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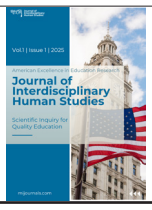

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MARYAM AL-ʿIJLIYA AND HER SCIENTIFIC LEGACY

Abstract. *This article analyzes the scientific and practical contributions of the female astrolabe maker referred to in the historical sources as al-ʿIjliya and widely known in modern literature as Maryam al-Usturlabi. Drawing primarily on the tenth-century bio-bibliographical work Al-Fihrist by Ibn al-Nadim, and situating its evidence within the broader history of the astrolabe and of astronomy in Islamic civilization, the study reconstructs the intellectual and courtly environment in which she worked at the court of the Hamdanid emir Sayf al-Dawla in Aleppo. The article examines the Greek origins and Islamic development of the astrolabe, its construction and its religious and practical functions, the place of women in the scientific culture of medieval Islam, and the documentary basis for what can responsibly be said about al-ʿIjliya herself. It argues that, although the surviving record concerning her is extremely limited, her recognized mastery of one of the most demanding of the mathematical crafts marks her as a figure of genuine historical importance and as an enduring symbol of the participation of women in science.*

Keywords: *al-ʿIjliya; Maryam al-Usturlabi; astrolabe; Islamic astronomy; ʿilm al-miqat; Sayf al-Dawla; Hamdanid Aleppo; women in science; Al-Fihrist.*

INTRODUCTION

The Islamic Golden Age, conventionally dated from the eighth to the fourteenth centuries, witnessed an extraordinary flourishing of the sciences across the Muslim world. In the great centres of learning – Baghdad, Cairo, Cordoba, Bukhara, and many others – scholars achieved decisive advances in mathematics, astronomy, medicine, optics, chemistry, and geography, building upon and critically extending the heritage

of the Greek, Indian, Sasanian, and Babylonian traditions. This body of knowledge not only served the needs of its own civilization but also became one of the principal foundations upon which the later European Renaissance and modern science were built (al-Hassan, 2001).

Among these sciences, astronomy held a position of special importance, for it was intimately bound up with the religious life of the Muslim community. The determination of the five daily prayer times, the establishment of the qibla (the direction of the Kaaba in Mecca), the sighting of the new moon that governs the lunar calendar, and the fixing of the months of fasting and pilgrimage all required exact astronomical knowledge. These religious obligations gave a powerful and sustained impetus to the development of observational astronomy, of mathematical astronomy, and, above all, of astronomical instruments (King, 2005).

The most emblematic of these instruments was the astrolabe, a device that combined geometric theory, astronomical knowledge, and refined craftsmanship in a single object that could be held in the hand. It is against this background that the figure of Maryam al-ʿIjliya – a woman who made astrolabes at the court of Aleppo in the tenth century – acquires its significance. The present article situates her life and work within the wider history of the astrolabe, the scientific culture of medieval Islam, the place of women within that culture, and the intellectual environment of Hamdanid Aleppo, in order to assess both her concrete contribution and her enduring symbolic importance.

The Astrolabe: Origins and Transmission to the Islamic World

The astrolabe – whose name derives from the Greek words meaning "star-taker" – is among the oldest and most sophisticated of pre-modern scientific instruments. Its theoretical basis, the stereographic projection of the celestial sphere onto a plane, was known to the Greek astronomers of the Hellenistic period; the underlying principle is associated with Hipparchus in the second century BCE and was elaborated in the works of Ptolemy and Theon of Alexandria. With the great translation movement of the eighth and ninth centuries, during which Greek scientific works were rendered into Arabic, the astrolabe passed into the Islamic world, where it was not merely received but profoundly developed (al-Hassan, 2001). The first Muslim scholar reported to have constructed an astrolabe was Muhammad ibn Ibrahim al-Fazari, in the late eighth century (Ragep, n.d.).

Muslim astronomers transformed the astrolabe from a Greek inheritance into an instrument of remarkable versatility. In the tenth century, ʿAbd al-Rahman al-Sufi is

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reported to have described more than a thousand distinct uses of the astrolabe, while in al-Andalus Abu Ishaq al-Zarqali (known in Europe as Arzachel) designed a universal astrolabe – the saphaea – which, unlike earlier models, did not depend on the latitude of the observer and could therefore be employed anywhere on earth (British Museum, 2018). Through al-Andalus this refined Islamic instrument was transmitted to Christian Europe from the eleventh century onward, and a significant number of technical terms still in use today, such as alidade, azimuth, and nadir, preserve their Arabic origins.

The Construction and Functions of the Astrolabe

In its classic planispheric form, the astrolabe consists of four principal elements. The mater (the "mother") is the main body, a disk with a raised rim within which the other components are housed. Inside it lie one or more plates, or tympans, each engraved with the coordinate lines – the horizon, the curves of equal altitude, and the lines marking the hours – appropriate to a particular geographical latitude. Above the plates rotates the rete, an openwork disk that serves as a map of the heavens, its curved pointers marking the positions of the principal fixed stars together with the ring of the zodiac. On the reverse of the instrument an alidade, a pivoted sighting rule, allows the user to measure the altitude of a celestial body above the horizon (British Museum, 2018).

By combining a measured altitude with the engraved coordinate lines, the user could solve a wide range of problems: determining the time of day or night, finding the altitude and azimuth of the sun or a star, measuring the height of a building or the depth of a well, and casting astrological charts (al-Hassan, 2001). In the Islamic context, however, the astrolabe acquired an additional and distinctive religious function. The science of timekeeping, ʿilm al-miqat, developed precisely in order to regulate the times of prayer and the direction of the qibla, and a specialized official, the muwaqqit, was frequently attached to mosques to determine these times. Many Islamic astrolabes accordingly carry tables and curves for the prayer times, gazetteers listing cities with their qibla directions, and inscriptions of Qur'anic verses and dedications, so that a single instrument was at once a scientific tool, a religious aid, and a work of art (King, 2005).

Women in the Scientific Culture of Medieval Islam

The participation of women in the intellectual life of medieval Islam, though unevenly documented, was by no means negligible. Women played a particularly prominent part in the transmission of hadith, where numerous female scholars (muhaddithat) acted as

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respected teachers and authorities whose certificates of transmission were sought by male and female students alike. In the sphere of patronage and institution-building, Fatima al-Fihri is traditionally credited with founding, in the ninth century, the mosque of al-Qarawiyyin in Fez, which developed into one of the oldest continuously operating institutions of higher learning in the world (Women's Contribution to Classical Islamic Civilisation, n.d.).

In the exact sciences, however – in mathematics, astronomy, and the making of precision instruments – the names of women that have survived in the historical record are exceedingly rare. It is precisely this rarity that lends Maryam al-ʿIjliya her exceptional importance: she is among the very few women whose work in a technical scientific craft was registered by a contemporary or near-contemporary authority, and her appearance in a list otherwise composed entirely of men marks her as a figure of unusual note.

Aleppo under Sayf al-Dawla: The Intellectual Environment

The city in which Maryam al-ʿIjliya worked, Aleppo, stood at the height of its cultural brilliance during the tenth century. Under the Hamdanid emir Sayf al-Dawla (r. 944/945–967), Aleppo was raised from relative obscurity to the rank of a major capital and became the centre of a vibrant intellectual and literary life (Kennedy, 2004). Although Sayf al-Dawla is best remembered for his ceaseless frontier wars against the Byzantine Empire, he was also a celebrated patron of learning who gathered around him some of the finest minds of the age, among them the great poet al-Mutanabbi, the philosopher al-Farabi – later honoured as "the Second Teacher" after Aristotle – the poet-prince Abu Firas al-Hamdani, and the grammarian Ibn Khalawayh (Kennedy, 2004).

It was in this milieu of generous princely patronage, in which poets, philosophers, grammarians, and men of science competed for favour and recognition, that a skilled maker of astronomical instruments could find both employment and esteem. The presence of an accomplished astrolabe maker at the Hamdanid court is therefore entirely consistent with what is known of the scientific and courtly culture of Aleppo in this period, and it provides the concrete historical setting for the notice that the sources preserve concerning al-ʿIjliya.

Maryam al-ʿIjliya: Life and Work

The principal – indeed almost the only – historical source for Maryam al-ʿIjliya is the Kitab al-Fihrist, the great bio-bibliographical catalogue compiled in Baghdad toward

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the end of the tenth century by Ibn al-Nadim (Ibn al-Nadim, ca. 988). In the section of this work devoted to the makers of astronomical instruments, Ibn al-Nadim lists a series of astrolabe makers, among whom appear a father and his daughter. The father, al-ʿIjliy al-Usturlabi, is identified as a pupil of the master Nastulus (a name also transmitted as Bastulus); the daughter, designated simply as al-ʿIjliya, is recorded as having likewise been a pupil of the same master and as having been attached to the court of Sayf al-Dawla.

The connection with Nastulus is significant, for he was among the most distinguished astrolabe makers of the early Islamic period; the oldest dated Islamic astrolabe known to survive, dated 315 AH (927–928 CE), is attributed to him (King, 2005). To have trained in the workshop of such a master placed both al-ʿIjliy and his daughter within the most advanced instrument-making tradition of their time. Maryam – in modern literature frequently called Maryam al-Usturlabi, "the astrolabe maker" – thus learned the craft at its highest level, mastering the geometry, the astronomical knowledge, and the precise metalworking that the construction of a reliable astrolabe demanded.

It must be acknowledged that the surviving evidence concerning Maryam is extremely limited. Beyond the brief notice in the Fihrist, no instrument attributed to her hand is known to survive, and the more elaborate accounts of her achievements that circulate in popular literature today extend well beyond what the medieval sources actually state. What can be affirmed on firm historical grounds is that a woman known as al-ʿIjliya, trained in the foremost astrolabe-making tradition of her age, practised this exacting craft at one of the leading courts of the tenth-century Islamic world. Ibn al-Nadim records the matter in the following words:

Al-ʿIjliy al-Usturlabi, a student of Nastulus, and his daughter al-ʿIjliya, who was in the court of Sayf al-Dawla and was a student of Nastulus.

Significance and Legacy

Modest as the documentary record is, the significance of Maryam al-ʿIjliya is considerable. In a catalogue that names sixteen makers of astronomical instruments, she is the single woman; her inclusion demonstrates that a woman could attain recognized mastery in one of the most demanding of the mathematical crafts and could exercise it in the service of a ruling court (Ibn al-Nadim, ca. 988). Her example complements the better-documented roles of women as transmitters of religious knowledge and as founders of educational institutions, extending the visible presence of women in medieval Islamic

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civilization into the domain of the exact sciences (Women's Contribution to Classical Islamic Civilisation, n.d.).

In the modern period, Maryam al-ʿIjliya has come to occupy a prominent place in discussions of the history of women in science. She is frequently invoked as an early example of female achievement in astronomy and engineering and as a source of inspiration for the participation of women in contemporary scientific and technological fields. Such modern commemoration must of course be distinguished from the sparse medieval record on which it rests, but it testifies to the enduring power of her example and to the continuing relevance of the question her career raises concerning the place of women in the sciences.

CONCLUSION

The astrolabe, inherited from the Greek world and brought to a high degree of perfection by the astronomers and craftsmen of Islam, stands as one of the great achievements of pre-modern science and as a vivid emblem of the union of mathematical precision, religious purpose, and artistic beauty that characterized Islamic civilization at its height. Within this tradition, Maryam al-ʿIjliya occupies a small but luminous place. Trained in the workshop of a leading master and active at the cultivated court of Sayf al-Dawla in tenth-century Aleppo, she practised the demanding craft of astrolabe-making at the highest level of her day and earned a place – the only woman among them – in Ibn al-Nadim's catalogue of the instrument-makers of the Islamic world.

Her career, though thinly documented, demonstrates that the pursuit of the exact sciences in medieval Islam was not closed to women, and that the harmony of faith and knowledge so characteristic of the age could find expression in the work of a woman as fully as in that of a man. For this reason Maryam al-ʿIjliya remains, more than a thousand years after her lifetime, both a legitimate subject of serious historical inquiry and a lasting source of inspiration for women in science.

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