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Yaʿqūb ibn Ṭāriq

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Flourished **Baghdad (Iraq), 8th to 9th century**

Yaʿqūb ibn Ṭāriq is known as a contemporary and collaborator of the 8th-century scholars in Baghdad (particularly **Fazārī**) who developed from Greek, Indian, and Iranian sources the basic structure of Arabic astronomy. Works ascribed by later authors to Yaʿqūb include the *Zīj maḥlūl fī al-Sindhind li-daraja daraja* (Astronomical tables in the *Sindhind* resolved for each degree), *Tarkīb al-aflāk* (Arrangement of the orbs), and *Kitāb al-ʿilal* (Rationales [of astronomical procedures]). He is also said to have written a *Taqṭīʿ kardajāt al-jayb* (Distribution of the *kardaja*s of the sine [sine values]), and *Mā irtafaʿa min qaws niṣf al-nahār* (Elevation along the arc of the meridian), which may be related to or incorporated within one of his more general works. An otherwise unknown astrological work entitled *Al-maqālāt* (Chapters) is also attributed to Yaʿqūb by one (unreliable) source. None of the above works is now extant, and only the first three are known in any detail from later writings.

Yaʿqūb's *zīj* (handbook with astronomical tables), like that of Fazārī, was apparently based on the Sanskrit original of the *Zīj al-Sindhind*, translated by them in Baghdad in the 770s. (A highly embroidered 12th-century account of Yaʿqūb's involvement in this translation is given by **Abraham ibn ʿEzra**.) Also like Fazārī's, the surviving fragments of Yaʿqūb's *zīj* are a heterogeneous mix from different traditions. For example, the mean motion parameters are Indian, as is the rule for visibility of the lunar crescent; the calendar is Persian; and the Indian sunrise epoch for the civil day appears to have been converted to the Greek-inspired noon epoch by the simple expedient of moving the prime meridian 90° (or 1/4th day) eastward from the usual location of Arin (Ujjain).

The *Tarkīb al-aflāk* was an early work on the topic that became known as *hayʾa* or cosmography (*i.e.*, the arrangement, sizes, and distances of the celestial orbs). Yaʿqūb's work apparently stated the orbital radii and sizes of the planets, as well as rules for determining accumulated time according to techniques in Sanskrit treatises. **Bīrūnī** in the 11th century mentioned the *Tarkīb* as the only Arabic source using the Indian cosmographic tradition (although at least some of the same values were known from other *zīj*es); if his descriptions of some of Yaʿqūb's rules are accurate, Yaʿqūb did not always fully understand or correctly interpret the Indian procedures.

It is also from Bīrūnī that we derive our knowledge of the *Kitāb al-ʿilal*, an early representative of the genre of "rationales" or "causes" treatises that undertook to provide mathematical explanations of the computational rules in *zīj*es. All of Bīrūnī's references to this work are contained in his *al-Ẓilāl* (On shadows), so they are limited to trigonometric procedures using gnomon shadows in calculations of time and location. By this time, evidently, Yaʿqūb's works were valued primarily for the information they provided about early influences from the Indian tradition, many of which were replaced in later Islamic astronomy by predominantly Ptolemaic techniques.

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