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Author(s): André Neher

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COPERNICUS IN THE HEBRAIC LITERATURE FROM THE SIXTEENTH TO THE EIGHTEENTH CENTURY

BY ANDRÉ NEHER

The study of the place occupied by Copernicus in the Hebraic literature of the sixteenth century to the end of the eighteenth century is interesting not only in itself but also through its repercussions for the problem of *religious tolerance*, one of the principal consequences of Copernicanism during this period. The data presented here will be useful towards yielding definitive conclusions obviously only if considered against the background of the evolution of Copernicanism in non-Jewish European thought. It would take us too far afield to trace all of this evolution. Let us limit ourselves to the data.

In 1612, a book on astronomy appeared in Prague: *Magen David* (*Shield of David*). It is the first Hebrew book in which Nicholas Copernicus is mentioned.¹ The author, David Gans, expresses himself in terms we cannot be content with describing as positive; they are in fact superlative and even dithyrambic.

Seventy years ago there lived a man called Nicholas Copernicus, a scientific genius, surpassing all his contemporary scientific astronomers. It was said of him that nobody since Ptolemy had been his equal. He has scrutinized the positions and movements of the planets and stars with meticulous precision and, in order to solve the innumerable and complex problems raised by these data, in order to penetrate especially the causes producing all these movements and their contradictions, he has judged, declared, and made every effort to demonstrate with exceptional elevation of mind that the spheres (of the stars) are absolutely fixed and that it is the terrestrial sphere which brings about the effect of a continuous motion around them. He devoted to this demonstration a great book filled with a profound and boundless intelligence. A great many of the most eminent scientists of our time have expressed their complete agreement with his theories. I present this fact in order to bring home the idea that we are far from admitting that everything related to the motion of the stars and planets is in absolute conformity with what the astronomers of antiquity have said about it. No, in this domain, the human mind is completely free to discover the theory which seems to be in conformity with its own logic, provided that this theory offers a reasonable explanation of the paradoxical movements of celestial bodies. . . .²

In 1629 there appeared in Amsterdam the second hebraic book mentioning Copernicus: *Elim*. The author, Joseph Salomon Delmedigo,

¹No less than explicit mention, for Copernicus is mentioned implicitly by the Maharal of Prague (1595 ff.), but under the anonymous "teacher of the new astronomy"; cf. note 7 below.

²*Magen David* (Prague, 1612), folio 3.

declared in it, without beating around the bush, that the proofs of Copernicus are convincing and that "anyone who refuses to accept them can only be classed among perfect imbeciles."³

Let up keep well in mind these two dates: 1612 and 1629. The first marks the very year in which the Holy Office set in motion the process which placed Copernicus's book on the Index in 1616. The second precedes by a year the miserable death of Kepler to whom the Holy Sacraments were refused. It coincides with the beginning of Galileo's trial which was to end in 1632 with his notorious retraction. This official intolerance stands in contrast to the bold Jewish affirmation that "the human mind is completely free to discover the theory which seems to it to be in conformity with its own reason." What superb confidence in this domain with regard to the "imbeciles" who refused to accept the theories of Copernicus!

We must emphasize strongly that Gans and Delmedigo are not outsiders in their Jewish community, or irresponsible critics who cannot be invoked as testifying for the authentic spirit of the Judaism of their time.⁴ First of all, though they are both astronomers and humanists (Gans a historian and Delmedigo a physician), they both proudly bear the title of Rabbi, acquired in the most celebrated Yeshivas (Cracow, Candia, Constantinople, Lublin); Delmedigo, moreover, performed for a certain time the functions of a Rabbi in Hamburg and Amsterdam. Consequently, their books appeared with the customary guarantees: approbations emanating from the pen of religious authorities of the highest level. Gans's book bears three eulogistic introductions, one by Rabbi Ephraim Luntzitsch, who in 1604 succeeded Maharal as Grand Rabbi of Prague; another by the famous disciple of Maharal, the commentator of the Mishna, known by the name of his principal work, the *Tosafot Yom-Tov* (*Harvest Holiday*); lastly, an especially moving approbation from the pen of Rabbi Isaac Cohen, the son-in-law of Maharal (the latter died in 1609, three years before the publication of Gans's book), who had accompanied his father-in-law during the famous and mysterious meeting between Maharal and the Emperor Rudolph II of Hamburg, in the Palace of the Hradschin in Prague in 1592. Everything takes place as though, between the several lines by his son-in-law, we hear Maharal himself giving his posthumous blessing to his disciple David Gans.⁵

³*Sefer Elim* (Amsterdam, 1629), 304.

⁴Recent writings on David Gans and Joseph Delmedigo: Jiri (George) Alter, *Two Renaissance Astronomers* (Prague, 1958); on David Gans as historiographer: Jirina Sedinova's several articles in *Judaica Bohemiae*, 8 (Prague, 1972); Mordecai Breuer, "R. David Gans, Author of the Chronicle *Zemah David*" (in Hebrew), *Ann. Univ. Bar Ilan*, 11 (1973), 97–118; Hayim Hillel Ben-Sasson, "The Reformation in Contemporary Jewish Eyes," *Israel Acad. of Sciences and Humanities Proceedings*, 4 (Jerusalem, 1970), 249, 255ff. On David Gans as cosmographer and astronomer: André Neher, *David Gans, disciple du Maharal de Prague, assistant de Tycho Brahé et de Jean Kepler* (Paris, 1974), hereafter Neher, *David Gans*.

⁵A single copy of *Magen David* is collated at present in the Bodleian Library of Oxford (Hebraica Opp. 4° 417).

As for Delmedigo, his book emerged from the famous publishing presses of Manasse Ben Israel, the distinguished leader of the Jewish community of Holland in the seventeenth century who was to plead in 1655 before Cromwell, in the Parliament in London, for the return of the Jews to England from which they had been expelled in 1290.

Gans and Delmedigo were truly representative spokesmen of the spirit of Judaism. Freedom of thought was by no means an inaccessible value; no one had to pay the price, as Spinoza claimed when breaking with the Jewish faith and community. *Freedom of thought was an integral part of the Jewish conception of science and the world*, as it was in the Middle Ages when Maimonides, to cite only his unique and illustrious example, adhered exactly to the Ptolemaic system by no means because it was in agreement with the Bible but because it was in agreement with reason.

The Yeshivas in which Gans and Delmedigo had finished their Talmudic studies should not be pictured as confined cloisters, removed from the outside world, and in which only casuistry and *pilpoul* (nitpicking arguments) counted. Staying with Gans, we must recall that at the head of the Yeshiva of Cracow where he obtained his rabbinical diploma, was Rabbi Moses Isserles (the Rema) who, to be sure, covered the *Choulhan Aruk (Code of Jewish Religious Law)* of Joseph Karo with authoritative glosses which are still respected today in the field of Rabbinic law, but who also gave his disciples a taste for history, mathematics, and astronomy; he left in a still unpublished manuscript a learned commentary of the *Theorica* of George Peurbach, who is considered a forerunner of Copernicus. As for Maharal of Prague, do I need to recall his humanism, his appeals to toleration and to understanding in all doctrines, no matter how conflicting they might be, whatever truth is implicit in each?⁶ He is, besides, the first Hebrew author who, without mentioning Copernicus' name, refers to his revolutionary theory. Maharal applied to it the label which is dear to him, namely, "relativism." Ptolemy was right in his time, so why should not Copernicus be right today? But in a few centuries another revolutionary mind will arise who will bankrupt the Copernican system (Einstein??). Such is the march of human thought, constantly exposed, Maharal writes, to the ups and downs of *inquiry (haqira)*, guiding reason to zones of perpetual renewals.⁷

We must in any case make it very clear that Gans and Delmedigo, imbued with the tolerant environment of their Jewish community, had the good fortune of being *personally associated with the astronomical revolution*. They did not draw their attitude from their formative

⁶For recent bibliography on Maharal of Prague, I refer to the collection of "Études Maharaliennes," Publications du Centre de Recherches et d'Études Hébraïques de l'Université de Strasbourg (Paris, 1959—). Titles published thus far: Théodore Dreyfus, *Dieu parle aux hommes*; Benjamin Gross, *Le messianisme juif*; Neher, *David Gans*.

⁷Maharal, *Netivot Olam*, 24c (Tel Aviv, 1955).

experience (*Bildungserlebnis*) but from their working experience (*Urerlebnis*).

Delmedigo studied medicine at the University of Padua in which Galileo was then teaching mathematics and astronomy. In his book *Elim* he relates emotionally how Galileo had on several occasions, around 1613, authorized his young Jewish student to make several observations by using the famous telescope that Galileo had constructed in 1609 and which he guarded jealously. When Delmedigo published *Elim* in 1629, he used the Hebrew term “Rabbi” in speaking of his teacher Galileo. Rabbi Galileo!⁸ Was this not something of a challenge directed to the inquisitors in Rome who were then preoccupied with Galileo and who were not to let him go until his death in 1642? Free Galileo, Delmedigo seems to be saying, release him to us; in the midst of our Jewish community, he will not be subjected to any trial, we shall not require him to make any retraction, we shall welcome him and honor him like a Rabbi in Israel!

As for Gans, he had even a closer association with the astronomical adventure. In fact, in 1599 Tycho Brahé became Rudolph II’s imperial “mathematicus” and installed his observatory in the castle of Benatek, near Prague. To it he called together collaborators (Johann Kepler, first of all, who was to succeed Brahé after his premature death in 1600), assistants, and computers. Among the latter was Gans who was to describe with enthusiasm the observatory at Benatek, its wonderful instruments, its astronomical clock, the inspiring nights that he spent observing the course of celestial bodies, and he was also to give an account of the many conversations that he had with Tycho, Kepler, and Johannes Müller,⁹ in short, the whole team of scientists that at times he brought together in a genuine “colloquium” in order to submit to them his questions, his perplexities, and his own hypotheses. All of this took place during the lifetime of his teacher, Maharal, in the city of Prague where he performed his functions of Grand Rabbi and edited his works.

These biographical parts of Gans’s book were already announced and outlined in the *Magen David*. But we find them elaborated in a book of 164 pages, the *Sefer Nehmad Venaïm* (*Beautiful and Fine Book*) of Gans, printed only in 1743, a hundred and thirty years after his death, but a complete manuscript of which exists, dated July 1613, a few weeks before his death. The *Magen David* was to serve as the “prospectus” of the book, which doubtless did not obtain enough subscribers for the printer. The manuscript of this *Nehmad Venaïm* is, with the *Magen David*, an excellent testimonial to the activity of Gans in astronomy, and enables us to understand better why the Jewish attitude from the begin-

⁸Cf. note 3 above.

⁹Johannes Müller, mathematician of Johann Georg, Elector of Brandenburg, not to be confounded as is too often done (even in the *Encyclopedia Judaica*, VII, 1971, art. Gans) with his homonym Johannes Müller, the famous Regiomontanus who lived from 1436 to 1476 and therefore could not have known Copernicus, Brahé, Kepler, or Gans!

ning leaned in favor of the hypotheses of Copernicus, despite the glaring contradictions between these hypotheses and the Bible's text.¹⁰

The reason is that, for the Jews, the problem was not that of a contradiction between science and Bible, but between science and *the traditional Jewish reading of the Bible which the Talmud gave*. The verses of the Bible which the authority of the Christian Churches cited in opposition to the Copernicans: the miracle of Joshua's stopping the Sun, or Psalm 19:6, or many other passages. How easy it was to bring such verses into harmony with Copernicus after the impressive flowering of Jewish exegesis in the Middle Ages had proposed interpretations of many such passages, e.g., "the sparks leaping from the rock on being struck by a hammer" (Rachi). The sun had not been stopped at Gibeon (Joshua 10:12,13); it had been "silenced" into a momentary stillness of the heavenly spheres, admirably confirmed by the musical theory ("harmony of the spheres") constructed by Kepler on Copernicus' theory. The very creation of the sun and the stars on the fourth day only showed that the "light" created on the first day and then "hidden," went beyond the empirical realm of the human orbit to an infinity of other suns more powerful than the sun whose companions were the earth, the moon, and the planets. The Cabala had added its irrational cosmological themes to rational exegesis, and with the dawn of the Copernican revolution, the Jewish Bible was thus ready to welcome it without reservations.¹¹

However, the Talmud was the real problem, especially the strange page of the treatise *Pesahim* (94b) in which the Talmud raised insurmountable contradictions between the astronomical system of the non-Jews (to wit: the Alexandrian School of Ptolemy) and the Jewish system, and itself affirmed that precisely on this point the Sages of Israel had bowed before the science of the non-Jews. Jerusalem had therefore recognized its defeat and had yielded to Athens. All of medieval Jewish astronomy—including Isaac Ibn-Sid who edited the Alphonsine Tables, the great Maimonides, Abraham Zacuto whose Tables were used by Christopher Columbus—all of it was built on the model of Arabic and Christian astronomy, on Ptolemy's *Almagest*, since the Talmud had itself recognized that the truth was on Ptolemy's side.

Now, in Chapter 25 of his book, Gans narrates how his frequenting the observatory of Benatek suddenly furnished him with the key to the enigma. In 1600, the Jewish assistant Gans gathered, in fact from the lips of his non-Jewish master, Tycho, the astonishing assertion: "Your Sages did not behave well in bowing before non-Jewish scientists. They have made themselves accomplices of a falsehood, for the truth is on the

¹⁰We now possess three MSS (one of them incomplete) of *Nehmad Vena'im*. On the present state of the problem: Neher, *David Gans*, 104-42.

¹¹A. Neher, "L' exégèse biblique juive face à Copernic au XVIème et au XVIIème siècles," *Travels in the World of the Old Testament*, Studies presented to Prof. M. A. Beck (Assen, 1974), 190-96.

side of the Sages of Israel.”¹² And Kepler went one better: “The Talmudic sentence not only implies the heliocentric view of Copernicus, but goes farther, in the direction of the observations that I have been able to make, thanks to Tycho’s instruments; it states precisely that the orbit of the planets is irregular and that it is distended at times to take the shape of the Hebraic letter ‘*Kaf*.’ ” (Kepler knew Hebrew, since he had studied it in Tübingen. We know that in his last work, the *Somnium*, about the famous dream of a trip to the moon, he designated the moon under its Hebrew name *Lebana*.)¹³

Hence, we find in the observatory of Prague a striking example of the coincidence of the ancient Jewish theme with that of Copernicus, a confirmation obtained by an astronomer-Rabbi, disciple of Maharal, from the lips of the coryphaeuses of astronomical science of his time. By a leap through the centuries of the Middle Ages, the Jewish attitude followed the line of a continuous Copernican tradition. It was not to deviate henceforth from this straight line.

Normally, this confirmation would have led Gans to construct his book on Copernican foundations. Why, then, did he illogically build his work nevertheless on Ptolemaic lines? The answer to this illogical disparity is to be found in the very logic of the habitat (*Sitz im Leben*) of that key-chapter, published during the several months of 1599–1600, while Gans was in touch with Tycho (then still alive: “Tycho Brahé told me. . .”) and with Kepler while he followed the Master in his research.

Now, where at this time were Tycho and Kepler in their scientific itinerary? The first had exactly reached a point in his research beyond which he was not to advance, and which the second would supersede only later, a point which explains the paradoxical question we raised concerning their modest but attentive assistant Gans.

To Tycho, Copernicus was right; however, Ptolemy was not wrong. The Tychonian system rested on the confusingly mixed hypothesis of the Sun as the center of the planets and the Earth as the astronomical center around which the moon and the solar system move. As for Kepler, if the indication given to Gans were offered a few years later, it would probably have been stated as follows: the planetary orbits are not circular as Ptolemy and also Copernicus taught, but are oval. However, we are still far from the *Astronomia Nova*, which was not to appear before 1609 and in which the law of the elliptical orbits of the planets, Kepler’s famous first law, was moreover submerged in a text totally impenetrable to anyone other than the author himself who was to clarify matters later, sometime after the death of Gans in 1613.

It was still on Ptolemy that astronomy continued to rest. Kepler was to repeat this explicitly to Gans a little later, and Gans carefully took

¹²With Salomon Munk (*Le Guide des Égarés*, II, 8, 78–79), we think that in Gans’s time the Talmud was not cited, but Maimonides’ classic commentary on it in his *Guide*.

¹³Kepler’s *Somnium*, trans. Edward Rosen (London, 1967), 53.

note of Kepler's remark in chapter 218 of his book. It was a matter of recalling the revolutionary theories of Al-Bitrogi (ca. 1290), discussed at some length by Gersonides (1288–1344), and more recently by Rema who introduced their views into his eclectic table of extant astronomical theories in 1570.¹⁴ Away with excentricities and epicycles, Al-Bitrogi had declared. A plague on Ptolemy, Hipparchus, and Al-Bitani! Absolute freedom to the cosmos in which the planets race through their courses like horses in a hippodrome. What stupid theories, replies Kepler: gross errors, worthy of rustics who gaze at the sky like animals without guessing what laws it conceals. In fact, Kepler says to Gans, all these adversaries of Ptolemy are pupils of ancient astronomers who had each built abstruse theories of the sort produced by Al-Bitrogi. But these "revolutionaries" ignore the fact that in the *Almagest* Ptolemy had, a long time ago, victoriously refuted the Ancients and swept away the fantasies of the Moderns with the same blow. Copernicus himself based all his calculations and the basis of his theory on the system of Ptolemy.

Thus the *Almagest* remains the bible of Tycho and of Kepler, as it was to remain that of Galileo, and yet . . . (*Eppure se muove*), something was set in motion. Galileo did it for the Earth and threw down the challenge of his conviction before the Inquisitors, his judges, at the very moment of his solemn retraction.

Gans also, in the modest limits of his study, knew that something was afoot. In the key-chapter 25 of his book, the one in which he tells how he received from the lips of both Tycho and Kepler the confidence that something was "stirring" in regard to Ptolemy's system, Gans revealed at the same time that the secret of this deviation had been known to the Sages of Israel for some time; he proceeded to resort to a stylistic mannerism in order to give his discovery reverberating expression.

Indeed, the Talmudic phrase of "the bird flying in the air" had been applied by Rema to the system of Al-Bitrogi. Gans applied the phrase to that group of orbital eccentricities which Tycho and Kepler had pointed out to him. But he plays around in that style, and we think that the playing on the ambiguity of the metaphor is deliberate. For in the Talmud and rabbinical texts "the bird in the air" signifies making an assertion without any support, a theory without proof, and more particularly, a rabbinical doctrine when it cannot be confirmed by the biblical text from which it is nonetheless derived.

And so through the choice of this metaphor of birds in flight Gans came to describing the astronomy of Israel's Sages precisely when general astronomy in its evolution was reaching a paroxysm of inexactitude. Astronomy was then, with Tycho and Kepler, offering un-

¹⁴Moses Isserles, *Torat Haola (The Law of the Holocaust)* (Cracow, 1570), I, 2, folio 8a, b.

supported assertions, unproved theory, a doctrine supposedly grounded in the *Almagest* bible without, however, being capable of harmonizing with that bible. Astronomical truth was stated by Jews; it was revealed to non-Jewish geniuses, but a veil of paradox and contradiction still covers that truth. You think you have it in hand, but see how it flies away like a bird, turning in every direction, including the nonsensical way in which the absurd trajectories of the planets continue to guard their secret jealously.

It is on Ptolemy's *Almagest*, therefore, that Gans built his work. He forewarns us to that effect in the first chapter. Such was Gans's methodological position. It was not different from Tycho's (whose laws were according to his own statement, only descriptions), nor from Galileo's (whose telescope only served to enlarge the field of observation). To all these contemporary astronomers and teachers of Gans, the explanatory keys were still solidly held by the hands of God, and human creatures did not feel frustrated for possessing on their part only the power to discover more and more intensively the Divine work without ever succeeding in explaining it.¹⁵ There was no Promethean spirit in these giants who felt strong in facing God because of their unique but very fulfilling motivation in the Creator's permitting them to embrace the cosmos with a glance at its divine dimensions. Newton had to come to help us grasp, in the narrow rational capsule of a mathematical formula, the explanation of this gigantic panorama, still vibrating in Kepler's musical harmony of the spheres. Then only did the observations of Galileo and Kepler also become *explanations* or *laws*. However, in 1600, Kepler and Galileo would have, like Tycho, countersigned the profession of faith posted by Gans in the form of a forewarning in the very first chapter of his book.

*The Eighteenth Century: Continued Enlightenment with Two
Exceptions close to the Time of the Sabbatian Crisis*

In order to find new, further references to Copernicus in Hebraic literature, we must go into the eighteenth century. There we find a graduated series of works with the following dates of publication: 1707, 1714, 1720, 1741, 1756, 1765, 1777, and 1791. They constitute an interesting panoply in many respects. With the exception of the first two by date, to be discussed later, *all* the works published between 1720 and 1791 remain in the wake of the pioneers of the sixteenth and seventeenth centuries, namely, a positive theological attitude with regard to Copernicus even though some reservations are made on the scientific level.

The *Sefer Yeshua Be-Israël (Redemption in Israel)* of Jonathan ben Joseph de Rozhany (Frankfurt-on-Main, 1720)¹⁶ is a large compendium

¹⁵Also Osiander's thesis in his Preface to Copernicus' *De Revolutionibus Orbium Coelestium* (Nuremberg, 1543).

¹⁶Reprinted in *Sefer Poal Hashem* (Bné Brak, 1968), I.

in which the author piles up his vast erudition. Through Delmedigo, whom he quotes often, he knows and appreciates Galileo and Copernicus. The same positive approaches towards Copernicanism occur in the *Nezah Israel (Eternity of Israel)* of Israel ben Moïse Halévi of Zamość (Frankfurt-on-Oder, 1741), in the *Ammoudé Shamayim (The Pillars of the Sky)* of Baruch ben Jacob Schick, also called Baruch Shklover (Berlin, 1777), and in the *Guivat Hamoré (The Hill of the Master)* of Salomon Maimon (Berlin, 1791).¹⁷ If I unite these two treatises of the Jewish calendar and that Commentary of Maimonides' *Guide of the Perplexed* in a single comment, it is because their authors were directly connected to the work and spirit of Moses Mendelssohn who was installed in Berlin at the same time as Rabbi Joël Sachs, publisher of the *Nehmad Venaïm* of Gans in 1743. Israel of Zamość was Mendelssohn's professor of mathematics in Berlin. Baruch Schick is known for having built a bridge between Mendelssohn's group and the School of Gaon of Wilna. Finally, Salomon Maimon is too celebrated to make it necessary to dwell on the importance of this disciple of Mendelssohn. Maimon's work, published in 1791, is the last by date of those we present here. Copernicus was clearly approached in an atmosphere of remarkable toleration and enlightenment; in the Introduction, there is a summary of the history of philosophy and science from the pre-Socratics to Kant.

The matter is quite otherwise in the first two books of the eighteenth century: the *Maasé Touvia (Tobias' Works)* of Toby Hacohen, published in Venice in 1707 (second edition, Jessnitz, 1721 at the press where only twenty-two years later the *Nehmad Venaïm* of Gans was to appear!) and the *Maté Dan, Kuzari Shéni* (London, 1714) by David Nieto.¹⁸ These two hebraic works were the *only* two works in which anti-copernicanism was virulent.

The author of *Maasé Touvia*, Toby ben Moses Hacohen, is a personality of great breadth who reminds one, in many respects, of Delmedigo. The two men were doctors and had acquired their degree at Padua. The two had also experienced many tribulations. Toby was born in Metz (where his father, Rabbi Moses Hacohen Narol had the distinction of receiving Louis XIV with great pomp when he visited the Synagogue of Metz in September 1657).¹⁹ Toby studied in Cracow and in Frankfurt-on-Oder (where he was the bursar of the Elector of Brandenburg). Then, after finishing his studies in medicine at Padua, he moved to Turkey, and died in Jerusalem. In a word, the two men were humanists in the fullest sense of the term. At home in the sacred sciences, they were equally concerned with the secular sciences; the *Maasé Touvia* deals with theology, astronomy, cosmography, botany,

¹⁷New ed. by S. H. Bergman and N. Rotenstreich (Jerusalem, 1958).

¹⁸New ed. by J. L. Maimon and C. Roth (London, 1958).

¹⁹A. Cohen, "Le Rabbinate de Metz pendant la période française," *REJ*, 14 (1883), 22-24.

and, of course, medicine. In this last subject, his contribution is very modern. He is one of the first medical men to admit Harvey's theory of the circulation of the blood: he does not hesitate consequently to criticize Galen and through him, Maimonides; he argues against superstition, bone-setters, amulets, etc.

Now, in astronomy the worthy Toby is the one Jewish author—and the *only* one—to mistreat Copernicus, to treat him as “the first-born of Satan.” He refutes Copernicus' system for the sake of *biblical* exegesis (pp. 52–53). I say pointedly, *biblical* and not *rabbinical*, for the distinction is an important one and we shall see how Toby was caught in his own net.

We admire at first the clarity of his astronomical exposition in *Massé Touvia* (part 2, pp. 48b–66a). After presenting what Toby calls the *ancient* system (48b–49d), comes the gallery of the representatives of the *new* system, at the head of which are Hipparchus and Ptolemy, followed by Copernicus and Tycho (50a–52b). We see that Toby understands perfectly the link between Copernicus and Hipparchus, and also the conciliatory effort of Tycho. Two very clear diagrams illustrate the systems of Copernicus and Tycho. Only then comes the refutation of Copernicus, that first-born of Satan. But though Toby in support of his refutation invokes common sense, then Galileo(!), and finally the Bible, he inserts, with all his scrupulous intellectual honesty (52b), a significant marginal note at the place where he comes to the verse in Ecclesiastes (1:4): “the earth abideth forever” which he quotes as proof of the inanity of the Copernican affirmation of the Earth's motion:

Remark of the author: I fear that the incredulous may draw an objection from a text of *Midrash Bereshit Rabba* (V,8) in which our Teachers, the Rabbis, of blessed memory, explain that if the Earth is called in Hebrew “*eret*” it is because it hastens (“*ratseta*”) before the Creator in order to accomplish His will. I acknowledge that the answer to this objection seems difficult for me to find.

Thus Toby, who evidently did not know the *Nehmad Venaïm* (printed in 1743) stumbled upon the problem that Gans had already known how to solve, thanks to his conversations with Tycho. The theological objections to the Ptolemaic system did not come in Judaism from the Bible but from the Talmud. The Rabbis of the Talmud spoke a Copernican language which Tycho approved, and on the basis of this approbation Gans was able in complete freedom to develop his praise of Copernicus.

Toby, on his part, was caught in an impasse. However, he must have heard in Venice, in 1707, echoes of the terrible episode in Jewish history about Sabbatai Zevi in 1666.²⁰ With the Sabbatean movement there

²⁰As a self-proclaimed Messiah, Zevi was captured in 1666 in Constantinople by the Turks and to escape death embraced Islam. Cf. G. Scholem, *Sabbatai Zevi*, trans. Werblowski (Princeton, 1975).

began a witch-hunt which Judaism had never previously known. One of its most famous victims, Moses Chaim Luzzato (1707–1747), was born in Padua in exactly the year in which Toby's book appeared, the only one, again, in which a gross anti-Copernican expression appears from a Jewish pen. The Rabbinate of Venice, which gave its warm approval of Toby's book, did not, alas, distinguish itself in the Luzzato affair by its sense of dignity or toleration. It did not hesitate, twenty years later, to pursue Luzzato with its attacks on him, detecting the scent of a Sabbatean heretic in him that Toby must have detected no doubt among the adherents of Copernicus in 1707.

The ironic climax occurred when Toby's book brought, in addition to the approval of the Venetian Rabbinate, superlatively warm approbation from Rabbi David Oppenheim of Prague, the very person who had in his library the copy (preserved to this day) of the *Magen David*, in which Gans made the dithyrambic eulogy of the so-called "first born of Satan" alias Copernicus. It is true that Oppenheim's library included thousands of volumes and the good Rabbi did not perhaps have the time to read the small work of a dozen pages entitled *Magen David*, at the very antipodes of the *Maasé Touvia* of 158 pages, recto-verso, which he praised in his *Haskama*.

From the same Venetian milieu emerged David Nieto (1654–1728), doctor of medicine of Padua, like Toby Cohen, and *dayan* (judge) in Livorno (Leghorn) before becoming *hakam* (*Rabbi*) of the Sephardic synagogue of London. His book *Esh Dat* (*Fire Law*) was a frontal attack on the Sabbatean heresy. It appeared in 1715, a year before the *Maté Dan* (*The Dan Tribe*) in which a dialogue, imitating the *Kouzari* of Judah Halevi, allowed the author to widen the front and to approach the whole set of theological, philosophical, and scientific problems of the time. Astronomy appears in the fourth dialogue and the Copernican hypothesis is swiftly refuted in paragraphs 130–134, by reference to the classical verse in the Book of Joshua. On the other hand, in the paragraphs that follow, Nieto is willing to accept the view that the stars are inhabited and glad to be able to support this modern conception of the plurality of worlds on the basis of rabbinical texts. The tone of the dialogue is moreover much more moderate than that found in the pages of Toby Cohen. Copernicus himself is not the object of any insult; one does not detect in his doctrine the presence of the devil. The formula employed by Nieto in order to reject that idea is a very stereotyped one and fits the normal categories of a style of language respectful of the opinion of others, despite everything else, even when he rejects an opinion *piggūl hū lō yerazé*: "it is a sacrifice which cannot be accepted in the Temple" (p. 59a, b).

Luzzato had to flee from Italy in order to find a liberal stopping-place and provisional tranquillity in the tolerant atmosphere of the community of Amsterdam in 1736, before going to the Holy Land where he

died soon after he arrived in 1747. Now, it was precisely in Amsterdam that the *Sefer Tekounat Hashama'im* (*Astronomical Treatise*) appeared in 1756. In this book of his, Raphael Halévi of Hanover (1685–1779) deals with the problem of the astronomical revolution with a mixture of disarming naiveté and remarkable intellectual honesty. We find again the serene atmosphere of Prague in it.²¹ With the warm approval of the two Grand Rabbis of Amsterdam, one for the Ashkenazi community and one for the Sephardic community, Halévi's book expounds in 95 small chapters (in 32 pages recto-verso) the indispensable astronomical topics for the establishment of the Jewish calendar. These topics are based upon the Code of Maimonides (whose name figures in the frontispiece before that of Raphaël Halévi himself) and as a logical consequence, upon the Ptolemaic system, without deviation or reservation.

But here we see, in the form of a conclusion, a final chapter (the 96th one) breaking abruptly the logical line followed by the author until this point. This final chapter, in fact, expounds in twenty lines the Copernican system, supported by a diagram. "Until now," declares Halévi at the end of chapter 95, "we have followed the Ancients' opinion. However, we see that in our time the great astronomer Copernicus has discovered another way of describing the cosmos: the system that is called the new astronomy which places the Sun at the center of the cosmos [etc., etc.], and has the third sphere of the Earth performing a rotation around the Sun in 365 and a quarter days [etc., etc.], . . . and each of these planets, besides a motion around the Sun, rotates on its own axis, the Earth in 24 hours [etc., etc.], which evidently entails a rotation of the Moon around the Earth [etc., etc.]. . . ."

We are curious to learn now what judgment Halévi is going to bring to bear on this "new astronomy" contradicting from top to bottom the ancient one on which he has built his system. Here is the answer in all its simplicity, which I find moving: "The advantages of this new system are in truth enormous, but this is not the place to develop them all. Let us be content with registering an advantage of general import: the new system dispenses with imagining the famous diurnal sphere that runs from east to west and moves all the spheres and all the stars with it, a sphere whose existence is incompatible with the results of reason. . . . Let that suffice for the novice in astronomy to whom this book is devoted."

Thus in the name of reason and of certain elementary didactic principles, Halévi leads his reader up to the great open doors of the new system, inviting him to admire its major lines without, however, taking the reader into it more deeply. And he concludes in a tone that I find equally moving:

And now, as a way of signing this book, small in format but rich in content, here is the prayer I address to my pupils and all my readers: study attentively and do

²¹Reprinted in *Sefer Poal Hashem*, loc. cit., II.

not hasten to accuse me when you run across passages in which I take a position contrary to that of my predecessors. He who probes secrets and penetrates the hidden recesses of consciousness knows and will be my witness that my intentions was in no way to diminish in any respect whatever the eminent worthiness of my predecessors. No, my intention was absolutely disinterested, in the service of truth and light, in the service also of my pupils whose mind I wish to stimulate and render familiar with the methods of these high sciences. Perhaps may I hope thus to find the sympathy of God and of men. . . .

Do I need to indicate that our sympathy as a twentieth-century reader goes out fully to Halévi, that valiant and modest servant of truth in the age of Enlightenment—but also, alas, in the age of the counter-Enlightenment. He makes us think back surely to that other servant of truth, David Gans, in the age of the Renaissance, as we wish to join them in the same homage due to men who do not shrink from taking risks. It is true that the work was printed *without* the assent of the author, as he indicates in the second part of his *Tables (Luhot Ha-Ibbur)*, published in the same year (1756) in Hanover.²² However, we should not conclude that Halévi challenged the content of the *Sefer Tekounat Hashama'im*. He was simply reproaching, in very courteous terms moreover, the publisher, Moses Titkin, for having printed the lecture-notes taken by students without informing him beforehand. Halévi had the good fortune to live a long time (he was 94 years old when he died in 1779). Himself a student of Leibniz, he devoted his whole life to teaching, for no pay! (Like Mendelssohn, he made a living as an accountant.) In 1726, he had composed a treatise on astronomy, *Hokmat Hatekuna*, the manuscript of which is in the Bodleian Library (Neubauer 2063). In 1756, his great work was his *Tables*, an absolutely original key to understanding the Jewish calendar based on Maimonides' principles, and he had in hand an *encyclopedic* work, progressing systematically from the physical sciences to metaphysics (Neubauer 2062).

We can understand, therefore, the emotional mood of Halévi when his lecture-notes were published at the very time that he was contemplating a magisterial work, which was never to see the light of day. Though it was a very understandable reaction, it was of a purely psychological order. Let us not imagine, therefore, that it was a retraction of the very basis of the book. This book preserves for the historian all of its value as a document, and we take nothing away from the homage due to him for we are convinced thoroughly of its legitimacy. We include in this homage the last two books that remain to be reviewed from that Hebraic gallery of Copernicanism in the seventeenth and eighteenth centuries. The book of 1765 is particularly close to my heart. Its author Moses Steinhardt (died in 1799), was the son of the famous

²²Moritz Steinschneider, "Die Mathematik bei den Juden," *MGWJ*, new series, 13 (1905), 526.

Rabbi Joseph Steinhardt (1720–76) known for his *Responsa Zikron Yosef*. The book appeared, it is true, in Germany in Furth, where Joseph Steinhardt had established himself as a Rabbi in 1763. But, prior to that date, he had for eight years been the Grand Rabbi of Lower Alsace with a post in Niedernai. Thus it was the air of Niedernai that his son Moses breathed while he was composing the book to be published in Furth in 1765. Now, Niedernai is situated at the foot of the Vosges, two kilometers from my small native city of Obernai. May the reader permit me to wax emotional for a moment over the fact that in the middle of the eighteenth century, on the footpaths of the Ehn connecting Obernai to Niedernai, which I have often trod in my youth, the son of the Grand Rabbi of Lower Alsace was dreaming, musing . . . about Copernicus. It was a curious musing, moreover, revealing a genuine obsession for truth and enlightenment. For Moses Steinhardt's book is by no means an astronomical treatise. It is concerned with a translation into Jewish-German of the *Treatise on the Duties of the Heart* by Bahya Ibn Paquda, the classic of medieval asceticism. But Steinhardt felt the need to provide the first Portico of this book on ethics ("The Portico of Unity") with a commentary in Jewish-German also. And this commentary is justified (p. 161) by a brief introduction in Hebrew, in which Moses explains that this Portico of Bahya's contains a brief cosmology evidently based on the medieval system of Ptolemy, so that it was indispensable to clarify it by notes referring to the system of Copernicus, according to which the Earth turns, first, around its axis and, secondly, around the Sun. And he adds:

I know well that if these notes are read by ignoramuses, they will make fun of me and treat me as a stupid imbecile. But I affirm loudly that this Copernican system is not in any way in contradiction with our religious faith and still less with reason. . . . I stand solidly therefore for my position, ready to confront anyone's criticisms. However, I also know that I shall find among my readers intelligent men who have grown up kneeling before Wisdom, and to them I dedicate this translation and commentary.

The book appeared, I repeat, two years after Steinhardt had left Niedernai for Furth in 1765, with the approval (and forbidding its reproduction within a period of ten years) of the Rabbi of Schwabach (Bavaria) and of the Rabbi of Carlsruhe (Bade), and last but not least, of the author's father, the *Gaon* (a title printed on the cover page) Joseph Steinhardt, Ab-Bet-Din of Furth, formerly Rabbi of all of Lower Alsace, who explicitly congratulates his son Moses for supplementing the Jewish-German translation of Bahya's book by "a commentary on the Portico of Unity, in the Jewish-German language, which will delight the German philosophers, for he clarifies a great many problems of astronomy concerning the course of the Sun, the Moon, and of the planets around the Earth."

Let us finally end the story, opened up in Prague in 1612, by a book which appeared in Prague in 1785. Its author is Eliyahu ben Chaim Hochheim. His book *Shevile de-Reqya (The Routes of the Sky)* is in quarto of 57 pages only, 25 of which are devoted to an exposition of trigonometry and 32 pages to summary of the astronomical ideas indispensable for the Jewish calendar. And the author warns us: "Given that my intention is to comment here on the principles established by Maimonides in his Code, it is impossible for me to depart from his own cosmological and astronomical conceptions [i.e., Ptolemaic], and I cannot therefore take account of the modern ideas even where they appear correct to me. I therefore intend to supplement my work by another in which I shall establish my treatise on algebra and astronomy upon the Copernican system; the whole will rest upon the theses of contemporary scientists."

Eliyahu did not to our knowledge compose this complement to his book which presented as a second choice for the Jewish calendar the Copernican and modern window in opposition to the Ptolemaic and ancient window-shutter. Let us register the fact, at least with satisfaction, that a Jew preoccupied with a fundamental topic of the Jewish tradition felt strongly enough in 1785 to plan to harmonize this topic with the Copernican system, and that he announced his plan in Prague about two centuries after David Gans in Prague had glimpsed the possibility, and even the necessity, for this harmony without, however, taking the decisive step which would have led him to its realization.

The story ends now. With Eliyahu of Hochheim Copernicus has definitely entered the Jewish house. But I must conclude with a piquant episode. In the issues of 1786 (year of the death of Mendelssohn and of Frederick II), of the Hebrew journal *Hameassef*, founded three years previously by Mendelssohn's disciples, we find (pp. 106–110) a review of the book of Eliyahu Hochheim. The author was evidently congratulated (*Hameassef* was in the vanguard of the Jewish Enlightenment of the time) for the manner in which he presented the necessity of a reconciliation between Jewish and Copernican astronomy. However, he is reproached (p. 109) for having employed the Hebrew term *nizoz* (spark) to designate *rays* of light, sacrificing the classical term *queren*, used hitherto by hebraizing scientists. Eliyahu seems also, the anonymous reviewer of his book goes on to say, to give his blanket endorsement of Newton's theories on the origin of light, theories which are purely hypothetical (note between parentheses that Eliyahu is an innovator in translation and that he proposed to render the term "logarithm" in Hebrew by *Magbil*; today it is more simply *logarithm*!).

Newton's theories of light date from the beginning of the eighteenth century (1704). Now we are nearly at the end of that century, but let us not forget that the two big volumes of Goethe's *Farbenlehre* in which he combats Newton's hypotheses were not to appear before 1810. That is

how science goes. Hardly has agreement on Copernicus been reached and we congratulate ourselves on the triumph of Reason, when Reason stands on guard against Newton whom nobody was to touch a century later . . . until the next challenge. Was this not the *relativistic* image of scientific evolution that the Maharal of Prague gave in 1595, the first Hebraic author, we said, to make implicit mention of Copernicus?

Jerusalem (Professor Emeritus, Strasbourg University). Translated from French by Philip P. Wiener.