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Ibn Sīnā: Abū ʿAlī al-Ḥusayn ibn ʿAbdallāh ibn Sīnā

Sally P. Ragep

Alternate names

Avicenna

Born **Afshana (near Bukhārā, Uzbekistan), 980**

Died **Hamadhān (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 ʿUbayd 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, basically being self-taught. It is said that he had access to the library of Nūḥ 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-Shifāʾ*, 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 Hamadhān (1015–1024), where he wrote several parts of the *Shifāʾ*. He lived his final years in Iṣfahān, where he completed the final parts of the *Shifāʾ*, including the *Almagest*, composed the *Najāt* (the abridgement of the *Shifāʾ* that included logic, natural philosophy, and theology), and wrote his treatise on *Astronomical Instruments* during periods of observation for the ruler ʿAlā' 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 Sīnā's *Taḥrīr al-majisṭī* 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 *Shifāʾ*. Two works of Ibn Sīnā that are often treated as separate treatises but are really part of the above work are:

(a) his *Ibtidāʾ al-maqāla al-muḍāfa ilā mā ikhtaṣara min kitāb al-majisṭī mimmā laysa yadullu*

ʿalayhī al-majisṭī (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 **Ibrāhīm ibn Sinān** (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 Sīnā 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 *Fī an laysa li-'l-arḍ ḥarakat intiqāl* (That the Earth does not have local motion), where Ibn Sīnā gives an account of Ptolemy's arguments against the possibility of the Earth's rotation but indicates that they are inadequate.

(2) Ibn Sīnā's *al-Arṣād al-kulliyya* (Comprehensive observations) was written in Jurjān (between 1012 and 1014) for Abū Muḥammad 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 ʿilā'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 Sīna wrote *Maqāla fī al-ālāt al-raṣadiyya* (Treatise on astronomical instruments) in Iṣfahān sometime between 1024 and 1037, during his period of observations for ʿAlā' al-Dawla. This work indicates a practical side to Ibn Sīnā's astronomical interests and also demonstrates his interest in precision.

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

(5) *al-Samā' wa-'l-ʿālam* (*De caelo et mundo*) was written for Abū al-Ḥusayn Aḥmad al-Sahlī [Suhaylī?]. Most likely, this is what later became the chapter of the same name in the *Shifā'*.

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

(7) *ʿIllat qiyām al-arḍ fī ḥayyizihā (fī wasaṭ al-samā')* (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-Sahlī to whom al-*Samā' wa-'l-ʿālam* is also dedicated.

(8) *Maqāla (Risāla) fī ibṭāl ʿilm (aḥkām) al-nujūm* (Essay on the refutation of astrology) or *Risāla fī al-radd ʿalā al-munajjimīn* (Treatise replying to the astrologers). This treatise attacks astrology and, along with his work on the categorization of the sciences, demonstrates Ibn Sīnā's attempt to demarcate astronomy from astrology.

(9) *Maqāla fī khawāṣṣ khaṭṭ al-istiwā'* (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-Dīn al-Rāzī, and **Naṣīr al-Dīn al-**

Ṭūsī.

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 Sīnā'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 Sīnā 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;33,30° and provided a new longitude distance for Jurjān, from Baghdad, of 9;20° (compared with the traditional value of 8;0° and the modern value of 10;3°). Ibn Sīnā'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 Sīnā's criticisms of the poor instruments and observations of Ptolemy and **Hipparchus**.

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

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