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# Ibn al-Bannāʾ: Abū al-ʿAbbās Aḥmad ibn Muḥammad ibn ʿUthmān al-Azdī al-Marrākushī

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*Born* **Marrakech, (Morocco), 29 or 30 December 1256**

*Died* **31 July 1321**

Ibn al-Bannāʾ al-Marrākushī, mathematician and astronomer, was born in Marrakech where he studied a variety of subjects, reportedly with at least 17 masters. However, he frequently went to Aghmāt, near Marrakech, where he was a student of Abū ʿAbd Allāh al-Hazmīrī (died: 1279); it may have been due to his influence that Ibn al-Bannāʾ became interested in both astronomy and astrology, and gained the reputation of being a Sufi. Ibn al-Bannāʾ was probably a practicing astrologer in the service of the Marīnid sultan Abū Saʿīd (reigned: 1309–1331), and he is said to have predicted the exact circumstances of the latter's death, which took place some 10 years after his own. He was dedicated to his teaching, which took place both in the great mosque of Marrakech and in his own home, and he had at least eight disciples.

The catalog of Ibn al-Bannāʾ's works comprises about a 100 titles, out of which some 50 are dedicated to mathematics and astronomy (including astrology), but the list also includes Quranic studies, theology (*uṣūl al-dīn*), logic, law (*fiqh*), rhetoric, prosody, Sufism, the division of inheritances (*farāʾiḍ*), weights and measures, measurement of surfaces (*misāḥa*), talismanic magic, and medicine. His reputation is based mainly on his mathematical works (especially arithmetic and algebra); he has been considered the last creative mathematician in the Maghrib, meaning that he approached new problems and gave original solutions. His works were extremely popular, and inspired an enormous number of commentaries, which were still being written until the beginning of the 20th century.

In the field of astronomy, Ibn al-Bannāʾ is a clear follower of the Andalusian tradition represented by the Toledan astronomer **Zārqālī**, whose works reached him either directly or indirectly. He wrote short works on the two varieties of universal astrolabes (*shakkāziyya* and *zarqāliyya*) designed by this author, as well as an astronomical handbook with tables (*zīj*) derived ultimately from the research of Zārqālī. The title of this *zīj* is *Minhāj al-ṭālib fī taʿdīl al-kawākib* (The student's method for the computation of planetary positions), and it became extremely popular in the Maghrib. There were at least three commentaries, and it was still in use in the 19th century. The direct source used by Ibn al-Bannāʾ was the unfinished *zīj* of **Ibn Isḥāq**, which seems to have exercised the predominant influence in Maghribī astronomy during the 13th and 14th centuries. Ibn al-Bannāʾ's *Minhāj* contains a selection of Ibn Isḥāq's tables accompanied by a collection of canons that are easy to understand, which makes the *zīj* accessible for the computation of planetary longitudes. This is accompanied by some modifications of the structure of the tables, designed to make calculations easier. Both the tables of the solar equation and those of the planetary and lunar equations of the center are “displaced” (a constant is added to every entry of the table in order to avoid negative values), a technique used for the first time in the Maghrib. Although Ibn al-Bannāʾ used the standard structure, derived from the *Handy Tables*, for the tables of the equation of the anomaly of Mars, Venus, and Mercury, he changed them entirely in the cases of Jupiter and Saturn – planets that have small epicycles – for which the equation of the anomaly is calculated in the same way as for the Moon.

The *Minhāj* is not the only *zīj* produced by Ibn al-Bannāʾ, who prepared a summary of it entitled *al-Yasāra fī taqwīm al-kawākib al-sayyāra* (The simple method for the computation of planetary positions). This smallest possible form of a *zīj*, concerned mainly with the computation of planetary longitudes, was prepared most likely for popular astrologers who, apparently, were expected to learn the very short text of his canons by heart. The very few numerical tables are also simplified as much as possible and, in the case of the Moon, we go back to a simple model with only one inequality and a maximum equation of 5° (either a rounding of the standard Indian value 4° 56' or of **Ptolemy**'s first lunar inequality of 5° 1′). The *Yasāra* met with some success, and Ibn al-Bannāʾ himself summarized it even further in his *al-Ishāra fī ikhtiṣār al-Yasāra* (How to summarize the *Yasāra*). The *Yasāra* was also the subject of commentaries, adaptations, and corrections of defects such as that written by Ibn Qunfudh al-Qusanṭīnī (1339–1407).

It is evident from his writings that Ibn al-Bannāʾ wrote mainly for his students and always tried to be extremely brief and concise. He was also interested in the practical applications of his knowledge. For example, he wrote on the applications of geometry to land surveying, on the use of arithmetic and algebra to solve problems of partitioning inheritances, on weights and measures, and on the procedures for calculating with the *Rūmī* ciphers (apparently derived from the Greek cursive alphanumerical system of numeration), which were often used in Maghribī legal documents. In a field more related to astronomy, Ibn al-Bannāʾ wrote the *Kitāb fī al-anwāʾ*, a book on the pre-Islamic Arabic calendar system and meteorological predictor based on the heliacal risings and acronychal settings. He was also interested in the problems of timekeeping applied to Islamic worship and wrote short works, such as his *Qānūn fī maʿrifat al-awqāt biʾl-ḥisāb* (Rules to know time by calculation [*i. e.*, without instruments]), which seems to have been directed toward the elementary astronomical education of muezzins and imams who were responsible for the determination of prayer times and for the fixing of the beginning of lunar months. Furthermore, Ibn al-Bannāʾ wrote a short report on the visibility of the New Moon of Ramaḍān of the year 1301 due to the fact that the people of Fez had begun their fasting 1 day earlier than those of Marrakech and Tlemcen. A similar practical/religious concern appears in his two short texts on the *qibla* (direction toward Mecca): Ibn al-Bannāʾ's contemporaries were worried about the problem posed by the different orientations of mosques, and he tried to ease their consciences by stating that all of them had a correct orientation, which should not be changed in as much as they had been established with due intellectual effort (*ijtihād*). Surprisingly enough, this astronomer rejected the use not only of the imprecise methods of folk astronomy but also of those of spherical astronomy, which had given exact solutions to the problem since the 9th century. He gave two reasons: The results obtained were not necessarily precise, for the differences in geographical longitude between Mecca and other Islamic cities were not reliably known; and the knowledge required could not be expected from a lay Muslim.

A difficult problem is that of Ibn al-Bannāʾ's attitude toward astrology. It has been well established that he had been interested in the subject during the early stages of his scholarly life and that he wrote a number of short astrological works that have little originality and a very limited interest. They do, though, bear witness to the fact that he is following an Andalusian–Maghribī tradition that has certain characteristics different from those of the Eastern Islamic one. On the other hand, it seems that he wrote a nonextant work entitled *Radd ʿalā al-aḥkām al-nujūmiyya* (Refutation of astrological judgments), which seems to have been written in the second period of his scholarly life (1290–1301). It is difficult to establish clearly whether Ibn al-Bannāʾ lost his faith in the scientific character of astrology since the *Minhāj* (apparently written during the same period) describes techniques of mathematical astrology and the Marīnid sultan Abū Saʿīd reportedly consulted him as an astrologer.

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