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History And Development of Astronomy in World Civilization

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ABSTRACT

Astronomy has played a crucial role in the development of Islamic astronomy knowledge. This paper explores the historical contributions of astronomers, the impact of classic astronomy on the broader scientific world, and its relevance in modern times, particularly in determining the Islamic calendar and prayer times. The study also discusses integrating traditional Islamic methods with contemporary astronomical practices. This study uses a qualitative approach to explain the phenomenon in as much depth as possible through data collection from published references. Certain verses in the Qur'an, such as surah Al-Anbiya verse 33 and surah Yasin, specifically mention astronomy. Historically, the development of astronomy has been divided into two phases: before Islam and in Islamic civilization.

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I. Introduction

The development of astronomy has been a vital part of human civilization, with roots tracing back to some of the earliest known cultures. The ancient Egyptians, Babylonians, and Greeks laid much of the groundwork for modern astronomy. The Egyptians, for example, used astronomical observations to align their pyramids and to establish a reliable calendar system essential for agricultural and religious activities [1]. The Babylonians, meanwhile, are credited with some of the earliest systematic observations of celestial bodies, recording the positions of planets and stars, which later influenced Greek astronomy [2].

Astronomy has attracted the attention of researchers and historians due to several factors, such as the contributions of scholars, the number of works, astronomical observatories, and documentation of natural observations. The civilizations of India, Persia, and Greece played a key role in the birth of the Arab (Islamic) Falak civilization. The

astronomy book Sindhind from India influenced the development of Arabic astronomy, while the Persian civilization gave astronomical terms still in use, such as zij and auj. Greece's civilization, led by Ptolemy, made a major contribution with his work 'Almagest,' which survived Copernicus' theory. The development of astronomy needs to be studied before and during Islamic civilization.

Islamic astronomy, also known as Ilm al-Falak, has been a significant field of study within the Islamic world for centuries. Rooted in the religious practices of Islam, which require precise knowledge of celestial events, this science has contributed extensively to global astronomical knowledge. The field has historically been crucial for determining prayer times, the Islamic calendar (Hijri), and the direction of the Qibla (the direction of the Kaaba in Mecca) [3].

The legacy of Islamic astronomy extends beyond the medieval period, influencing the European Renaissance and the subsequent development of modern astronomy. The preservation and enhancement of Greek and Indian astronomical knowledge by Islamic scholars provided a crucial link between ancient and modern science. The works of Islamic astronomers were translated into Latin during the 12th century, making their way to Europe, where they were studied by scholars such as Copernicus, who credited them with providing the observational data and mathematical tools necessary for his heliocentric theory [4]. Thus, Islamic astronomy played a pivotal role in the broader history of science, bridging the gap between ancient civilizations and the modern scientific era.

In modern times, Islamic astronomy has integrated traditional methods with contemporary astronomical tools and data. This integration has been particularly evident in observatories like the Observatorium Ilmu Falak UMSU, which combines classical Islamic astronomy with modern technology [5].

II. Method

The type of research used by the author for this research is Library or literature research that explains according to normative, organized, and systematic principles and is accurate in the object of study, which is the subject matter. This study aims to explain the phenomenon as deeply as possible through data collection from published references.

III. Results and Discussion

A. Pre-Islamic Astronomy

The science of astronomy has been studied by nations such as Egypt, Mesopotamia, Babylon, and China since the 28th century B.C. Initially, they studied it to produce a count of time used to worship various idols such as Osiris, Isis, Anom in Egypt, and Astaroth and Bel in Babylon and Mesopotamia. The need for time division encourages them to delve into astronomy. Over time, the field of astronomy discussion developed into an understanding of the sky and everything around it. Ancient civilizations such as Babylon, Egypt, China, India, Persia, and Greece were active in astronomy and astrology, reflecting the character and tendencies of each civilization [6].

The Sumerian civilization, estimated at around 4500 BC, is considered the beginning of the emergence of science, especially in astronomy and astrology, for subsequent civilizations. Babylon, as a continuation of the Sumerians, had a strong influence. The Babylonians were known for their experimental activities, which helped this civilization survive and flourish. Astrology, born around 2,000 BC in the Mesopotamian Valley, became an important contribution and, at the same time, a problem still relevant today in Babylon. The glittering sky inspired astrologers and celestial surveyors without city lights, predicted celestial phenomena, and regarded the motion of celestial bodies as a message from the rulers of nature. Originally intended for kings and countries, astrology eventually permeated the daily lives of ordinary people, discussing predictions, characters, tendencies, joys, and sorrows.

According to one story, the division of a week or seven days has existed for more than 5,000 years. At that time, to avoid confusion, they gave names of known celestial bodies, such as the sun for Sunday, the Moon for Monday, Mars as Thursday, Mercurius as Wednesday, Jupiter as Thursday, Venus as Friday, and Saturn as Saturday.

There are significant differences between astronomy and astrology, although both involve the interpretation of the universe (the sky). These two fields are related to the meaning of celestial bodies. Astrology focuses on the relationship between the positions of the constellations (zodiac), planets, sun, and moon to a person's character and fate. On the other hand, astronomy investigates the movement of celestial bodies scientifically for the benefit of humans and the development of civilization. It also observes galaxies, planets, stars, comets, and other celestial bodies that continue to evolve as human knowledge advances. Astronomy studies natural phenomena such as lunar and solar eclipses, sunspots, and others with a physical-mathematical approach and the laws of nature. In conclusion, the objects in the sky were considered celestial entities, not gods or extraordinary beings.

During the Babylonian civilization, tables of celestial circulation, calendars of the seasons changed, phases of the moon, mapping of the sky, and predictions of eclipses which became the beginning of modern astronomy. This civilization also established a circle measuring 360°, measuring the circumference of the Earth measuring 360°, and determining the division of time with one day equal to 24 hours, 1 hour equal to 60 minutes, and 1 minute equal to 60 seconds. Astronomy had gained a very important and broad position in the Land of Greece, which was in the golden age of knowledge. The names of famous Astrologers before Islam include:

1. Aristoteles (384 – 322 SM)

Aristotle argued that the center of the universe is the Earth, while the Earth is in a state of rest, motionlessness, and non-rotation. All the motions of celestial bodies revolve around the Earth. The trajectory of each celestial body is circular. Meanwhile, eclipse events, for example, are no longer seen as giants swallowing the moon but are natural events. Man's view of the universe from then on generally follows Aristotle's view, namely the geocentric Earth as the center of circulation of celestial bodies

2. Claudius Ptolomeus (140 M)

The opinion put forward by Ptolemy is under Aristotle's view of the cosmos, namely the Geocentric view; the Earth is surrounded by the moon, Mercury, Venus, the sun, Mars, Jupiter, and Saturn. The celestial bodies are far from the Earth in successive distant checks. The trajectory of these celestial bodies is in the form of a circle within a celestial sphere. While the sky is where the true stars are, so they are glued to the walls of the celestial sphere. Ptolemy had a great book on the science of the stars entitled' Syntasis. Ptolemy's geocentric view prevailed until the 6th century A.D. without any change.

The civilizations of India and Persia have an important role in the development of Arabic astronomy (Islam) and coexist with the civilization of Greece [7]. India's influence on Islam is more dominant than that of Persia. An interesting myth from the Ancient Indian nation depicts the Earth as flat, perched on several giant elephants standing on the back of a large turtle. The sky is considered a giant cobra that circles the Earth, its scales glittering like stars at night. The text "Sindhind" from India had a great impact on the development of Arabic (Islamic) astronomy, especially during the Abbasid period (750-1258 AD) under the reign of Al-Manshur. An order was issued to translate this book into Arabic, and Ibrahim al-Fazzari produced an explanatory book entitled "As-Sind Hind al-Kabir." This gave rise to astronomy works with a touch of Indian astronomy during the Abbasid period.

Persian civilization also exerted a significant influence on Islam. They learned from the civilizations of India and others. The Abbasid king, Al-Manshur, gathered Persian astronomers for astronomical discussions, including figures such as Nubekht al-Farisi, Umar bin al-Farkhan, and Ibrahim al-Fazzari. Persian astrological terms such as 'zaij' (zij) and 'auj' (aphelion) remain relevant in Islam. Persian-language astrological books that attracted the attention of Arabic (Islamic) include "Zaij asy-Shah" or 'Zij Syahryaran,' a well-known epilicator (zij) of the time. One of Al-Khawarizmi's works, entitled "Ta'dil al-Kawakib" also reflects the style of the Persian astronomical school.

B. Astronomy in the Islamic Age

The science of astronomy in the classical Muslim intellectual tradition is considered one of the signs of the progress of Islamic civilization. Initially, the science of Falak only focused its study on aspects of worship, such as the direction of the Qibla, the time of prayer, and the beginning of the month of Qamariah. The development of Falak in the Islamic world reached its peak with the process of translating monumental works from Greece, which had a great impact on its evolution. Works such as "The Sphere in Movement" (Al-Kurrah al-Mutharrikah) by Antolycus, "Ascentions of the Signs" (Matali' al-Buruj) by Aratus, "Introduction to Astronomy" (Al-Madkhhal ila Ilmi al-Falak) by Hipparchus, and "Almagesti" by Ptolemaeus greatly influenced Falak's thought [8].

Over time, translating these works and in-depth research produces new theories. At this point, an influential figure in the Muslim community, al-Khawarizmi, emerged with his monumental work, "al-Mukhtasar fi Hisab al-Jabr wa al-Muqabalah." This book had a significant impact on the thought of European scholars. It was later translated into Latin by

Robert Chester in 535 AH/1140 AD under "Liber al-gebras et almucarabah". In 1247 AH/1831 AD, Frederick Rosen translated the book into the United Kingdom. In the Quran, Surah Al Anbiya verse 23 says:

وَهُوَ الَّذِيْ خَلَقَ الَّيْلَ وَالنَّهَارَ وَالشَّمْسَ وَالْقَمَرَۗ كُلٌّ فِيْ فَلَكٍ يَّسْبَحُوْنَ ﴿٣٣﴾

It states, "And it is He who created the night and the day, and the sun and the moon; all [heavenly bodies] in an orbit are swimming." This verse highlights the concept of celestial bodies moving in precise orbits, a fundamental idea in Islamic astronomy, or Ilm al-Falak. Islamic scholars have historically interpreted this verse as an indication of the ordered nature of the universe, which aligns with the scientific understanding of celestial mechanics. The recognition of orbits in the Quran has been viewed as a reflection of the divine knowledge that precedes human discovery, motivating Muslim astronomers to explore and understand the heavens. This Quranic insight has encouraged a tradition of astronomical observation and study in the Islamic world, leading to significant advancements in the field [9].

Under the influence of previous civilizations, astronomy during the Arab civilization (Islam) was initially better known as the study of astrology. The main factors were the habits of living in the desert that involved celestial bodies to know the changes in time, the change of seasons, and the like, as well as their influence on the astrological habits of neighboring nations. During the Abbasid Dynasty, under the rule of Al-Manshur, astronomy was placed in a special position after monotheism, jurisprudence, and medicine. Astronomy at that time was studied for practical purposes of worship and developed as a basic foundation for advancing other sciences such as shipping, agriculture, military, mapping, and others. Caliph Al-Manshur even allocated large funds from the state to develop astronomy studies. During this period, the study of astronomy developed naturally and scientifically with many new improvements and breakthroughs. Muslim astrologers scientifically calculate prayer times, qibla directions, and rukyatul hilal and calculate seasons and other aspects.

From the Umawiyah era to the Al-Makmun period, the movement to translate foreign astronomy literature into Arabic became widespread. Examples are the translation of Miftah an-Nujum based on Hermes the Great, and Sindhind in 154/771 translated by Ibrahim al-Fazzări (d. + 180/796), as well as Ptolemy's "Almagest" translated by Yahya bin Khalid al-Barmaki and perfected by Al-Hajjaj bin Matar and Säbit bin Qurrah (d. 288/901), among other works.

Islam gave birth to many influential astronomers in the world, such as Al-Battani (d. 317/929), Al-Buzjani (d. 387/997), Ibn Yunus (d. 399/1008), Ath-Thūsi (d. 672/1273), Al-Biruni (d. 440/1048), Ibn al-Majdi (d. 850/1446), and others [10]. The development of Arab-Islamic astronomical civilization, as previously highlighted, is not only based on previous civilizations but has certain peculiarities:

a. Although adopted from previous civilizations, the science of astronomy developed in Islamic civilization is always enriched with corrections and re-explanations of theories, producing new works with their characteristics and advantages.

b. The Arab-Islamic astronomical civilization is not limited to a mere theoretical review but expands its scope to other fields of science such as mathematics, physics, geometry, and others. This is reflected in the works and observation tools produced.

c. In the context of astrology, Arab-Islamic civilization did not completely erase this tradition. The practice of astrology is still present in daily life. This is due to astrology, which highlights various aspects of a person's life, including all possible joys and sorrows.

In the 16th century, the geocentric system collapsed thanks to the contribution of Nicholas Copernicus (d. 1543 AD) in 1512 AD. He stated that planets and stars moved around the sun in circular orbits and made the sun the center of the universe. Copernicus' thoughts are recorded in his works "De Revolutionibus Orbium Coelestium" and "Little Commentary." Johannes Kepler (d. 1630 A.D.) supported this idea in 1609 A.D. by stating that the sun is the center of the solar system and fixed the orbits of the planets into elliptical shapes through his three Kepler laws. Later, Galileo (d. 1642 AD) created a monumental telescope, and from his observations, he concluded that the Earth was not the center of movement. The discovery of this telescope, in addition to strengthening Copernicus' heliocentric concept, also opened a new chapter in the development of astronomy.

IV. Conclusion

Astronomy is a field of knowledge that studies celestial bodies and their environment. Around 4500 BC, it is considered the starting point of the emergence of knowledge, specifically astronomy and astrology, for subsequent civilizations. Babylonia, as a continuation of Sumerianism, had a very strong influence. Although astronomy and astrology interpret the universe, the two have significant differences. Ancient Egypt has a long history in science, inventing the sundial (mizwalah) and the calendar system of its time. Allegedly, the Ancient Chinese civilization also conducted studies on Nova and Supernova. These two civilizations played a special role in the emergence of Arab (Islamic) and Greek astronomical civilizations.

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