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ʿAlī ibn Khalaf: Abū al-Ḥasan ibn Aḥmar al-Ṣaydalānī

Roser Puig

Alternate name

ʿAlī ibn Khalaf ibn Aḥmar Akhīr [Akhiyar]

Flourished **Toledo, (Spain), 11th century**

ʿAlī ibn Khalaf is known for his work on "universal instruments." No details of his biography are known. In Arabic sources, he is only mentioned by **Ṣāʿid al-Andalusī** in his *Ṭabaqāt* as an outstanding geometer, who belonged, along with **Zarqālī**, to a group of young Toledan scholars interested in philosophy.

There are several variants of his name. A footnote in Bū ʿAlwān's edition of the *Ṭabaqāt* gives ʿAlī ibn Khalaf ibn Aḥmar Akhīr (or Akhiyar) al-Ṣaydalānī. A very similar reading quoted by an anonymous Egyptian 14th-century source (preserved in Leiden, Universiteitsbibliotheek, MS 468) is Abū al-Ḥasan ʿAlī ibn Khalaf ibn Akhir (or Akhyar) bearing the title al-Shajjārī, the botanist. This has led D. A. King to identify him with Abū al-Shajjār, who is mentioned in Zarqālī's treatise on the *ṣafīḥa zarqāliyya* (MS Escorial 962). King also identifies him with ʿAlī al-Shajjār, who appears in a list of astronomers in the *zīj* of **Ibn Isḥāq** (13th century; Hyderabad, Andhra Pradesh, MS 298). According to this source, ʿAlī ibn Khalaf determined a value of 77° 13′ 30″ for the solar apogee, and he made an observation of the obliquity of the ecliptic of 23° 32′ 12″. This observation was made in Toledo in 1084/1085 with the aid of the physician, pharmacologist, and botanist Ibn Wāfid (died: 1075). Bearing in mind Ibn Wāfid's date of death, this may not be a completely reliable source.

ʿAlī ibn Khalaf is the author of a treatise on the use of the *lámina universal* (universal plate) preserved only in a Spanish translation included in the *Libros del Saber de Astronomía* (III, 11–132), compiled by the Spanish King **Alfonso X**. To our knowledge, the Arabic original is lost. ʿAlī ibn Khalaf is also credited with the construction of a universal instrument called *al-asṭurlāb al-maʾmūnī* in the year 1071, dedicated to al-Maʾmūn, ruler of Toledo.

The universal plate and the *ṣafīḥa* (the plate) of Zarqalī (devised in 1048) are the first "universal instruments" (*i. e.*, for all latitudes) developed in Andalus. Both are based on the stereographic meridian projection of each hemisphere, superimposing the projection of a half of the celestial sphere from the vernal point (and turning it) on to the projection of the other half from the autumnal point. However, their specific characteristics make them different instruments.

In ʿAlī ibn Khalaf's universal plate, the markings engraved on the mater correspond to longitudes and latitudes of ecliptic coordinates. The horizontal diameter represents the ecliptic, and the names of the zodiacal signs are engraved on the plate. These markings also can be used in a way corresponding to the almucantars and azimuthal circles of horizontal coordinates. The plate is fitted with a rete. One half of it shows a hollowed-out half-set of markings corresponding to the meridians and parallels of declination of equatorial coordinates; the other half shows a selection of star pointers from the Northern Hemisphere and the Southern Hemisphere. The rete is provided with two indexes. Although there is no evidence of examples of that instrument, its influence on the development of subsequent instruments has been suggested by E. Calvo.

Finally, in the introduction to his treatise, ʿAlī ibn Khalaf states his intention of writing a theoretical treatise on the several possibilities of projecting the sphere. However, there is no evidence of the existence of such a work.

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