**Ancient astronomy** Part 7: **Islamic (Arab) astronomy: the pivotal link between ancient and modern astronomy**

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Depiction of an Islamic astronomer Islamic astronomical texts, Timbuktu

Modern Western astronomy owes a huge debt to Islamic astronomy. It acted as a vital link between the astronomy of ancient cultures and the start of scientific inquiry in Renaissance Europe, bridging the gap created by the Dark Ages. It has also left a lasting legacy, one example being the fact that the vast majority of star names in current use are of Arabic origin or are the Arab translation of Greek names. Examples include well-known stars like Achernar, Aldebaran, Altair, Denebola, Fomalhaut, Mintaka, Rigel, Saiph and Vega.

There is no evidence that pre-Islamic Arabs had any form of astronomy apart from informal observations. It was the rise of Islam and the associated valuing of scholarly learning which provoked interest in this field. Most astronomers and other scientists worked in the courts of regional leaders who financed their work. Scientific work, including astronomical, which took place in the Islamic world from the 8th to the 15th centuries CE has been the most important and influential.

Islamic astronomy was undertaken across a wide geographical area including the Middle East, Central Asia and North Africa, later extending to India and China and, via the invasion of Spain in the 11th century CE, into Europe. Important centres of Islamic astronomy included Baghdad and Damascus.

Astronomy was a branch of the Islamic sciences which assimilated and built on existing foreign knowledge and material to create science with Islamic characteristics. Islamic astronomy was built largely on the science of two cultures, Hellenistic and Indian. A large body of Islamic astronomical literature survives today, Arab translations often being the only remaining records of writings from earlier cultures.

Islamic astronomy was closely associated with religion, its central importance being the need for the frequent time-keeping needed for religious adherence eg. praying five times a day at specific positions of the Sun. The Koran makes frequent references to astronomical patterns visible in the sky. In addition to timing, Islam required that all followers face Mecca during prayer. This made the determination of latitude and longitude important in Islamic astronomy. Using the stars, particularly the pole star, as guides, several tables with directions were compiled for important cities in the widespread Islamic world. Islamic astronomy also had secular purposes, particularly as a tool for navigation.

Part of the development of Islamic astronomy involved the construction of both instruments and observatories. The latter, the first of which dated to the 9th century CE, usually included a mosque and a library, as well as high quality instrumentation and a dedicated staff of researchers. They were built in a number of places including Damascus (Syria), Baghdad (Iraq), Esfahan, Maragah and Tehran (Iran) Samarkand (Uzbekistan) Istanbul (Turkey), Toledo and Cordoba (Spain). These all preceded the first observatory built in Europe by Tycho Brahe in 1576. One example of the innovative work done in Islamic observatories was the use of transits of the Sun by Mercury or Venus to very accurately calculate the obliquity of the ecliptic (the tilt of the Earth’s axis relative to the Sun – 23.5°). It was calculations like these which facilitated the compilation of latitude and longitudes of major cities in the Islamic world.

Islamic astronomers and mathematicians made improvements to many existing instruments, such as adding new scales, or refining details. These instruments included celestial globes, armillary spheres, astrolabes (a simple sextant-like instrument to measure the altitude of stars, particularly useful for navigation), sundials and quadrants (an instrument using angles to measure different aspects of time from astronomical observations and calculations). These and other devices, and records of observations were used in the development of calendars and other measures for both secular and religious purposes. The latter included calculating the start of Ramadan, the hours of prayer and the direction of Mecca.

The writings of Hellenistic astronomers, particularly Ptolemy, were important in early Islamic astronomy, but Arab astronomers did not unquestionally accept existing theories and models. However, although they examined them and identified a number of inconsistencies, they did not dispute the core concept of a geocentric universe when they developed alternatives.

A huge growth in astronomical knowledge and understanding took place up to the mid-15th century CE. However, the following centuries were marked by a period of stagnation when the direction and focus of Islam changed. Notwithstanding this, the Arabs left an important astronomical legacy.

There are a number of concepts central to Western mathematics and physics which they introduced to Europe. For example, the 9th century astronomer Al-Khwarizmi invented algebra, basing the system on Indian numbers borrowed by the Arabs (today’s Arabic numerals, including zero). He also performed detailed calculations of the positions of the Moon, Sun and planets, as well as some eclipse predictions. His works were later translated into Latin and directly influenced science in Renaissance Europe. Islamic astronomers also refined earlier calculations of astronomical cycles including the length of the year, which the Persian Omar Khayyam accurately calculated to the 6th decimal place.

Islamic writings also influenced advances in cosmology in Europe. For example, translations of writings on refinements made to the Ptolemaic geocentric model by several Islamic astronomers were important, providing a solid base for the development of the heliocentric theory.

**Sources** <http://en.wikipedia.org>, [www.starteachastronomy.com](http://www.starteachastronomy.com), [www.incamera.as.arizona.edu](http://www.incamera.as.arizona.edu), Riddpath,I (Ed) 2007 Oxford dictionary of astronomy 2nd ed.

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