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Gersonides: Levi ben Gerson

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Born **Bagnols, (Gard), France, 1288**

Died **probably Provence, France, 20 April 1344**

Gersonides left few letters and does not talk about himself in his writings; nor is his life discussed at great length by his contemporaries. He may have lived for a time in Bagnol sur-Ceze. It is probable that his father was Gershom ben Salomon de Beziers, a notable mentioned in medieval histories. Though Gersonides made several trips to Avignon, he most likely spent his entire life in Orange. There is some evidence that he may have followed the traditional occupation of his family, moneylending. With the decline of Spanish Judaism in the 13th century, Provence quickly became the cultural center for Jewish intellectual activity. The popes in Avignon had a lenient policy toward the Jews, whose creative life flourished, particularly in philosophy and theology. Although Gersonides spoke Provençal, his works are all written in Hebrew, and all of his quotations from **Ibn Rushd**, **Aristotle**, and **Maimonides** are in Hebrew as well. He may have had a reading knowledge of Latin; he appears to manifest an awareness of contemporary scholastic discussions. Gersonides might, however, have learned of such discussions in oral conversations with his Christian contemporaries.

Although Gersonides wrote no scientific works as such, scientific discussions were included in his philosophical works. Gersonides' major scientific contributions were in the area of astronomy; his works were known by his contemporaries, both Jewish and Christian. One of the craters of the Moon, Rabbi Levi, is named after him. Gersonides' astronomical writings are contained primarily in Book 5, part 1 of *The Wars of the Lord* (Milḥamot ha-Shem), his major philosophical *opus*, which was completed in 1329. The astronomical parts of *The Wars* were translated into Latin during Gersonides' lifetime. Although the astronomy chapters were conceived as an integral part of the work, they were omitted in the first printed edition of *The Wars* but have survived in four manuscripts. In the 136 chapters of Book 5, part 1 of *The Wars*, Gersonides reviews and criticizes astronomical theories of the day, compiles astronomical tables, and describes one of his astronomical inventions.

With respect to his astronomical observations, what distinguished Gersonides from his Jewish philosophical predecessors was his reliance upon and consummate knowledge of mathematics, coupled with his belief in the accuracy of observations achieved by the use of good instruments. Because of this rootedness in empirical observation, which was bolstered by mathematics, Gersonides believed that he had the tools to succeed where others had failed, particularly in the area of astronomy.

That Gersonides clearly considered his own observations to be the ultimate test of his system is explicit from his attitude toward **Ptolemy**. “We did not find among our predecessors from Ptolemy to the present day observations that are helpful for this investigation except our own” (*Wars* V.1.3, p. 27), he says, in describing his method of collecting astronomical data. Often, his observations do not agree with those of Ptolemy, and in those cases he tells us explicitly that he prefers his own. Gersonides lists the many inaccuracies he has found trying to follow Ptolemy's calculations. Having investigated the positions of the planets, for example, Gersonides encountered “confusion and disorder,” which led him to deny several of Ptolemy's planetary principles (Goldstein, 1988, p. 386). He does warn his colleagues, however, to dissent from Ptolemy only after great diligence and scrutiny. It is interesting to note that Gersonides briefly discusses, and then dismisses, the heliocentric model of the Universe before rejecting it in favor of geocentrism (*Wars*, Chapter 51; also Commentary on Deuteronomy, 213c).

Gersonides is perhaps best known for his invention of the Jacob's Staff. This instrument, which he called *Megalle ‘amuqqot* (Revealer of profundities) and which was called *Bacullus Jacobi* (Jacob's staff) by his Christian contemporaries, is described in detail in Chapters 4–11 of *Wars* 5.1. The material contained in these chapters was translated into Latin in 1342 at the request of Pope Clement VI and survives in a number of manuscripts. Gersonides' instrument was used to measure the heights of stars above the horizon. It consisted of a long rod, along which a plate slides, that could be used to find the distance between stars.

Gersonides was interested in other instruments as well, including the astrolabe for which he suggested several refinements, and the camera obscura. The latter instrument was used by him for making observations of eclipses. Gersonides also applied the principle of the camera obscura to make a large room into an observing chamber, taking advantage of the image cast by a window on the opposite wall.

Chapter 99 of Book 5, part 1, contains astronomical tables commissioned by several Christian clerics. Besides containing a general explanation of the tables, Chapter 99 contains instructions on how to compute the mean conjunction and opposition of the Moon and Sun; a method for deriving the true conjunction or opposition of the Moon and Sun; a computation of solar time; and a discussion of eclipses, with tables for positions of the Moon for each day.

In Book 5, part 2, of *The Wars*, which was included in most manuscripts, Gersonides deals with technical, albeit nonmathematical, issues in astronomy, such as the interspherical matter (*Wars* 5.1, Chapter 2); topics concerning the diurnal sphere, the Milky Way, and the movements of the planets (*Wars* 5.1, Chapters 4–5, 7–9); and how the Sun heats the air (*Wars* 5.1, Chapter 6). In Book 5, part 3, Gersonides examines a number of additional topics, such as the Aristotelian question of how many celestial spheres are needed to explain the movements of the heavenly bodies (*Wars* 5.3, Chapter 6), and whether the velocities of the heavenly bodies are related by a commensurate number (*Wars* 5.3, Chapter 10). In this context, Gersonides addresses Ptolemy's theory of cosmic distances based on a system of nested spherical planetary shells. He introduces a fluid layer (“the matter that does not keep its shape”) between two successive planetary shells so that motion of one planet would not affect the motion of the planet adjacent to it. Gersonides then computes the planetary distances according to three separate theories (*Wars* 5.3, Chapters 130–135).

Gersonides was also an avid supporter of judicial astrology, which plays an important role in his philosophical views on free will and providence. The treatise, *Pronosticon de conjunctione Saturni et Jovis et Martis*, was started by Gersonides (possibly at the request of Pope Clement VI) and completed by his Latin translator, Peter of Alexander, and Levi's brother, Solomon. This work is a prediction based on the conjunction of Saturn and Jupiter to take place in March 1345. Gersonides himself died in 1344, a year before the event in question. In his prognostication, Gersonides

predicts a number of calamitous events. The Black Death, which arrived in Europe in 1347, was thus provided with numerous astrological credentials.

In short, according to Gersonides the ultimate function of astronomy is to understand God. Astronomy, he claims, can only be pursued as a science by "one who is both a mathematician and a natural philosopher, for he can be aided by both of these sciences and take from them whatever is needed to perfect his work" (*Wars* V.1.1, p. 23). Astronomy, he tells us, is instructive not only because of its exalted subject matter, but also because of its utility to the other sciences. By studying the orbs and stars, we are led ineluctably to a fuller knowledge and appreciation of God. Astronomy thus functions as the underpinning of the rest of his work.

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