

Rabbi David Friesenhausen's Zemirah for the Solar System

By: JEREMY BROWN

Although his work is not well remembered today, Rabbi David Friesenhausen (c. 1756–1828) was perhaps the earliest proponent of the modern *Torah im derekh erez* approach that advocated for a dual curriculum of Jewish and secular learning. He was also an emphatic exponent of the Copernican model of the solar system in an era when many Jews still preferred the geocentric model. Both of these facts are surprising since he was educated in traditional *yeshivot* until the age of thirty, and spent much of his life in a small and intellectually isolated town in northern Hungary. Despite his lacking a formal secular education, he taught himself mathematics and astronomy, and wrote on both subjects. Uniquely, he also composed a *zemirah* in praise of the sun and the beauty of the solar system. This paper will review R. Friesenhausen's life and his contribution as an observant Jew to astronomy and the debate over the truth of the Copernican model, and will analyze parts of his forgotten *zemirah* and its references to the solar system. In an increasingly fractured world, the works of R. Friesenhausen will be seen as a model of integration of science and religion.

Friesenhausen's teachers

David ben Meir Cohen was born in Friesenhausen, some sixty miles northeast of Frankfurt, around 1756, but was educated in the town of Fürth where he studied in what was then the largest yeshiva in Germany. Among his teachers were R. Pinḥas Horowitz and R. Natan Adler, who were also influential teachers of R. Moses Sofer,

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as well as R. Joseph Steinhart (c. 1705–1776). R. Horowitz was a staunch opponent of the Haskalah movement, but R. Steinhart was perhaps even more reactionary, criticizing not only the Sabbatian movement, but also both the Hasidim and those who would study secular books. In the introduction to his responsa R. Steinhart noted with sadness that the Hasidim “...with their customs and actions separate themselves from the holy congregation. They have regressed, turning most of their days into holidays, and whistling and groaning during their prayers...”¹ R. Steinhart was equally critical of those who studied anything other than traditional Jewish texts, and so was vehemently opposed to the study of secular philosophy and the natural sciences, which he characterized as “works of falsehood and stupidity.”² That R. Steinhart was so opposed to secular studies perhaps explains why R. Friesenhausen chose not to mention him in the books that he published, a move that was not typical of a student who would usually thank his teachers in print.³

It therefore comes as somewhat of a surprise to discover not only that R. Joseph Steinhart’s son Moses was the author of a work that praised Copernicus, but that the elder Steinhart wrote a glowing *haskamah* for the work, in which he congratulated his son for “...clarifying many problems of astronomy concerning the sun and moon, and the planets around the Earth.”⁴ This fact complicates

¹ Joseph Steinhart, *Zichron Yosef* (Fürth: Issac Buchbinder, 1773), second page of the unnumbered introduction. Shmuel Glick noted that as a result of these criticisms many copies of the book had this introduction torn out by angry members of the Hasidic movement (Shmuel Glick, *Kuntrot Ha-Teshuvot He-ḥadash* (Jerusalem and Ramat Gan: Bar-Ilan University, 2006). Vol. 1, 325.) However the bibliophile Dan Rabinowitz pointed out to me that in every copy of *Zichron Yosef* he has seen, the introduction was intact, which suggests that Glick may not be correct.

² Steinhart, pp. 1-2 of the unnumbered introduction. Steinhart does seem to approve of a brief study of some of these subjects “in order to know how to answer those who question us,” but his overall approach is clear.

³ Meir Gilon, “R. David Friesenhausen between the Enlightenment and Hassidism (Hebrew),” in *The Rabbinical Seminary of Budapest 1877–1977*, ed. Moshe Carmilly-Weinberger (New York: Sepher-Hermon Press, 1986) 22-23.

⁴ Ibn-Pakuda, *Hovot Ha-Levavot* (Fürth: Ḥayyim ben Tzvi Hirsch, 1765), 161. Gilon (22) states that the work contains the “earliest unequivocal ac-

any assessment of R. Joseph Steinhart's opposition to natural philosophy and secular knowledge. The book that the younger Steinhart published in 1765 was an edition of *Hovot Ha-Levavot* (*Duties of the Heart*), a popular ethical work by Ibn-Pakuda written in the late eleventh century. Moses' edition translated the work into Yiddish and contained an additional section at the end of the book entitled *Metaphysics*, written by himself, which he prefaced with a note "to you, my beloved reader":

I have pointed you to a number of natural and divine signs that suggest you should follow Copernican astronomy, that states the Earth is one of the planets that orbits around the constellations. Its revolution around its axis causes day and night... I am certainly well aware that if this work reaches those who have not been illuminated by the light of wisdom and who do not see her signs, they will laugh at me and consider me a fool...⁵

The style and choice of Moses' Yiddish text strongly suggests that it was adapted from a German source, although no such source is mentioned.⁶ For example there is frequent mention of the Latin term *ens entium*, meaning being of being, or essence of essence, which Steinhart translated into Hebrew as *yahid u-meyuhad*, or single and unique.⁷ The use of this phrase clearly demonstrates that despite his father's adamant opposition, Moses had studied secular philosophy. But if the reader of this edition of *Hovot Ha-Levavot* had wanted a detailed exposition of the Copernican system in Yiddish he would have been disappointed; Copernicus is not the central topic of *Metaphysics*, which focuses primarily on the four elements and the ability of reason to provide knowledge about them. But when mentioning Copernicus, Steinhart once again warns the reader not to be surprised:

ceptance of the Copernican model" in Jewish thought, a claim that is wildly inaccurate.

⁵ Ibn-Pakuda, *ibid.*

⁶ I am deeply indebted to Prof. Jerold Frakes of the University of Buffalo for these observations and for his translation of the Yiddish text.

⁷ Elmar Waibl and Philip Herdina, *German Dictionary of Philosophical Terms* (München, New York: K.G. Saur ; Routledge, 1997), 72. This phrase would later be used by Kant in his *Critique of Pure Reason*.

Many who are inexperienced in both sciences will be shocked, especially that I [verb omitted] the Copernican system (systemata copernicum) that the Earth is mobile and moveable, that is, it makes one movement around its axis day and night, and one in the zodiac around the sun, which determines the four seasons of the year.⁸

R. Friesenhausen, with his interest in science, would certainly have seen this work of Moses Steinhart, since it had been published in the same town as the yeshiva in which he studied. Whether this Yiddish text was responsible for kindling R. Friesenhausen's interest in astronomy, or merely provided confirmation for a worldview that had already been formulated, is not known, but with its publication Copernicus had entered Yiddish literature.⁹

First contacts outside the yeshiva

R. Friesenhausen married briefly in 1783, but divorced only four years later, and left the world of the traditional yeshiva for Berlin, where the early Haskalah movement was taking hold. He stayed in Berlin from about 1788 to 1796, during which time he was supported by Benjamin Halberstadt, one of the city's wealthy Jews, and it was in Berlin that he published his first book, *Kelil Heshbon* on algebra and trigonometry. The book made mathematics available to those who could read only Hebrew, and was an important addition to the works on secular subjects published by the Berlin *Juedische Freischule* and its printing house.¹⁰ Berlin should have contained all

⁸ Ibn-Pakuda, 161b. There is also another reference to Copernicus: "Since then according to the opinion of Copernicus all bodies—indeed also even our Earth—move. Thus the universal craftsman must of necessity have set such things in motion" (Ibn-Pakuda, 165a).

⁹ It is likely that this is also the first time that Copernicus is mentioned in Yiddish literature.

¹⁰ David Friesenhausen, *Kelil Heshbon* (Berlin: Hanoach Na'arim, 1796). The work is dedicated to Halberstadt. Although a mathematical book, it has three rabbinical approbations, including one (perhaps obligatory approbation) from R. Zevi Hirsch Levin, head of the Berlin *Bet Din*. A second edition was published posthumously in 1835 in Zholkva. *Kelil Heshbon* followed the general pattern of Hebrew works on mathematics, in that it

the elements needed to satisfy his inquisitive mind, a mind that was steeped in traditional Jewish learning but eager to expand and study wider non-Jewish culture. However R. Friesenhausen grew increasingly disenchanted with the members of the Berlin Haskalah, who he felt had rejected fundamental Jewish beliefs in God and the Divine authorship of the Torah.¹¹ Perhaps in reaction to this he left Berlin for Hunsdorf in the Carpathian Mountains of what was then northern Hungary. This town had a Jewish community that had been untouched by the Haskalah, and R. Friesenhausen served on its rabbinical court. But R. Friesenhausen found it difficult to make a living there, and in 1808 he moved again, this time south to Ujhely, serving on its rabbinical court as well.¹² There he came into close contact with Rabbi Moses Teitelbaum, founder of the first Hasidic dynasty in Hungary (and the great-great-grandfather of R. Yoel Teitelbaum, founder of the Satmar Hasidic sect). R. Friesenhausen spent eight years in Ujhely, during which time he observed that he did not like the Hasidim and R. Teitelbaum their leader. In later years R. Friesenhausen described R. Teitelbaum as being “proud and always chasing after recognition, who considered the great rabbinical leaders of our time as if they were nothing...”¹³

addressed religious questions. Another example was *Na'avah Kodesh* (1786). It also contained sections on geometry, but was essentially religious texts, being a commentary on Maimonides' *Laws of the New Moon*. *Sefer Elim* published in 1629 dealt with philosophy, science and astronomy, in addition to mathematics. Later mathematical works such as *Kanbeh Hochma* (Vilna 1829) also contained large sections devoted to religious questions or the explanation of Talmudic passages. One Hebrew work purely on mathematics that did precede *Kelil Heshbon* was *Meleket Makhshevet* by Elijah ben Moses Gershon Zahlin, published in Berlin in 1765. Even that work (in which mathematical principles are taught in answers to general questions) opens with mathematical problems found in the Talmud. For more on *Kelil Heshbon* see Abraham Tourgeman, “Matematika Ivrit Be'ivrit” (Hebrew), *Alon le-Moreh Matematika (Aleh)* 38 (2007).

¹¹ David Friesenhausen, *Mosdot Tevel* (Vienna: Anton Sharvit, 1820), 85b. Gilon, 23–26.

¹² The town of Satoraljaujhely is called Ujhely or Ihel in Hebrew.

¹³ Friesenhausen, *Mosdot Tevel* 77b-78a. After a long description of the way in which Teitelbaum produced amulets for the masses, R. Friesenhausen

In 1816, after eight unhappy years in Ujhely, R. Friesenhausen left in order to secure the publication of his second book, *Mosdot Tevel*.

Efforts to introduce a new curriculum into yeshivot

Before examining his *Mosdot Tevel*, it is important to note that R. Friesenhausen is probably best remembered (if he is remembered at all) for his attempts to introduce a new curriculum for the training of rabbis in and around Hungary.¹⁴ He dedicated a great deal of time and effort to this end, preparing a detailed curriculum in which some elements of secular study would be combined with the traditional study of Talmud and the codes of Jewish law. His goal was that all rabbis in the Hungarian empire would have to graduate

wrote, “I am concerned that such a person as this would be liable... as a false prophet” (Friesenhausen, *Mosdot Tevel* 79a). The animosity felt towards R. Teitelbaum was also personal, and this surely complicated R. Friesenhausen’s ability to remain objective. As a result of a *psak* issued by R. Teitelbaum, R. Friesenhausen lost a considerable sum of money, which both delayed the publication of *Mosdot Tevel* and was a severe financial setback. (See below p. 9 and the unpaginated “*Apology to my supporters*” at the opening of *Mosdot Tevel*.)

¹⁴ Friesenhausen, *Mosdot Tevel* 89a-90a. For an excellent analysis of R. Friesenhausen’s educational contributions see Gilon, and Shnayer Z. Leiman, *Rabbinic Responses to Modernity*, vol. 5, Judaic Studies (New York 2007), 22–32. Leiman concludes that R. Friesenhausen “won no friends, influenced few people, and spent a lifetime as a wandering Jew who was almost denied his rightful place—at the very least as a footnote in Jewish history.” Indeed R. Friesenhausen has been long overlooked; for example he does not appear in either Israel Zinberg’s twelve-volume *A History of Jewish Literature*, or in Feiner’s more recent work *The Jewish Enlightenment*. He is ignored in Levine’s review of Jewish reactions to Copernicus, Hillel Levine, “Paradise Not Surrendered: Jewish Reactions to Copernicus and the Growth of Modern Science,” in *Epistemology, Methodology, and the Social Sciences*, ed. R. S. Cohen and Marx W. Wartofsky (Dordrecht, Holland; Boston, U.S.A.: D. Reidel, 1983) and is mentioned in two short sentences in a paper by Panitz (Michael Panitz, “New Heavens and a New Earth”: Seventeenth- to Nineteenth-Century Jewish Responses to the New Astronomy,” *Conservative Judaism* 40, no. 2 (1988)). The *Encyclopedia Judaica* mentions him only in passing (in an entry on mathematics), whereas he surely deserves his own entry.

from his government-approved rabbinic schools. After several years of consideration by the Hungarian government, his proposal was rejected in 1813, after which R. Friesenhausen faced criticism from the spectrum of Jewish leaders. Those in the traditionalist camp viewed him as a dangerous reformer whose educational models would remove power from the traditional *yeshivot*, while those on the left viewed his reforms as not going far enough, since all but a few hours a day were dedicated to traditional Jewish study. Perhaps R. Friesenhausen was simply ahead of his time, for ultimately his notion of combining secular and religious study was embraced by others. For example R. Azriel Hildesheimer more successfully negotiated the political realities of his day and established a rabbinic seminary where the curriculum was very similar to that which had been proposed by R. Friesenhausen.¹⁵ An analysis of Friesenhausen's writings on astronomy reveals a similar story, of a rabbi whose thoughts would not be mirrored in the wider Jewish society for decades.

Mosdot Tevel

Mosdot Tevel had three parts; the first was a review of astronomy and a defense of the Copernican model, the second an explanation of Euclid's eleventh axiom, and the third an autobiography and ethical will.¹⁶ *Mosdot Tevel* is a historical treasure, containing not only an important analysis of astronomy from a rabbi steeped in traditional Jewish learning, but also a record of both his intellectual pur-

¹⁵ The Rabbiner Seminar für das Orthodoxe Judentum (known today as the Hildesheimer Rabbinical Seminary) was founded in 1873, and operated until 1938 when life in Berlin became intolerable for Jews. In June 2009 it ordained its first graduates since closing.

¹⁶ Euclid's eleventh axiom is more commonly referred to as his fifth postulate. It states that if a straight line crossing two straight lines makes the interior angles on the same side less than two right angles, the two straight lines, if extended indefinitely, meet on that side on which the angles are less than the two right angles. In *Kelil Heshbon*, his earlier book on mathematics, R. Friesenhausen had committed to publishing a proof of this axiom in German, but he failed to do so. He therefore returned to this subject in *Mosdot Tevel*.

suits and life for the Jews of Hungary at the start of the nineteenth century.

The importance of astronomy is clear from the title page of *Mosdot Tevel*. On it, R. Friesenhausen announced that part one of the book would outline “the structure of the universe according to Copernicus, and describe all of the new findings of contemporary astronomers by explaining their investigations and their proofs, or by using common sense, which any intelligent and non-stubborn person would accept.” Although there are two other sections in the book, astronomy is the subject matter of over half the book. R. Friesenhausen had spent many years writing and researching his subject, having produced a draft manuscript by 1798.¹⁷ But it took another twenty years until the book was published. As was common for those who wrote Hebrew books, the author had to obtain a list of subscribers who would commit to buying a copy of the work, and this took several years to complete.¹⁸ But even once R.

¹⁷ R. Friesenhausen obtained the approbation of Rabbi Meshulam Zalman Cohen of Fürth in early 1798 that was printed on the first page of the book. Cohen wrote that he had seen the manuscript called *Mosdot Tevel* “which the author wrote to understand the Laws of the Sanctification of the New Moon.” This misconception about the book’s content does not appear to have been the result of any duplicity on the part of R. Friesenhausen. Cohen wrote that he had not read it in any detail “because of my communal responsibilities and because I do not understand these subjects.” There are forty-two pages in the section on astronomy, nine in the section on Euclid’s axiom, and twenty-seven in the final section containing the author’s ethical will.

¹⁸ The list included Rabbi Moses Teitelbaum, who as we saw was intensely disliked by R. Friesenhausen (and was the object of a character assassination in the book), as well as Rabbi Moses Sofer. In addition there were over seventy chief rabbis who are listed as subscribers. The list of subscribers leaves us with an important historical record of who was interested in obtaining a work that would discuss the Copernican model of the universe. It contains almost one hundred and sixty towns and villages in which over eleven hundred men (and three women) had agreed to buy a copy of the book. This was a huge number, as will become apparent with some comparisons. Friesenhausen’s first book listed just sixty-eight subscribers, and a work on the natural sciences called *Limudei Ha-Teva* published in 1856 in Chernivtsi in the Ukraine (a work that was also pro-Copernican) listed only four hundred and fifty subscribers drawn from

Friesenhausen had obtained enough subscribers to ensure that the work was economically viable, he was unable to publish for a number of years owing to a series of economic misadventures. In 1817 R. Friesenhausen lost a significant sum in a complicated transaction based on wine futures—a loss that he attributed in part to the legal decisions of R. Moses Teitelbaum. Having recovered economically a year or so later, R. Friesenhausen learned that it was considerably cheaper to print in Prague, and decided to travel there in order to print the book. However the journey was dangerous for someone carrying large sums of money, and R. Friesenhausen left his money for safekeeping with a Rabbi Oppenheim in Vienna. This proved to be a bad decision. R. Oppenheim died suddenly while R. Friesenhausen was travelling, and R. Oppenheim's wife used the book funds to pay off the family's debts. As a result, R. Friesenhausen lost money a second time, and *Mosdot Tevel* ended up being printed in Vienna, where, in order to save on the costs of paper, a smaller than usual font was used. This historical accident, however, allowed the author to reveal the makeup of his intended audience. "I trust that the reader will not blame me for the few pages and the small print size. What does the print size really matter? After all, I have written the book for young people and not the elderly, for whom the small print would make it difficult for them to

thirty-seven towns and villages. *Shevilei Ha-Rakiyah*, on mathematics and Ptolemaic astronomy published in Prague in 1784, had ninety-four subscribers. Judging a book's popularity by the number of those listed as its subscribers is not an exact science. Not all books listed those who had agreed in advance to buy a copy, and perhaps not all authors relied on subscriptions in order to raise enough money to begin printing. In addition, some subscribers bought more than one copy; Baruch Lindau undertook to buy no fewer than thirty-two copies of Friesenhausen's first book *Kelil Heshbon* (which appears to be somewhat of a record). Some of those who subscribed did so on the condition of anonymity, and of course the author may have exaggerated the list in order to attract readers. It is also possible that not all those who subscribed understood the exact content of the work they had paid for in advance, although there is no evidence that this was the case. The lengthy list of subscribers to *Mosdot Tevel* may be an indication of the author's powers of persuasion and charisma, the nature of the subject matter, or some combination of both.

read.”¹⁹ R. Friesenhausen understood that the new astronomy (like his new educational curriculum) would likely not be well received by older, more conservative readers, but would have a greater appeal for a new generation of Jews.

Copernican astronomy in *Mosdot Tevel*

Perhaps the most striking feature of the section on astronomy in *Mosdot Tevel* is that this is a deeply religious work.²⁰ R. Friesenhausen frequently mentioned his belief in a benevolent God, and in many places this belief framed his discussion of astronomy. For example R. Friesenhausen suggested that life must exist on other planets in the solar system, “for why limit God’s glory, and suggest that He leave a large planet desolate and devoid of life?”²¹; elsewhere he suggested that new planets are likely to be discovered beyond Saturn, “for why limit God’s ability to create another planet or two?”²² There is barely a page on which a reference does not appear to God’s wisdom, mercy, and care for mankind, often woven seamlessly into scientific discussions.²³ Furthermore, the chapter on

¹⁹ See the mispaginated opening section of *Mosdot Tevel* entitled “*Apology to my supporters*” where R. Friesenhausen described in great detail how these economic catastrophes occurred—and how he was not to blame for them. It is certainly possible that Friesenhausen’s description of his target audience was a *post-hoc* justification. However there was no reason for him to have even raised the issue of the size of the print of the book were it not for the fact that it allowed him to reveal that his audience was a new generation of Jewish intellectuals.

²⁰ Henceforth we will reference the section on astronomy simply as *Mosdot Tevel*.

²¹ Friesenhausen, *Mosdot Tevel* 37a.

²² Friesenhausen, *Mosdot Tevel* 32b.

²³ By way of just a few examples: “The Creator, blessed be He, formed the Earth out of His kindness and His abundant goodness” (16b); “God has done great things...” (24b); “The Creator, blessed be He, made the heavens and all the stars, and the Earth, and formed them from nothing” (25b); “Any honest and sensitive person on the Earth cannot but give praise and thanks to His great name for the scope of His kindness” (35b); “We must thank God for the awesome size of His creation... and give Him praise and honor with all of our strength” (41b); “The existence of life is palpable evidence of a creator, blessed be He, above all else, and of

astronomy is broken up with a four-page poem, presumably written to be sung at the Shabbat table, describing in detail God's handiwork and the need to praise Him; we shall focus on this *zemirah* below. There is, then, absolutely no doubt that *Mosdot Tevel* is the work of a profoundly religious Jew.

In addition to his religious worldview, there is another feature of the work that is immediately striking, and this is the simple assumption that the Copernican model is correct. Although the title page states that the book will outline astronomy according to the Copernican model, this model is neither derived nor supported. Rather, it is a given that the author supports only in passing with but a single (and somewhat tangential) scientific fact.²⁴ The heliocentric model is described as being both more elegant and more accurate than the geocentric one, and with that the entire question of the movement of the Earth is settled.

If you were to place the Ptolemaic structure of the universe on one side of an intellectual scale and that of Copernicus on the other, and you were to understand the differences between the two systems in detail, you would see that the latter is superior to the former as gold is superior to copper. This advantage is both in terms of natural laws and in terms of beauty and elegance...²⁵

This acceptance of the Copernican model as a given is one of the earliest examples of its kind in Jewish literature. Until now, authors had felt it necessary to support (or challenge) the model using real or imagined experiments, as well as an array of biblical quotes.

His perfection (45b). See also 41a 42a, 43a, 43b, 44a-b, 45a-b, 46a-b, 48a-b, and the lengthy poem on God's wonders through Jewish history on pp. 48b-56b. The Shabbat *zemirah* he composed (39a-40b) is discussed in detail below.

²⁴ On 43a R. Friesenhausen describes the delay in the calculated times of the eclipse of the moons of Jupiter. This delay was due to the increased time it took light from the moons to reach the Earth when the Earth is at its furthest point from Jupiter. This observation was also among the earliest proofs that the speed of light could not be infinite. See Anton Pannekoek, *A History of Astronomy* (New York: Dover Publications, 1989), 256.

²⁵ *Mosdot Tevel* 37a.

For R. Friesenhausen, there was no need for any of this, and it was time to move on. Students looking for a work to explain *why* the Copernican model should be accepted would be disappointed, while those who wanted a Hebrew-language digest of astronomy without extraneous diversions would perhaps be rather pleased.

Although R. Friesenhausen viewed the Copernican debate as long settled, he did feel it important to explain why the study of Aggadah (rabbinic legends and stories) had no bearing on astronomy. Firstly, R. Friesenhausen repeated the story in which the knowledge of astronomy was divinely revealed and then passed down in a chain of traditional teachings.²⁶ However, this knowledge was lost when the Jews were exiled from their homeland, which resulted in a dilution of certain truths regarding the nature of the universe. Consequently, even when a Talmudic sage made a claim about astronomy, its truth was not to be taken as granted. “I am often unsure,” R. Friesenhausen admitted, “about certain Talmudic statements (like that in *Betzah* 4b, “now we are expert in the phases of the moon”). I don’t know if this knowledge was part of an unbroken tradition, or was discovered through careful study, or perhaps was learned from gentiles who were expert in these matters.”²⁷

Secondly, there was a plethora of conflicting aggadic statements found in the Talmud that may be interpreted in any number of ways. Some of these interpretations would put these statements at odds with modern astronomy, while others would make them seem in perfect harmony. All of this led R. Friesenhausen to conclude that

one should not contradict a well-established principle of astronomy on the basis of any aggadic statement, so long as the principle is well founded, logical and in keeping with observations of the movements of the stars. Even though texts describing the days of creation are founded in holiness, and hint at the most lofty and sublime ideals, most Jews cannot understand them. Their meaning has only been revealed to those with spe-

²⁶ For a detailed examination of this legend see Abraham Melamed, *Rekochot Vatabachot (The Myth of the Jewish Origins of Science and Philosophy)* (Jerusalem: Magnes Press, 2010).

²⁷ Friesenhausen, *Mosdot Tevel* 18b-19a.

cial qualities. Consequently these texts can never be used to challenge a single fact of astronomy.²⁸

As R. Friesenhausen understood things, even though long ago the rabbis once understood the nature of the universe, they could no longer do so on the basis of any type of religious study. Consequently, the entire enterprise of explaining how biblical texts could be reconciled with astronomy was pointless, and “any matter that does not contradict the written or oral law should be decided by logic alone.”²⁹ This was a radical separation of religion and science that had not been formulated before, and it would imply that those Jews who had accepted the Ptolemaic model—including Maimonides and later the kabbalists—had been mistaken. This suggestion might have troubled those who saw kabbalistic teachings as in some way exempt from the general theory of exile causing the Jews to lose their divinely given wisdom. But R. Friesenhausen suggested that the acceptance of the Ptolemaic model and its frequent representation in kabbalistic works was entirely accidental, and occurred because that model was the only one available at the time. “Had the contemporary model of the universe become known during their time, they would have rejected Ptolemy and agreed with the model we have today, for this model is of no consequence to the understanding of kabbalah.”³⁰

Of course the suggestion that logic and the powers of rational argument alone should settle any dispute that does “not contradict the written or oral law” does not immediately suggest that scientific matters are no longer under the jurisdiction of a religious worldview. In order for that to occur it would also need to be clear that the written and oral law—the Torah and the Talmuds—were not at odds with whatever issue was being debated. The problem was that some ways of reading the Bible indeed suggested that the Earth was motionless. R. Friesenhausen glossed over this rather important point, preferring instead to outline in broad strokes how a religious Jew might accept modern scientific statements. Neither

²⁸ Friesenhausen, *Mosdot Tevel* 19a.

²⁹ Friesenhausen, *Mosdot Tevel* 23b.

³⁰ Friesenhausen, *Mosdot Tevel* *ibid.*

was he concerned that there remained large gaps in the scientific corpus in general and in astronomy in particular. “Even though we do not yet know of the law that describes the orbits of the planets, and we do not have precise measures of the periods of their orbits, soon these things will be known to our children and grandchildren.”³¹ The scientific practice of astronomy was a young discipline and there was much that remained to be discovered. “The principles that were established over two hundred years ago were not precise and cannot be used to build a foundation of accurate observations for today... But if our descendants carefully follow the footsteps of those who went before them, the work will be much easier, and they will discover and publicize all of these [scientific] laws.”³² *Mosdot Tevel*, then, was a deeply religious work that managed to invoke the Divine and also suggest a radical separation of what Stephen Jay Gould would later call the two magisteria of science and religion.³³

Friesenhausen’s observations of general astronomy

As a work of science, *Mosdot Tevel* was more or less up to date, and provided the reader with an outline of the outdated Ptolemaic model, the accepted Copernican one, and the sizes of the planets and the characteristics of their orbits and moons. R. Friesenhausen enthusiastically shared the news of the discovery of what were thought to be two new planets in 1801 and 1802. These planets, named *Ceres* and *Pallas*, were given delightful Hebrew names by R. Friesenhausen, but about fifty years later were re-classified as asteroids.³⁴ R. Friesenhausen also described the discovery of Uranus by

³¹ Friesenhausen, *Mosdot Tevel* 45a.

³² Friesenhausen, *Mosdot Tevel* 45b.

³³ Stephen Jay Gould, *Rocks of Ages: Science and Religion in the Fullness of Life* (London: Vintage, 2002), 1–10.

³⁴ R. Friesenhausen named them *Ze’iri* (“The Younger One”) and *Pilai* (“The Amazing One”). See Pannekoek, , 352. The notion that asteroids may be mistaken for planets is of course well known to any modern reader; in August 2006 Pluto, formerly the outermost planet in the solar system, was downgraded and re-categorized as a dwarf planet by the International Astronomical Union.

Herschel, the nature of comets in general and Halley's comet in particular, and Kepler's Third Law of planetary motion. He also mentioned the kilometer as a unit of measure, making him perhaps the first rabbinic figure to do so,³⁵ and supported the notion of there being life on other planets within the solar system, using as we noted earlier an argument based entirely on his religious beliefs—"for why limit God's glory, and suggest that He leave a large planet desolate and devoid of life?"³⁶ It is also interesting to note that he despaired of the ability to observe any planets orbiting remote stars "even if the telescope was improved many times over compared with that of today," a pessimistic forecast that turned out to be quite wrong.³⁷

Reflecting his profound faith, R. Friesenhausen reworked the argument raised by the geocentrists that since God created the universe for humanity, it was only fitting that they live on a planet at the center of that universe.

Now pay attention to this, look to the skies and you will see God's great works... This planet Earth is tiny and inconsequential, and it is lost among the infinite number of planets. But your soul should rejoice at God's creation, and your tongue should praise His righteousness. For among all of these creations He chose Israel on this tiny dot, and made them holy with His holiness. He gave them His holy and pure Torah with its just laws, and called them "My firstborn children" in order that He dwell with them forever.³⁸

This geocentric argument from symmetry had been argued before, and would be articulated sixty years later by Rabbi Reuven

³⁵ Friesenhausen, *Mosdot Tevel* 31a, 32a-b and 33a. The kilometer is mentioned on 34a. In the discussion of Halley's comet, Friesenhausen's date of its appearance in 1749 and calculated reappearance in 1824 are incorrect. The comet actually appeared in 1759 and 1835.

³⁶ Friesenhausen, *Mosdot Tevel* 37a.

³⁷ See for example John Noble Wilford, "2 Sightings of Planet Orbiting a Sunlike Star Challenge Notions That Earth Is Unique," *The New York Times* 1995, Section A, 21. Since then over five hundred extrasolar planets have been discovered.

³⁸ Friesenhausen, *Mosdot Tevel* 43b.

Landau.³⁹ The fact that the Earth's position was neither central nor important would, so it was feared, lead to the conclusion that humanity was utterly unimportant and alone, drifting on an insignificant planet. The astronomer Carl Sagan expressed exactly this in his book *The Pale Blue Dot*, which was also the title of a famous picture taken—at Sagan's suggestion—by pointing the camera on Voyager 1 back towards Earth as the spacecraft sped beyond Saturn. At this distance the Earth would appear as just a point of light, but, thought Sagan,

...precisely because of the *obscurity* of our world thus revealed, such a picture might be worth having... Our posturings, our imagined self-importance, the delusion that we have some privileged position in the Universe, are challenged by this point of pale light. Our planet is a *lonely speck* in the great enveloping cosmic dark. In our obscurity, in all this vastness, there is no hint that help will come from elsewhere to save us from ourselves.⁴⁰

R. Friesenhausen, writing close to two centuries earlier, turned this existential fear of insignificance on its head. Although the Earth was tiny and seemingly inconsequential, God had chosen to give the Torah to those who inhabit it, and this restored humanity to a place of importance. But although this might save the reader from despair, R. Friesenhausen cautioned against any form of spiritual arrogance:

How could you believe that the universe was created only for mankind who live like lowly worms on the surface of this tiny dot? And when the Rabbis stated [that the world was only created] for the sake of Israel and the Torah... this means that through the merit of the Torah and Israel who observe it were

³⁹ See Jeremy Brown, "Rabbi Reuven Landau and the Jewish Reaction to Copernican Thought in Nineteenth Century Europe," *The Torah u-Madda Journal* 15 (2008-9), 112-142. For an earlier formulation of this argument see Pinchas Hurwitz, *Sefer Ha-Berit* (Brno: Issac Carl Neiman, 1797), Part one, #3:3.

⁴⁰ Carl Sagan, *Pale Blue Dot: A Vision of the Human Future in Space* (New York: Random House, 1994) pp. 2 and 7, emphasis added.

all the worlds and their inhabitants created, so that God may do good to them all, together with doing good for Israel.⁴¹

R. Friesenhausen's *Shabbat Zemirah* in honor of the solar system

While Gustav Holst composed the only example of a symphonic tribute to the solar system, David Friesenhausen wrote what is likely to be the only *zemirah* (a song composed to be sung during one of the three Shabbat meals) written on the same subject.⁴² R. Friesenhausen placed the *zemirah* after his discussion of the nature of the solar system, for an understanding of its vastness and beauty could only lead to a deeply religious response.

Now I have briefly explained the solar system as it is known to contemporary scientists. They have taught new concepts that earlier *Hakhamin* could not have even imagined. So I will sing to God a new song and praise to our Master; not because He is great and exalted, but because praise is due to Him... but we cannot approach even a fraction of His true praise...

R. Friesenhausen appealed to the reader to grant him some leeway should his *zemirah* inadvertently break a rule of musical composition. "For I am not a singer, and if I have transgressed, please

⁴¹ Friesenhausen, *Mosdot Tevel* 45b. R. Friesenhausen is referencing a homiletic commentary of Rashi on the very first verse of the Bible, in which two *midrashim* are combined:

In the beginning (*be'reshit*) God created the heaven and the Earth (Genesis 1:1) ...God created the word for the sake of the Torah which is called "The beginning (*reshit*) of His way" (Prov. 8:22) and for the sake of Israel who are called "The beginning (*reshit*) of His increase" (Jer. 2:3).

Since this is part of the commentary on the first verse of the Bible, it was among the best known of Rashi's exegetical statements. This fact was not lost on R. Friesenhausen, who clearly understood how it could be used to support the notion that all of creation existed to serve mankind. It is for this reason that he offered his own different account of Rashi's meaning.

⁴² For more on Holst see Dava Sobel, *The Planets* (New York: Viking, 2005), 161–176. The song is found on 39a-40b of *Mosdot Tevel*.

grant me atonement, just as God would grant atonement for your own transgressions, should you, like me, be in error.”⁴³

As is well known, the daily prayers make many references to the sun, planets and stars. Less well known are the large number of *piyyutim* that were written about the stars and planets. For example, Yannai (c. 7th century CE) referenced the planets in his *piyyutim* for *Bereshit*, *Tezaveh* and *Beha'alotecha*, and Yehuda, a poet from the 6th-7th century CE, described the planets in his *piyyut* written for Chanukah.⁴⁴ It was perhaps in this tradition that R. Friesenhausen penned his poem. (The full text and translation is available at www.Hakirah.org/Vol14BrownAppendix.PDF.) What follows is an analysis of some of its content and references.⁴⁵

Analysis of the *Zemirah*

In the opening verse of the *zemirah*, R. Friesenhausen outlines the religious impetus for studying astronomy. Man was created with the ability to acknowledge his creator, an act usually accomplished through the contemplation of God's works on Earth. However, observing the stars and planets at night adds another level of appreciation of God's universe, and allows the observer a religious dimension that would otherwise be missing. Indeed, R. Friesenhausen suggests that acknowledging that God is the Creator of everything can be done only by literally observing everything that God has created. The first verse ends with an introduction to the refrain “On this Sabbath day of rest...” and references the blessing found in the daily *shaharit* prayer service that introduces the blessings of the *Shema*: “Blessed are You... who forms light and darkness, makes peace and *creates everything*.”

Observation begins with that which is closest, and in the second verse it is the wonders that are apparent on the Earth itself that R.

⁴³ Friesenhausen, *Mosdot Tevel* 39a.

⁴⁴ For details see Reimund Leicht, “Planets in Ancient Hebrew Literature,” in *Giving a Diamond: Essays in Honor of Joseph Yabalom on the Occasion of His Seventieth Birthday*, ed. Wout van Bekkum and Naoya Katsumata (Leiden & Boston: Brill, 2011), 36.

⁴⁵ I am grateful to Rabbi Amnon Haramati for his help with the translation, but any errors are the author's responsibility alone.

Friesenhausen first brings to our attention—"the wild animals of the forest, livestock, small creatures and birds" whose creation is remarkable. The nature of the secrets that the animals and birds reveal is not clear, but contextually the author is suggesting that the secret is the glory of God being the creator. But observation of creatures close at hand is not enough, and the task now turns heavenward. R. Friesenhausen points out in the third verse that meaningful observations of the stars and planets require "wisdom and knowledge." There are two likely reasons for him to have issued this reminder. The first is a reference to the Talmudic statement commenting on the verse in Deuteronomy (4:6) "for it is your wisdom and understanding in the eyes of the nations." The Talmud (*Shabbat* 75a) comments, "what would the other nations of the world consider to be wisdom and understanding? Surely this would be calculating the seasons and the constellations." A second reason also presents itself though, and this would align with R. Friesenhausen's motives for writing the section on astronomy in *Mosdot Tevel*. Historically, although the heavens were closely observed, an entirely inaccurate picture was created in which the Earth lies motionless at the center of the universe, with the sun and planets revolving around it. This model, the Ptolemaic, accords with simple observations of the sun rising and setting, but did not explain other phenomena, such as the retrograde motion of the planets. The Copernican model, later refined by Kepler who demonstrated that the planets moved in elliptical and not circular orbits, gave an entirely different explanation for the same observations. Friesenhausen reminds those who would sing his *zemirah* that some observations require novel explanations, and astronomy must be undertaken with reverence, using the very best intellectual skills with which we have been endowed. Indeed it is only after undertaking the required intense observations that the correct deductions will be made. "Then," he continues, "our lips will be filled with laughter and our tongues with praise..."

In the fourth verse, R. Friesenhausen poetically expresses the realization that the new astronomy of the heliocentric system may result in humanity expressing an existential despair, when they realize that the Earth is not the center of the universe. R. Friesenhausen's expression of humility "From the depths of my

lowly position, from a dark and gloomy land” was later echoed by the great expositor of astronomy Carl Sagan: “Our planet is a *lonely speck* in the great enveloping cosmic dark.”⁴⁶ But while Sagan reacted to this reality with the depressing conclusion that “there is no hint that help will come from elsewhere to save us from ourselves,” Friesenhausen made the opposite inference: Writing in *Mosdot Tevel*, he encouraged his readers not to share in the gloomy loneliness that might envelop humanity. “But your soul should rejoice at God’s creation, and your tongue should praise His righteousness. For among all of these creations He chose Israel on this tiny dot...”⁴⁷ The fifth verse poetically echoes this sentiment. Everything that God created is for “the enjoyment of mankind, and of all the creatures that have life.” Although we do not live at the center of the universe, God has created a solar system for the benefit of mankind. This system depends on the sun as the source of power, light and energy. Without the sun “...all vegetation would wither and return to dust dried out, and the land would be a desolate wilderness.”

The eighth verse is a poetic description of the structure of the solar system, based on the Copernican model with the sun at the center. The Earth, therefore, is described as “the third planet,” for it is the third planet from the sun, after Mercury and Venus. In 1801 and 1802 two new objects that were thought to be planets were discovered in the solar system. Named *Ceres* and *Pallas*, they lay between Mars and Jupiter. Both were reclassified as asteroids after the discovery of many more objects like them in the vicinity that is now called the asteroid belt. Friesenhausen named them *Ze’iri* (“The Younger One”) and *Pila’i* (“The Amazing One”), which was also an alliteration of their scientific names, *Ceres-Ze’iri* and *Pallas-Pila’i*. Beyond Jupiter and Saturn is *Timna’i* (literally, “The Eighth”) which is the planet Uranus discovered by Herschel in 1781. In *Mosdot Tevel*, Friesenhausen explained that he categorized *Ze’iri* and *Pila’i* (as well as two other newly seen planet-like objects) together as one “for they all lie at almost the same distance from the sun, and they are much smaller compared to the other planets... perhaps

⁴⁶ Sagan, 7, emphasis added.

⁴⁷ Friesenhausen, *Mosdot Tevel* 43b.

long ago they were one single planet that split into four parts at the will of their Maker...”⁴⁸ The words in verse nine are spoken by these newly discovered planets, which, although younger and smaller than the others, “were created by the same Creator.” These newly discovered tiny planets call to the others to be considered as worthy, for despite their diminutive size, “our greatness is as great as is yours,” and they were overlooked only because of “the blindness of people,” that is, the inability of mankind to see them without telescopes. The source of the Hebrew word טפחה (here meaning spanned) might easily be missed, but R. Friesenhausen chose it carefully, for it is found in a verse in Isaiah: “My hand has also laid the foundation of the Earth, and My right hand has spanned (טפחה) the heavens; I call to them to stand together.”⁴⁹ The plea is thus all the more meaningful when contextualized by the verse in which all the planets are called “to stand together.”

Having made the case for the newly discovered planets to be acknowledged and given their rightful place within the solar system, the *zemirah* returns in verse ten to sing the praises of the sun. All the planets orbit the sun, and so see both its “front and back,” and all are utterly dependent on it to obtain warmth and light. Without the sun, “everything would be covered with ice and frost,” and so it is fitting that God be thanked for this great creation. The next verse describes a different object in the night sky, but one that has been the subject of a great deal of interest. R. Friesenhausen describes comets that circle the sun due to its gravitational force as “being captured in the sun’s net.” Comets are described as objects of beauty (יפה פירות), and Friesenhausen uses a poetic phrase to describe a feature of their appearance: “their face is turned towards your face and when they leave they go backwards.” This description suggests the comet paying deference to the sun as a loyal subject defers to her king by not showing her back to him. The simile has a scientific explanation. As a comet races towards the sun, the head of the comet, which consists of frozen minerals and gases, is warmed, and as a result some of the gases evaporate. This is the cause of the tail of the comet that may be seen. Once the comet orbits the sun and heads

⁴⁸ *Mosdot Tevel* 29b.

⁴⁹ Is. 48:13.

back out of the solar system, the sun still causes the production of gases, but these are now thrust in front of the head of the comet by the solar wind. And so it is that the head of the comet always faces the sun, or, in Friesenhausen's words, "their face is turned towards your face and when they leave they go backwards."

In the next two verses the sun is asked to praise God for having been placed in a position of power, "ruling over many nations." In a footnote R. Friesenhausen explained that this refers to "the creatures that live on each of the planets."⁵⁰ The association of the planets with the sun in the heliocentric system is emphasized, for all the planets "follow your light... to be associated with you forever." The final two verses focus on the original meaning of the Sabbath as a day on which divine creation came to an end. God reminds His creations that "everything was made by My hands, and they should trust and look to Me." The last three verses make reference to three kinds of angelic or heavenly beings, Seraphim, Ophanim and *Hayot*, which are also referenced in the *shaharit* service on the Shabbat.

Conclusion

R. Friesenhausen ended his review of astronomy with a return to the theme of the special role that the Jewish people play in the universe. God had chosen to give the People of Israel "His pure Torah and mitzvot, and His laws and just statutes." Then R. Friesenhausen went on to remind the reader that among the Jewish people the *Kohanim* or priestly class had a special role to play: "He appointed the *Kohanim* to serve Him. They would admonish the people if they wandered from the good path, and they would atone for their sins and transgressions. They would correct the people with kindness and great gentleness as a parent reprimands his child, so that they would return to Him with a whole heart."⁵¹ This detail of the role of the Kohen as a spiritual beacon seems out of place here, until we remember that R. Friesenhausen was himself a Kohen. Bearing this in mind, the closing paragraph is perhaps the

⁵⁰ See *Mosdot Tevel*, 40a footnote 3.

⁵¹ Friesenhausen, *Mosdot Tevel* 48b.

author's reminder—either to himself or to his readers who understood the allusion—that his role was to ensure the correct beliefs and actions of his fellow Jews. In this context it is striking that this reminder came not in a work of traditional textual commentary or exegesis, but rather at the end of a primer on astronomy, and demonstrates once again the importance with which R. Friesenhausen saw his educational task. R. Friesenhausen had worked for years—in vain as it turned out—to promote a dual curriculum for rabbinic students, and his enthusiastic promotion of the new astronomy faced an uncertain and perhaps similar future, because the notion that Copernican thought would destroy the traditional Jewish worldview was still considered to be very real. His poetic contribution was a reminder not only that it was possible for a religious Jew to sing to God about creation and science, but that only when contemporary science was incorporated into religious liturgy could God's praises most eloquently be expressed. ❧