

# Biographical Encyclopedia of Astronomers

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Ibn Sīnā: Abū 'Alī al-Husayn ibn 'Abdallah ibn Sīnā

Born Afshana (near Bukhārā, Uzbekistan), 980

Died Hamadhan, (Iran), 1037

Ibn Sīnā, also known as Avicenna, is renowned for his great works in philosophy and medicine. He was also interested in the mathematical sciences, and he dealt with a number of problems related to astronomy and cosmology that had an impact on later astronomical work in Islamic regions and in Europe.

Ibn Sīnā lived a full and colorful life and left an autobiography that was completed by his associate Abū 'Ubayd al-Jūzjānī. Here we emphasize his astronomical career. Ibn Sīnā lived in Bukhārā between 985 and 1005, where he studied Ptolemy's *Almagest* at an early age, essentially self-taught. It is said that he had access to the library of Nūh ibn Manṣūr (died 997), which included many books by the "Ancients." Ibn Sīnā lived in Gurganj from 1005 to 1012, where he wrote *Station of the Earth*. He then resided in Jurjān (1012–1014), and during that brief period he wrote his *Comprehensive Observations*, a treatise on the Correction of the Longitude of Jurjān, and his Summary of the *Almagest* (which he probably later incorporated into *al-Shifā'*, his great philosophical encyclopedic work). It was here that Jūzjānī began studying the *Almagest* with him. In 1014–1015, Ibn Sīnā moved to Rayy and then on to Hamadhan (1015–1024), where he wrote several parts of the *Shifa'*. He lived his final years in Isfahan, where he completed the final parts of the *Shifa'*, including the *Almagest*, composed the *Najāt* (the abridgement of the *Shifa'* that included logic, natural philosophy, and theology), and wrote his treatise on *Astronomical Instruments* during periods of observation for the ruler Ala' al-Dawla. After Ibn Sīnā's death, Jūzjānī added supplemental treatises on astronomy and mathematics to his *Najāt*.

There are many astronomical works associated with Ibn Sīnā, but nine can be identified as authentic, and these can be classified into four general categories: summaries of Ptolemy's *Almagest*, works on instruments and observational astronomy, philosophical and cosmological works, and miscellaneous works

(1) Ibn Sina's *Tahrir al-majisti* is an extensive summary of the *Almagest*. Composed in Jurjān between 1012 and 1014, he later revised it, and it became Part 4 of the mathematical section of the *Shifa'*. Two works of Ibn Sina that are often treated as separate treatises but are really part of the above work are:

(a) his *Ibtida' al-maqāla al-mudāfa ilā mā ikhtaṣara min kitāb al-majisti mim mā laysa yadullu 'alayhi al-majisti* (Beginning of the treatise appended to the summary of the *Almagest* containing what is not indicated in the *Almagest*). Ibn Sīnā states: "It is incumbent upon us to bring that which is stated in the *Almagest* and what is understood from Natural Science into conformity." Among the topics included are the dynamics of celestial motion, a mathematical examination of the implications of the theoretical construction of Ibrahim ibn Sinan (who is

unnamed) that would account for the discrepancies between Ptolemy's precessional rate and his obliquity, and those of 9th-century Islamic astronomers (Ibn Sinan gives his own observed value of the obliquity as 23, 33, 30°); the motion of the solar apogee, taken to be fixed by Ptolemy, and a proposal to explain its motion; and the problem of latitude brought about by the epicycle poles.

(b) his *Fi an laysa li-'l-ard harakat intiqal* (That the Earth does not have local motion), where Ibn Sinan gives an account of Ptolemy's arguments against the possibility of the Earth's rotation but indicates that they are inadequate

(2) Ibn Sina's *al-Arṣad al-kullīyya* (Comprehensive Observations) was written in Jurjān (between 1012 and 1014) for Abū Muhammad al-Shīrāzī and incorporated by Jūzjānī into Ibn Sīnā's *Najāt* after his death. This short work contains nine chapters and was translated into Persian as *Raṣadhā kullī* in the *Dānishnāmah-i ilā'ī*. Ibn Sīnā states that he wishes to "abridge the explication of the comprehensive observations from which one learns the general principles regarding the configuration of the orb and the calculation of the motions."

(3) Ibn Sina wrote *Maqāla fī al-ālāt al-raṣadiyya* (Treatise on astronomical instruments) in Iṣfahān sometime between 1024 and 1037, during his period of observations for Ala' al-Dawla. This work indicates a practical side to Ibn Sina's astronomical interests and also demonstrates his interest in precision

(4) *Fitūl Jurjān* ([Correction of the] longitude of Jurjān) was written in Jurjān (1012-1014) and dedicated to Zarrayn Kīs, daughter of Amir Qābūs (= Shams al-Ma'ālī). It is not extant but is discussed by Bīrūnī in his *Tahdid al-amākin*, disparaging Ibn Sīnā's abilities in practical astronomy.

(5) *al-Sama wa-'l-'ālam* (*De caelo et mundo*) was written for Abū al-Husayn Ahmad al-Sahli [Suhaylī?]. Most likely, this is what later became the chapter of the same name in the *Shifā'*

(6) *Maqāla fī al-ajrām al-samawiyya (al-'ulwiyya)* (Treatise on the celestial bodies). Like (5), this work is written from the perspective of cosmology/natural philosophy, not mathematical astronomy.

(7) *Illat qiyam al-ard fī hayyizihā (fī wasat al-sama')* (On the cause of the Earth's remaining in its position [in the middle of the heavens] = Station of the Earth). It was written in Gurganj (circa 1005-1012), and dedicated to al-Sahli, to whom *al-Sama' wa-'l-'ālam* is also dedicated

(8) *Maqāla (Risala) fī ibtal ilm (ahkām) al-nujūm* (Essay on the refutation of astrology) or *Risāla fī al-radd alā al-munajjimīn* (Treatise replying to the astrologers). This treatise attacks astrology and, along with his work on the categorization of the sciences, demonstrates Ibn Sina's attempt to demarcate astronomy from astrology

(9) *Maqāla fī khawāss khatt al-istiwa'* (Essay on the characteristics of the Equator). This work is no longer extant, but Ibn Sīnā's position that the equatorial region is the most temperate is known from his *Canon on Medicine* and from his critics, which included Bīrūnī, Fakhr al-Din al-Rāzī, and Nasir al-Din al-Tūsī.

Some of the works associated with Ibn Sīnā are misattributions, uncertain works, or duplications (due to longer or slightly different titles). (For details, see Ragep and Ragep.)

Ibn Sina's astronomical knowledge and works may be viewed as less developed than those of his contemporaries such as Ibn al-Haytham and Bīrūnī; nevertheless, he had an impact upon later writers, and several general points can be made about his astronomical work

First, Ibn Sina shows a remarkable interest in observational astronomy. Later writers refer to his observation of a Venus transit of the Sun, when it was seen as a mark on its face. This helped him establish that Venus was, at least sometimes, below the Sun. He also gave a new obliquity observation of  $23^{\circ} 33' 30''$  and provided a new longitude distance for Jurjan, from Baghdad, of  $9^{\circ} 20'$  (compared with the traditional value of  $8^{\circ} 0'$  and the modern value of  $10^{\circ} 3'$ ). Ibn Sina's treatise on instruments includes a description of a large instrument with an improved sighting system that theoretically could provide considerably improved accuracy. Also, his summaries tend to emphasize the role of observation. Noteworthy as well are Ibn Sina's criticisms of the poor instruments and observations of Ptolemy and Hipparchus

Second, Ibn Sina's cosmological writings are more within the tradition of natural philosophy rather than mathematical astronomy, and there is no extant work (and none reported) that one could call *haya* work (i.e., one that provided a physical account of the mathematical models of the *Almagest*). One can therefore understand his concern with the dynamics of celestial motion and his reliance on natural philosophy to criticize Ptolemy's attempt to rely strictly upon empirical evidence to disprove the possible rotation of the Earth. He is also aware of violations of the accepted physics in Ptolemy's models as well as the need for reforming the Ptolemaic system and reconciling physics with mathematical astronomy.

Finally, Ibn Sina plays a significant role in redefining and recategorizing astronomy. He demarcates exact mathematical astronomy (*'ilm al-haya*) from astrology, which he views as being part of natural philosophy

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### **Alternate names**

Avicenna

Sina

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