legacy of cosmogonic inheritance continues to reinforce the rabbis' presented interpretive and legislative authority over fellow Jews – and over each other – in the Sasanian context.

Although it is epistemic authority and scientific expertise that can best explain the workings of the natural world, the presentation of the interaction between epistemic and deontic authority in the Bavli and related literature tends to favour the latter simply by dint of the rabbinic station, even when the empirical data is correct, and the deontic pronouncements can be shown to be incorrect.

This pattern is especially potent when applied to elite rabbis presented in the texts – for example, Rabban Gamaliel, who overturns the epistemic authority of R. Joshua in *b. Rosh HaShanah* 25a and R. Joshua, who – in a role reversal – argues against the epistemic authority and expertise of R. Eliezer in *b. Bava Metzri'a* 59b. As I have demonstrated in my analyses of the primary texts related to the laws of nature and celestial topics, this is the case even when the empirical facts presented about the natural world are both crystal clear and factually correct, as in the example of R. Joshua in *b. Rosh HaShanah* 25a, presented above. Finally, this pattern is also notable when deontic figures are granted exceptions to the usual celestial rules.

As also noted in chapter three, this emphasis upon the deontic also extends, *ad absurdum*, to mathematics, which is downplayed and devalued in the literatures analyzed here in favour of the rabbinic emphasis upon halakhic topics more immediately relevant to the rabbinic project, including their consolidation of authority, including such matters as *kashrut*, bird offerings, and the laws of *niddah*.

As I demonstrate, compelling evidence exists for the presence of advanced mathematics in rabbinic milieus, as well as displays of awareness of Babylonian and

Greek science in the rabbinic texts at hand. This serves to further support my contention that lack of access was not likely at play in the presentation of a low degree of mathematical precision in early rabbinic texts, and extending to the Bavli. Indeed, despite the evidence for awareness of more sophisticated science and mathematics, *Mishnayot* elevating the deontic over the epistemic are discussed and debated in the Gemara but the Amoraim and redactors ultimately leave the tannaitic inaccuracies unchallenged. This allowed the pattern of epistemic devaluation to survive into the Bavli, an anthological work of the highest significance in rabbinic thought.

Indeed, this is a key devaluation for other reasons as well, for mathematics, emblematic of empirical and epistemic expertise, is vital to both the intercalation of the Jewish calendar and to the development of a fixed Jewish calendar. Without mathematical precision, there can be no calendrical evolution. It might even be surmised that this devaluation of the epistemic, including mathematics, may have played some role in the slowness of the progression toward the final form of the Jewish fixed calendar in the medieval period. This is a matter beyond the scope of this project, but is surely one that bears further examination.

Ultimately, what this trend toward epistemic devaluation leads to in the Bavli is the overarching sense that although celestial topics are of no small importance to the rabbis, they are presented in the texts in a way that serves to reinforce rabbinic status, but in effect, also diminish the importance and value of empirical phenomena and scientific expertise by placing these under the rabbis' authoritative control. So strong is this

presentation of rabbinic control that it extends to astrological forecasts to determine the fate of elite rabbis – that is, a projection of rabbinic control into Judaism as projected by the rabbis into the future. I submit that by presenting celestial *topoi* in this manner, the Amoraim and redactors of the Bavli unwittingly undermined the nature of scientific thought in rabbinic Judaism. Further, I suggest that this has continued to be an issue worthy of note in rabbinic sources that rely upon the Bavli as an inspired source for not only *halakhab*, but for scientific expertise as well.

Ultimately, however, as I also describe, it is the attempt to consolidate status in environments where rabbis were not the only purveyors of wisdom during the formative period of rabbinic Judaism that is at the core of these collective self-presentations in the texts. This self-presentation in the Bavli demonstrates the priority for the rabbinic authors and redactors to be perceived as masters of Jewish time (calendar), worship (astrolatry/astral magic), collective and individual destiny (astrology) and most of all, as the sole inheritors of the Divine cosmogonic project and its halakhic unfolding through time.

5.2 Minding the Gaps: The Celestial Sciences and Judaism

As I have demonstrated throughout this analysis, the celestial topics examined here are fluid and overlapping. When working with texts spanning the Late Antique sciences, there looms the ever-present risk of being drawn into anachronistic interpretations and projections. Once again, as the voluminous and sweeping scholarly

literature attempting to define, bracket, and qualify these terms reveals, this is also the very recipe for the dual pitfall of reification and anachronism.²²⁶

Owing to the inextricability of astronomy and other celestial *topoi* in the ancient context, I suggest that astronomy became embroiled in controversial discourses surrounding astrology, astrolatry, calendar, astral magic, and the bans on examining secret doctrines related to creation in rabbinic Judaism.²²⁷ In addition, these definitional quandaries are further compounded when one aims to establish fixed relationships between these moving definitional targets in an attempt to establish universal taxonomies of knowledge. This is a particular danger when such attempts are made without recourse to the specifics of given sociohistorical contexts, such as, for example, those of the rabbis of the formative period.²²⁸

An additional complication of the scholarly attempt to make sense of the members of these intersecting sets is a form of epistemic confusion by association that I refer to as *category ambivalence* – not merely the overlap of categories, but the natural consequence of the presentation of overlapping topics in the primary texts. The primary feature of this classification challenge is the conflation of topic B with topic A such that

²²⁶ Again we also see this overlap with respect to the terms “religion,” “science, and “magic”. Indeed, as Kocku von Stuckrad has described, sweeping definitions of certain terms including “Judaism,” “religion,” “astrology” and “paganism” among others, are best avoided in order to avoid anachronistically defining categories which are ultimately “hybrid, fleeting and dynamic.” (2011, 248-49) This notion with respect to ancient magical fields finds its parallel in the discussion and study of ancient science. On this topic, Reed writes that “it can be tempting to celebrate as ‘science’ those developments that seem to make ‘progress’ towards our own present. (Reed 2014, 214) As such, caution is the watchword when interpreting these topics through our contemporary lens.

²²⁷ Even calendrics was subject to being marked as containing controlled knowledge – e.g., *Sod Ha-Ibbur*, the secrets of intercalation.

²²⁸ Simply expressed, there is nothing fixed upon which to hang the heuristics.

topic B becomes embroiled in the discourse related to topic A. For our purposes, for example, B encompasses the discourse field of astrology and its inextricability from those of astral magic and astrolatry in antiquity, and A represents astronomy, calendar, and other epistemic elements of the set.²²⁹

In brief, as a result of these features, it is difficult to get a firm fix on clear definitions of these early scientific fields and their boundaries.²³⁰ This is evident when a discourse field such as that of the Jewish calendar becomes embroiled within the discourse about astrology or astral magic. For example, situated within the nexus of celestial concerns addressed in these pages, astronomy and astrology, rightly seen as astronomy/astrology in antiquity, share a tight field of interest, from Mesopotamia onward, such that there is simply no way to tease the *topoi* apart in a systematic or fixed manner. Therefore, their significant enmeshment poses special challenges for the reader. Such overlapping spheres are a given in the Bavli, and this is further compounded by the anthological nature of the Bavli, which, once again, does not present these topics in a systematic manner.

Moreover, as evidenced by the examples in the Bavli, where discussions of calendar or observation of the heavens are concerned, other celestial topics and the

²²⁹ This is in keeping with the helpful terminology of Von Stuckrad, who chooses to refer to certain Late Antique religious phenomena as magical “fields of discourse.” (2011, 249) As he expresses it, any attempt to create linear trends with respect to “the multiplicity of astro-magical perspectives in ancient culture” can only be considered “scholarly emplotment.” (248)

²³⁰ For further taxonomical approaches to related terms and discourses in religious studies, see Kocku von Stuckrad, 2011, *passim*; J.Z. Smith, “Religion, Religions, Religious”; Kocku von Stuckrad, 2010, *Locations of Knowledge in Medieval and Early Modern Europe: Esoteric Discourse and Western Identities*; Burkhard Gladigow, 2014, “Meaning/Signification.” In Kocku von Stuckrad, Ed. *The Brill Dictionary of Religion*. Brill Online. http://referenceworks.brillonline.com/entries/brill-dictionary-of-religion/meaning-signification-COM_00273 Accessed November 14, 2014.

threats they represent to rabbinic Judaism are not far behind, inviting the imposition of deontic authority in the form of the tight controls seen in the texts.

I further suggest, then, that the inextricability of astronomy and astrology may have caused practices that might now be bracketed as value-neutral to become embroiled in the controversial, overlapping discourses surrounding astrology, astrolatry, and astral magic in rabbinic Judaism, as well as the well-controlled topic of cosmogony. With respect to astronomy/astrology, then, category ambivalence imbues the former with some of the perceived dangers of the latter practice and its close cousins.

For example, rabbinic anxiety with respect to astrolatry that no longer existed within the aniconic Sasanian context is presented as a threat to deontic authority in the Bavli. While it is possible that this was simply a preservation of tannaitic concern in the text, I might also suggest the possibility that rabbinic concern regarding the threat posed by the magi and their astrological and magical teachings may have also been a factor. However, this is admittedly speculative.²³¹

Moreover, as discussed in chapter four, cosmogony and magic appear together in several *sugyot* in the Bavli – for example, in the creation of both a calf and a man, as attested in *b. Sanhedrin* 65b and 67b, by means of what might be seen as cosmogonic magic. Moreover, idolatry, the topic of the *ba'al ov*, magic, astrology and cosmogony are all broached within a single *sugya* in *b. Sanhedrin* 65a-b, are all broached within a few lines of each other. That Rabba, R. Hanina and R. Oshaya are not punished for these

²³¹ On this anxiety, also see Kalmin 2008, 641.

microcosmic acts of ritual cosmogony speaks to their exceptional, deontic status, resembling that of Honi in *b. Ta'anit* 23a. However, even in these cases, when dispensation is granted by the rabbis in the text, the reader nevertheless easily detects the dangers with which the otherwise banned acts are imbued, and the tension established in the *sugyot*.

We also note evidence for a shared discourse field with respect to *sugyot* that mirror each other, particularly with respect to polemic toward outsiders marked as idolaters. For example, in *b. Hagigah* 12b, where we note a telling cosmogonic parallel to the commentary on magic and astrology found in *b. Sotah* 12b, in which the magi gaze and predict without understanding. Another example of this trope may be found in *b. Hagigah* 12b, within the context of a cosmological description of the Earth resting on pillars, we read: "תניא, רבי יוסי אומר: אוי להם לבריות שרואות - ואינן יודעות מה רואות, עומדות - ואינן יודעות על מה הן עומדות." "It is taught: R. Jose says: Alas for people that they see but know not what they see, they stand but know not on what they stand." Further, in *b. Sukkah* 29a, we note the overlap of astrolatry with eclipses in astronomy, and the conflation of the sun, moon, and astrological signs in *b. Rosh HaShanah* 24b, *b. Avodah Zarah* 43a-b, and elsewhere. This is also notable in rabbinic texts that eventually made their way into later Jewish liturgy, such as the direction in *b. Berakhot* 59b to recite the *oseh ma'aseh bereshit* blessing upon seeing the sun, moon, stars, and *mazalot* in the sky. As such, one might be hard pressed to separate these parallel polemical statements into distinct "disciplines" as we know them today.

If we take as read the idea that such category ambivalence existed among the rabbis of Late Antiquity, we might also consider the doubly complex challenge faced by contemporary scholars attempting to interpret the texts to decipher the fuzzy boundaries of these celestial topics in the Late Antique context. Further, as Reed has rightly pointed out, anachronism is a danger when analyzing and writing about the ancient Jewish sciences. (Reed 2014, 218 *et passim*; Eadem 2007, 463) Moreover, avoiding such impositions of contemporary perspectives and assumptions is often easier said than done. Indeed, the mental apparatus through which scholarship must peer in order to carefully attempt to examine scientific topics with Late Antique eyes can only be adopted for so long before current ways of seeing begin to colour interpretations.

Added to this challenge is the fact that category ambivalence is, as I have illustrated, a cognitive, epistemological, and ultimately taxonomical challenge that persists in scholarship. It may be further detected when scholars understandably differ in their taxonomical interpretations based on the amorphous categories I have discussed. This is evident, for example, in the varying classification of astrology as divinatory, and divination as non-magical by Gideon Bohak, in contrast to other scholars including Von Stuckrad (i.e., 2011, 247, 251, *passim*) and Veltri (1998 “The Rabbis and Pliny”, 64) who classify astrology and divination with magic. Key here is that there is no single correct definition, as there is no litmus test to establish the correct taxonomies, nor can there likely ever be. With no consistent classification scheme, however, scholars will continue to employ divergent taxonomies for ancient science in their research.

Unfortunately, there are only two ways to avoid category ambivalence while also sidestepping anachronism and reification. One is to avoid attempts at establishing fixed, universal terminologies and taxonomies altogether. A second way – a corollary to the first – is to maintain a focus on the unique nature of celestial topics in their differing social and historical milieus.²³² For example, the emphasis of Kimberly Stratton upon the social construction of magic as supporting power structures, while existing within “a specific history and origin” (2012, 246-47)²³³

Nevertheless, with these taxonomical and resulting hermeneutic challenges in mind, the organizing principle of authority in these chapters has been useful, for by clustering celestial *topoi* together in this analysis, it is possible to somewhat sidestep the taxonomical concerns and focus on the prism of authority through which the *topoi* are seen. As such, the shared discourse field containing the play of celestial topics been well highlighted in this study, allowing for an in-depth analysis of the many ways in which these topics made themselves manifest in expressions of rabbinic, deontic authority in the Bavli.

5.3 Directions for Future Research

As Reed, Michael Swartz, Mladen Popović, and Helen Jacobus have each highlighted in various ways, there is compelling evidence suggesting points of continuity and interconnection between early Jewish and rabbinic celestial texts, with possible

²³² This includes astral magic.

²³³ Reed expresses similar cautions regarding the subtle distinctions between times, places, and terminologies. (2014, *passim*)

continuations into the medieval period. For example, Reed suggests the possibility that there may be points of continuity between Enochic and Qumran astronomy and cosmology and scientific rabbinic texts dating to the end of Late Antiquity.²³⁴ She further posits the possibility of transcending the scholarly tendency to examine scientific texts within the context of hermetically sealed periods in Jewish studies. (2014, 200) In brief, then, the emerging research in this area holds much potential for future creativity and generativity in rabbinic scholarship, and is suggestive of an emerging shift from exclusive to more inclusive and collaborative paradigms across fields and temporal periods.

With the interdisciplinary nature of the field of rabbinic Judaism and the history of the celestial sciences in mind, the material, and the field itself, would almost certainly benefit greatly from such a broadening of scholarly inquiry. Indeed, as John B. Carlson, David S.P. Dearborn, Stephen C. McCluskey, and Clive L.N. Ruggles point out:

Archaeoastronomy provides potential links between a number of other disciplines besides anthropology, archaeology, astronomy, and history. There are often individuals in the fields of religious studies, philosophy, and geography as well as in regional specializations, such as Near Eastern and Latin American studies, who have developed an interest in archaeoastronomy. Interdisciplinary collaboration leads to new perspectives, approaches, and methods that may impact upon broader topics in indigenous science, or even farther afield. (Carlson, Dearborn *et al.*, 12)

The lens of the play of epistemic and deontic authority is but one analytic framework through which we may view the astral sciences in rabbinic Judaism. The twentieth century and the first decade of the twenty-first saw the blossoming of Mesopotamian studies of the celestial sciences, spanning scientific traditions in the fertile crescent, cuneiform tablets attesting to omen series and celestial divination, as well as apotropaic

²³⁴ Reed highlights astronomical/astrological works from this later date, including *Baraita de-Shmuel*, *Pirke de Rabbi Eliezer*, and *Seder Rabbah di-Bereshit*. (2014, 199)

rituals to ward off celestial harm. Shifting laterally for a moment, the allied fields of archaeoastronomy and ethnoastronomy have also established themselves, with similar emphases on the celestial concerns and material culture of Mesopotamia, as well as Neolithic structures in the British Isles and Mesoamerica. Since the 1970s, much scholarship has been produced in these fields, which viewed together, represent an “anthropology of astronomy.” (Carlson, Dearborn *et al.* 1999, 8)

Given the burgeoning interest in the Jewish sciences and the publication of several key journal articles and volumes in the field from 2007 onward, it may yet be possible to begin to envision interested scholars allowing Jewish ethnoastronomy to shine its light upon the diverse and distinct Jewish texts and sociohistorical contexts of Late Antiquity. It is time to overturn old presuppositions regarding the limited nature of the rabbinic sciences and allow the Late Antique sources to both speak for themselves and shed new light on Jewish literature.²³⁵

²³⁵ I am indebted to Annette Y. Reed for her call for this renewed focus upon the ancient Jewish sciences as a way to overturn the dichotomies and allow the ancient scientific Jewish sources to illuminate the broader field of Jewish literature. (2014, 229)

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