From: Thomas Hockey et al. (eds.). *The Biographical Encyclopedia of Astronomers*, *Springer Reference*. New York: Springer, 2007, pp. 573-574

http://dx.doi.org/10.1007/978-0-387-30400-7_696

Ibn Yūnus: Abū al-Ḥasan ʿAlī ibn ʿAbd al-Raḥmān ibn Aḥmad ibn Yūnus al-Ṣadafī

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Died **(Egypt), 1009**

Ibn Yūnus was one of the greatest astronomers of medieval Islam and the most important astronomer of medieval Egypt. Unfortunately, nothing of consequence is known about his early life or education. As a young man he witnessed the Fatimid conquest of Egypt and the founding of the new city of Cairo in 969. In the period up to the reign of Caliph al-ʿAzīz (975–996), he made astronomical observations that were renewed by order of Caliph al-Ḥākim, who succeeded al-ʿAzīz in 996 at the age of 11 and was much interested in astrology. Ibn Yūnus's recorded observations continued until 1003.

Ibn Yūnus's major work was a monumental *zīj* or astronomical handbook with tables. Three substantial fragments of it survive in three manuscripts in Leiden, Oxford, and Paris. The *Ḥākimī Zīj*, dedicated to the caliph, is distinguished from all other extant *zīj*es by beginning with a list of observations made by Ibn Yūnus and others made by some of his predecessors. Despite his critical attitude toward these earlier scholars and his careful recording of their observations and some of his own, he completely neglects to describe the observations that he used in establishing his own planetary parameters; nor does he indicate whether he used any instruments for these observations. In view of the paucity of this information, it is remarkable that the statement that Ibn Yūnus worked in a "well-equipped observatory" is often found in popular accounts of Islamic astronomy. A. Sayılı has shown how this notion gained acceptance in Western literature.

Ibn Yūnus's *Zīj* was intended to replace the *Mumtaḥan Zīj* of **Yaḥyā ibn Abī Manṣūr**, prepared for the ʿAbbāsid Caliph **Maʾmūn** in Baghdad almost 200 years earlier. When reporting his own observations, Ibn Yūnus often compared what he observed with what he had computed using the *Mumtaḥan* tables.

The observations Ibn Yūnus described are of conjunctions of planets with each other and with Regulus, solar and lunar eclipses, and equinoxes; he also records measurements of the obliquity of the ecliptic (Chapter 11) and of the maximum lunar latitude (Chapter 38).

In spherical astronomy (Chapters 12–54), Ibn Yūnus reached a very high level of sophistication. Although none of the several hundred formulae that he presents is explained, it seems probable that most of them were derived by means of orthogonal projections and analemma constructions, rather than by the application of the rules of spherical trigonometry that were developed by Muslim

scholars in Iraq and Iran during the 10th century.

The chapters of the *Zīj* dealing with astrological calculations (77–81), although partially extant in an anonymous abridgment of the work preserved in Paris, have never been studied. Ibn Yūnus was famous as an astrologer and, according to his biographers, devoted much time to making astrological predictions.

Ibn Yūnus's second major work was part of the corpus of spherical astronomical tables for timekeeping used in Cairo until the 19th century. It is difficult to ascertain precisely how many tables in this corpus were actually computed by Ibn Yūnus. Some appear to have been added in the 13th and 14th centuries. The corpus exists in numerous manuscript sources, each containing different arrangements of the tables or only selected sets of tables. The best copies are two manuscripts now in Dublin and Cairo. In its entirety the corpus consists of about 200 pages of tables, most of which contain 180 entries each. The tables are generally rather accurately computed and are all based on Ibn Yūnus's values of 30° 0′ for the latitude of Cairo and 23° 35′ for the obliquity of the ecliptic. The main tables in the corpus display the time since sunrise, the time remaining to midday, and the solar azimuth as functions of the solar altitude and solar longitude; entries are given for each degree of both arguments, and each of the three sets contains over 10,000 entries. The remaining tables in the corpus are of spherical astronomical functions, some of which relate to the determination of the five daily prayers of Islam. The impressive developments in astronomical timekeeping in 14th-century Yemen and Syria, particularly the tables of **Abū al-ʿUqūl** for Taiz and **Khalīlī** for Damascus, also owe their inspiration to the main Cairo corpus.

It is clear from a contemporaneous biography of Ibn Yūnus that he was an eccentric, careless, and absent-minded man who dressed shabbily and had a comic appearance. One day in the year 1009, when he was in good health, he predicted his own death in 7 days. He attended to his personal business, locked himself in his house, and washed the ink off his manuscripts. He then recited the Quran until he died – on the day he had predicted. According to his biographer, Ibn Yūnus's son was so stupid that he sold his father's papers by the pound in the soap market.

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