Ṣāghānī: Abū Ḥāmid Aḥmad ibn Muḥammad al-Ṣāghānī [al-Ṣaghānī] al-Asṭurlābī

Roser Puig

Flourished   **Ṣāghān (near Merv, Turkmenistan)**

Died   **Baghdad, (Iraq), 990**

Ṣāghānī was a mathematician, astronomer, and astrolabe maker. The 13th-century biographer al-Qifṭī reports that Ṣāghānī was an expert in geometry and cosmology (ʿ*ilm al-hayʾa*) and was the inventor and maker of instruments of observation. He had a number of students in Baghdad. He was also one of the outstanding astronomers at the observatory (*bayt al-raṣd*) built by order of the Būyid ruler Sharaf al-Dawla (982–989) at the extremity of the garden of the royal palace.

The Sharaf al-Dawla Observatory was the first in the history of Islam to have official status of some kind. According to al-Qifṭī, its program included the observation of the seven planets. This task was entrusted by Sharaf al-Dawla to **Wījan ibn Rustam al-Kūhī**, the director (*ṣāḥib*) of the observatory and the leader of the astronomers working at the institution in 988. One of the project's achievements was the observation of the Sun's entrance into two signs (the sign of Cancer and about three months later the sign of Libra). Two official documents were drawn up to testify to the accuracy of the procedures, and Ṣāghānī was one of the signatories.

According to **Bīrūnī**, Ṣāghānī used a ring with subdivisions into 5 min and diameter of 6 *shibr*, *i. e.*, about 145 cm, for the determination of the obliquity of the ecliptic and also for measuring the latitude of Baghdad. The date of the observation is given as 984/985, and the site is specified as "Birka Zalal" in western Baghdad. Bīrūnī also mentions that Ṣāghānī determined the lengths of the seasons using similar methods.

Ṣāghānī is frequently associated with a determination of the obliquity of the ecliptic by an observation using a 21-ft. quadrant in the year 995. However, this observation with a quadrant of a very similar size has also been attributed to Ṣāghānī's contemporary, the great astronomer and mathematician **Abū al-Wafāʾ al-Būzjānī**, who died in 997 or 998. As Ṣāghānī died in 990, the latter attribution must be the correct one.

Ṣāghānī's work on the astrolabe, entitled *Kitāb fī kayfiyyat tasṭīḥ al-kura ʿalā saṭḥ al-asṭurlāb*, was dedicated to ʿAḍūd al-Dawla (977–983). In this treatise in 12 sections, Ṣāghānī describes his own method, which he claims to be new, of projecting the sphere onto the plane of the astrolabe. With this technique, conic sections (ellipse, parabola, and hyperbola), in addition to points, straight lines, and circles, are formed by taking as the "pole of projection" not one of the poles but some other

point on the line joining them. In his book *Kitāb fī istīʿāb al-wujūh al-mumkina fī ṣanʿat al-asṭurlāb*, Bīrūnī states that no one can deny that Ṣāghānī is the inventor of this projection. Ṣāghānī seems to have encouraged Bīrūnī to develop a special type of projection, the orthographic or cylindrical.

Ṣāghānī's treatise, *Risāla fī al-sāʿāt al-maʿmūla ʿalā ṣafāʾiḥ al-asṭurlāb*, of which only the first chapter is extant, deals with the circular arcs that represent the hour lines on an astrolabe plate. Ṣāghānī states that many people in his time believed that these arcs pass through the projections of the north and south points. With a very clear and practically oriented explanation, he then proves that on astrolabe plates for the temperate latitudes the circular arcs for the ends of the first, second, and third seasonal hour cannot all pass through the projections of the north and south points.

Ṣāghānī also wrote a work in three parts on planetary sizes and distances.

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