



Codification Historical Astronomy Pre-Islamic Ancient Civilizations and Their Contributions to Islamic Astronomy

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Abstrak: Sebagai salah satu cabang ilmu tertua, Astronomi telah ada pada abad-abad sebelum Masehi dan dipelopori oleh beberapa peradaban kuno. Setelah Islam datang, Ilmu Astronomi digunakan untuk keperluan ibadah yang kemudian dikenal dengan Ilmu Falak. Artikel ini bertujuan untuk menggali bentuk-bentuk pengetahuan astronomi pada beberapa Peradaban Kuno sebelum Islam kemudian melihat keterkaitan dan kontribusi pengetahuan astronomi tersebut terhadap perkembangan Ilmu Falak Islam. Penelitian ini merupakan penelitian pustaka menggunakan teknik analisis kualitatif (analisis konten dan analisis hubungan). Dari kajian dan telaah pustaka yang dilakukan, ditemukan bahwa pengetahuan astronomi pada beberapa Peradaban Kuno sebelum Islam adalah astronomi yang masih sederhana dan digunakan untuk berbagai kebutuhan, seperti keperluan ibadah (dalam hal ini menyembah Dewa-Dewa), pertanian, peternakan, meramal nasib, menentukan arah, dan keperluan politik. Di antara bentuk kontribusi peradaban kuno sebelum terhadap Ilmu Falak Islam dapat dilihat dalam berbagai hal diantaranya, kalender, zij (ephemeris), ataupun alat seperti Mizwalah yang dimodifikasi dan disesuaikan dengan tuntunan syara' oleh Astronom Muslim. Peradaban Kuno sebelum Islam juga melahirkan banyak tokoh dan pemikir ulung, yang mana banyak berpengaruh dalam perkembangan Ilmu Falak Islam.

Kata Kunci: Astronomi, Peradaban Kuno, kontribusi, Ilmu Falak Islam

Abstract : As one of the oldest branches of science, astronomy existed in the centuries before Christ and was pioneered by several ancient civilizations. After Islam came, Astronomy was used for religious purposes which became known as Astronomy. This article aims to explore the forms of astronomical knowledge in several ancient civilizations before Islam and then look at the connection and contribution of this astronomical knowledge to the development of Islamic astronomy. This research is library research using qualitative analysis techniques (content analysis and relationship analysis). From the studies and literature reviews carried out, it was found that astronomical knowledge in several ancient civilizations before Islam was simple astronomy and was used for various needs, such as worship (in this case worshipping the Gods), agriculture, animal husbandry, predicting fate, determining direction, and political needs. Among the forms of contribution of ancient civilizations before the Islamic Astrology can be seen in various things, including calendars, zij (ephemeris), or tools such as the Mizwalah which were modified and adapted to Islamic guidance by Muslim Astronomers. Ancient civilizations before Islam also gave birth to many great figures and thinkers, who had a lot of influence on the development of Islamic Astronomy.

Keywords: Astronomy, Ancient Civilizations, contributions, Islamic Astronomy

A. Introduction

Long before it became a scientific discipline, astronomical knowledge about the universe and the natural world existed among people in various ancient civilizations in the world. Its development was pioneered by the Sumerians and Babylonians and then spread to various corners of the world such as Greece, Persia, India, China, Arabia, Maya, Europe and Asia.¹ However different with man

¹Mhd. Fikri Maulana Nasution, "Perkembangan Ilmu Falak Pada Peradaban Pra Islam," *Jurnal Penelitian Medan Agama* 9, no. 1 (2018): 141–56.



moment this is studying phenomenon natural Based on research data, humans are in the hundreds even thousand last year lots hook phenomenon natural with *superstition* or trust local. For example, humans used to think that a solar eclipse occurred because a giant swallowed the sun, therefore people needed to hit a gong to make the giant go away and the eclipse stopped.² Apart from that, knowledge about object sky is also used for needs farming and searching livelihood.³

After Islam developed, knowledge astronomy in civilization before Islam reconstructed by Astronomers Muslim for interest worship with base to proposition *syara'*. This kind of knowledge is what we later know as Islamic Astronomy Science (Falak). Seeing the connection between astronomical knowledge in ancient civilizations before Islam and Islamic Astronomy, the author found two problem formulations, namely, what kind of astronomical knowledge existed in ancient civilizations before Islam? and what is its contribution to Islamic Astronomy Science? This article aims to find out the relationship between astronomical knowledge in ancient world civilizations and the Islamic Astronomical Science that we know today.

Previously there was some literature related to Astronomy commonly and Islamic Astronomy from a historical perspective. Among them article Imam Ghozali's work entitled " Perspektif Historis tentang Ilmu Falak ". This article in a way whole discuss about history knowledge celestial sphere before and after Islam.⁴ Beside that, there is writing Mhd. Fikri Maulana Nasution who discussed about history knowledge celestial sphere pre-Islamic in some countries. This article only give description general about knowledge celestial sphere before the entry of Islam.⁵ Then article entitled "Kontribusi Peradaban Bangsa Babilonia Dalam Perkembangan Budaya Pada Abad 21" by Bella Safitri. This article focuses on contribution civilization Babylonians against culture, including one of them in field astronomy.⁶ Temporary in this article writer focus to knowledge astronomy in civilization ancient (no only Babylonian) and analyze contribution civilization the to Islamic Astronomy Science. Article entitled *The Dynamics and Development of Astronomy from the Pre- Islamic Era to the Contemporary Era* by Pepep et al. by general article this discuss about history knowledge celestial sphere in civilization classic before Islam arrived Islamic civilization and also Islamic Astronomy in Indonesia.⁷

So far search writer not yet there is an article discussing it in a way detailed about knowledge astronomy in civilization ancient before Islam and its contribution to development Islamic Astronomy Science. Civilization ancient in question is where is the world civilization? knowledge

²Mohd. Kalam Daud, *Studi Ilmu Falak: Arah Kiblat Dan Waktu Shalat* (Aceh: Sahifa, 2019).

³OIF UMSU, "Astronomi Pada Masa Mesir Kuno," 2018, <https://oif.umsu.ac.id/2018/08/astronomi-pada-masa-mesir-kuno/>.

⁴Imam Ghozali, "Prespektif Historis Tentang Ilmu Falak," *Humanistika: Jurnal Keislaman* 2, no. 1 (2016).

⁵Nasution, "Perkembangan Ilmu Falak Pada Peradaban Pra Islam."

⁶Debi Setiawati Bella Safitri, "Kontribusi Peradaban Bangsa Babilonia Dalam Perkembangan Budaya Pada Abad 21," *Dewaruci: Jurnal Sejarah Dan Pengajarannya* 1, no. 2 (2022): 1–13.

⁷Pepep Puad Muslim, Tatang Farhanul Hakim, and Suparman, "The Dynamics and Development of Astronomy from the Pre-Islamic Era to the Contemporary Era," *Al-Tsaqafa: Jurnal Ilmiah Peradaban Islam* 20, no. 1 (2023): 14–28, <https://doi.org/10.15575/al-tsaqafa.v20i1>.



knowledge start developing, that is starting in the 12th century BC, pioneered by the Assyrians in the Mesopotamian Civilization. So from that 's urgency from this library research is to serve more detailed information regarding form knowledge astronomy from a number of civilization before Islam, which was excavated from relevant primary sources. So thats, it deaf this is also purposeful to complete shortcomings in previous writings with focuses on discussion about knowledge astronomy exists in some civilization ancient in the pre-Islamic world, then explained form contribution and connection knowledge astronomy in civilization ancient the to development Islamic Astronomy Science.

B. Method

This research is library research *using* qualitative data analysis techniques and a descriptive approach. Literature studies are used by writers to collect data, whether in the form of books, articles, websites, or other sources that discuss research topics. The primary references used are an article entitled *History of Astronomy* by Jay Pasachoff et al., as well as a book by Hajar, M.Ag entitled "Ilmu Falak: Sejarah, Perkembangan, dan Tokoh Tokohnya ". Data from primary and secondary sources is analyzed using content analysis techniques to understand the patterns and descriptions of astronomical knowledge in the ancient civilization in question. Then, using relationship data analysis techniques, an analysis was obtained regarding the contribution of astronomical knowledge of ancient civilizations to Islamic Astronomy.

C. Results and Discussion

1. Knowledge Astronomy Mesopotamian and Babylonian Civilizations

Mesopotamia is something current area this located in the territory of Iraq, place where beginning developing world civilization. By geographically, Mesopotamia is flanked by two rivers; Tigris and Euphrates.⁸ The first city in this civilization was the City of Uruk which was built by the Sumerians in 3200 BC.⁹ In its glorious times, the nation Sumerian has know system the numbering is based on the underlying 60 (*sexagesimal*). clock system that has 60 minutes and 1 circle own 360° angle. Apart from that, nation Sumerian also developed basics algebra and geometry.¹⁰

Civilization nation Sumerian Then taken taken over by the Somites in the 26th century BC, then in 1200 BC Mesopotamia was taken taken over by the Assyrians.¹¹ Emergence nation Assyria is beginning new for civilization in Mesopotamia marked with start development knowledge knowledge like mathematics, medicine, history, and literature. Knowledge about astronomy in Mesopotamia is one of them be marked with naming the planets, constellations, or stars. Mesopotamians only know sun and moon, as well as five planets (apart from earth), i.e Mercury,

⁸Kathleen, *Mesopotamia : The World's Earliest Civilization* (Kuiper and Britannica Educational Publishing, 2011).

⁹"Mesopotamia - HISTORY," nd

¹⁰Ajat Sudrajat and Miftahuddin, *Pengantar Sejarah Asia Barat* (Yogyakarta, 2008).

¹¹Nasution, "Perkembangan Ilmu Falak Pada Peradaban Pra Islam."



Venus, Mars, Jupiter, and Saturn. In some literature, mentioned that the planets that which known to the Mesopotamian people were Marduk/Jupiter, Nabu/ Mercury, Ishtar/Venus, and several other.¹² After the glory days the Assyrians, Mesopotamia finally controlled by the nation Chaldeus in 612 BC and so was born Babylonian city.

Apart from naming object the sky in Assyrians glorious times, knowledge in the field astronomy also developed during the Babylonian era, such as distribution seven day in a week already known Babylonian society. Then, determination What is the name day during seven day that guided to what is the name object the sky they are know. Sun for name day *Utu* , Moon for name day *Nanna-Suen*, Mars for name day *Nergal*, Mercury for name day *Nabu*, Jupiter for name day *Marduk*, Venus for name day *Inanna*, and Saturn for name day *Ninurta*.¹³

The Babylonians also believed that the stars were God's guidance, so people used many constellations to predict their lives, so the science of astrology was more developed than the science of astronomy. But they still pay attention and develop knowledge astronomy to use needs life like agriculture and shipping.¹⁴ Apart from astrology, they have also made tables of seasons, time, calendars, eclipses, and sky mapping,¹⁵ which is this give donation important to development knowledge world astronomy.

In addition, as proof of advances in knowledge in the field of astronomy, the Assyrians had a calendar that adopted the existing Mesopotamian calendar system which is better known as the "Standard Mesopotamian Calendar". Apart from the Assyrians, the Babylonians also had a calendar. The Babylonian calendar had 12 months, each month having 29 or 30 days. The change of months in the Babylonian calendar was determined by looking at the new moon. The names of the months in this calendar are *Nisannu*, *Ayyaru*, *Simanu*, *Du'uzu*, *Abu*, *Ululu*, *Tasritu*, *Arahsamnu*, *Kissilimu*, *Tebet / Kanunu*, *Sabatu*, and *Addaru*; which are based on 12 constellations starting from Aries.¹⁶

From the previous explanation, it can be seen that the astronomical knowledge that was known in the world's oldest civilization was knowledge about simple celestial bodies, in the form of the sun, moon and planets in the solar system. Plus knowledge about the names of the days. This knowledge is used to help with agricultural and shipping needs (related to the seasons). However, knowledge about stars and celestial bodies is still associated with *superstition* and fortune telling. Therefore, the science of astrology dominates more than the science of astronomy in people's lives.

¹²Mustofa Umar, "MESOPOTAMIA DAN MESIR KUNO: Awal Peradaban Dunia," *El-Harakah: Jurnal Budaya Islam* 11, no. 3 (2009), <https://doi.org/https://doi.org/10.18860/el.v0i0.434>.

¹³L. S. Copeland, "Sources of The Seven-Day Week," *Popular Astronomy* 47, no. 4 (1939): 175.

¹⁴Hajar, *ILMU FALAK : Sejarah, Perkembangan Dan Tokoh-Tokohnya*, ed. Bowo and Istiqowati Nugroho (Pekanbaru: Sutra Benta Perkasa, 2014).

¹⁵Nasution, "Perkembangan Ilmu Falak Pada Peradaban Pra Islam."

¹⁶Yigal Bloch, "Middle Assyrian Lunar Calendar and Chronology," in *Living the Lunar Calendar*, 2019, <https://doi.org/https://doi.org/10.2307/j.ctvh1dj98.6>.



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2. Knowledge Astronomy Ancient Egyptian Civilization

The Ancient Egyptians studied astronomy to find out when flash floods on the Nile River would begin so they could be prepared to deal with them. If previously they counted years based on the moon, then after they learned that the flood of the Nile was related to the seasons, they also counted years based on the sun.¹⁷ The flooding of the Nile River, which occurs regularly, coincides with the phenomenon of the rising star Sirius in the eastern sky. They then used the Nile flood event as the basis for creating a calendar system consisting of 12 months. Each month has 3 weeks, and each week has 30 days. In one year, there are 3 seasons, namely *ḥt*, *prt*, and *šmw*. Where *ḥt* means inundation or flood, *prt* means winter, and *šmw* means summer. Each season consists of 4 months or 120 days.¹⁸

In "*History of Astronomy*" mentioned that knowledge Egyptian Astrology originated from the entire African region, from the Dogon region in Mali, to West Africa, to Ethiopia, to South Africa.¹⁹ One of object legacy in the field astronomy nation Egypt phenomenal antiquity adalah Pyramid of Giza. Fourth side Pyramid exactly follow location three stars shaper Osiris' belt in the constellations Orion star.²⁰ The Ancient Egyptians developed and used special mathematical methods for calculating the slope of the pyramids. In general, a pyramid seked is a kind of fraction, given as many palms horizontally for every cubit vertically, where 7 palms equal one cubit.²¹

Sky object like the sun, moon, planets, and stars, were considered by the Egyptians to be inhabiting Gods sky. That sky felt and imagined with various way in ancient Egypt. One of them is picture ocean water that surrounds the world. Sky god use boat lor sail and explore various regions in the sky. They pass the sky is rising more and more high above the horizon and culminates in the meridians. Journey with boat they mentioned in lots text and relief or original painting from various period Egyptian history. One of the earliest iconographic sources attesting to this idea dates to the first dynasty. This is an image carved on the surface of an ivory comb in the form of relief decoration. The image shows the very ancient Eagle God on his barque resting on a pair of wings representing the sk.²²

It can be concluded that astronomical knowledge in the Ancient Egyptian Civilization was not much different from astronomical knowledge in the Mesopotamian and Babylonian Civilizations. They use their knowledge of astronomy to determine the changing seasons to support their livelihoods. The Nile River flood that occurred in Egypt was used as the basis for the calendar

¹⁷Ahmad Fuad Basya, *Sumbangan Keilmuan Islam Pada Dunia* (Jakarta: Pustaka Al-Kautsar, 2015).

¹⁸Leo Depuydt, "The Calendars and the Year-Counts of Ancient Egypt," *Chronique d'Egypte* 92, no. 184 (2017): 271–94, <https://doi.org/10.1484/J.CDE.5.115207>.

¹⁹Jay Pasachoff, Magda Stavinschi, and Mary Kay Hemenway, "History of Astronomy," nd, [http://sac.csic.es/astrosecundaria/zh/cursos/formato/materiales/conferencias/L3 History definitiva.pdf](http://sac.csic.es/astrosecundaria/zh/cursos/formato/materiales/conferencias/L3%20History%20definitiva.pdf).

²⁰OIF UMSU, "Astronomi Pada Masa Mesir Kuno."

²¹Dušan M, "THE SEKED: ON ANCIENT EGYPTIAN MATHEMATICS AND ASTRONOMY," *Großes Handwörterbuch Ägyptisch-Deutsch* 13 (2004): 772.

²²Dušan M.



system they created. Mythological matters cannot be separated from this ancient civilization. This is proven by the assumption that celestial bodies are Gods who inhabit the sky. Of course, modern astronomical knowledge is still very far from this civilization.

3. Knowledge Astronomy Greek Civilization

When the Greeks appeared on the historical scene, the stars had the same meaning for them as they did for other primitive people. Celestial phenomena become a reference for their work, orientation in navigation and time calculations. In the rural life of Greek society, the phenomenon of stars always accompanied their agricultural activities in various seasons of the year. When the Pleiades rise, it is time to use the scythe to harvest. Then when the Pleiades set (in the morning, November 1), they used the plow to prepare new agricultural land. 60 days after the winter solstice, grapes should be pruned. But when Orion and Sirius came, the grapes had to be picked. When the Pleiades move away from Orion, storms may occur. Fifty days after the sun turns (the summer solstice) is the perfect time for humans to navigate.²³

Astronomy in Greece began to be developed in the 6th century BC²⁴ and developed rapidly and expanded in the 4th century BC because it was considered a very important position, especially at that time Greece was in the golden age in the field of science. Progress knowledge This Keep going continues until 2nd²⁵ century BC. However Thus, Tanikawa and Kiyotaka are in his research mention that No There is observation astronomy in Greece before 362 BC.²⁶ Apart from that, experts agree that from the 3rd century BC onwards there was increasingly visible interaction between Babylonian Astronomy and Greek Astronomy. For example, Hipparchus in the 2nd century BC approached Babylonian meteorologists and astronomers to understand the phenomena of lunar and solar eclipses and made a lot of use of them.²⁷ Knowledge astronomy from Babylonian society was carried away until to ancient Greece through traders Phoenician.²⁸

If the Babylonians were recorder phenomenon great astronomy, then the Greeks built knowledge That For trying to "explain" the sky. Most ancient Greeks, including Aristotle (384 BC – 322 BC), argued that Earth is center natural universe, and consists from four elements: Earth, Air, Fire, and Water. Beyond the earth is the fifth element, aether (or quintessence), which forms points of light in the sky. Then in the 2nd century AD, Greek astronomer Claudius Ptolemy followed Aristotle by placing the Earth at the center of the universe. The moon and planets circle it in nested circles that grow larger with distance from Earth.²⁹

²³A. Pannekoek, *A History of Astronomy* (New York: Interscience Publishers, 1961).

²⁴Hajar, *ILMU FALAK : Sejarah, Perkembangan Dan Tokoh-Tokohnya*.

²⁵Taufiqurrahman Kurniawan, *Ilmu Falak Dan Tinjauan Matlak Global* (Yogyakarta: MPKSDI Yogyakarta, 2010).

²⁶Kiyotaka Tanikawa, "Greek' Astronomy," *The Fifth Symposium on History of Astronomy*, 2016, 1–17.

²⁷Fuad Basya, *Sumbangan Keilmuan Islam Pada Dunia*.

²⁸Mohd. Kalam Daud, *Studi Ilmu Falak: Arah Kiblat Dan Waktu Shalat*.

²⁹Pasachoff, Stavinschi, and Hemenway, "History of Astronomy."



Apart from Aristotle and Ptolemy, there were also several other famous Greek astronomers. Among them, Thales is considered the pioneer of Greek classical astronomy. Thales thought that the earth was a vast plain. In contrast to Thales, Pythagoras said the shape of the earth was round. Then there was Erastosthenes who is considered as the first person to measure the circumference of the earth through distance and the earth's shadow. Next there was Aristarchus who measured the distance between the earth and the sun and was also the originator of the Heliocentric theory. At that time, this understanding did not receive support because the popular understanding was the Geocentric ideology of Hiparcus (90-125 BC). This Heliocentric understanding/ theory only became popular centuries later, namely by Ibnu Syathir and Nicolas Copernicus.³⁰

The treasures of Greek Astronomical civilization are not only decorated with famous astronomers (and their theories), but also with astronomical relics. One of the ancient Greek astronomical relics that has attracted the attention of researchers is the Antikythera Mechanism. The Ancient Greek Astronomical Calculator, discovered in 1901, is a cultural treasure based on technology for making astronomical predictions, by mechanizing astronomical cycles and theories.³¹ This calculator is also known as the Greek computer and is used to map the positions of planets and celestial bodies, to predict eclipses, and it is also possible that it is also used for astrological purposes.

Apart from astronomical calculators, the Ancient Greeks also knew the calendar (Solon Calendar). According to Herodotus, the Greek calendar was a mixture of the solar calendar and the luni-solar calendar. Tanikawa and Kiyotaka call the Solon calendar neither lunar nor lunar-solar nor solar, but only based on their own observations. The Solon calendar is a mixture of the solar calendar and the luni-solar calendar, so it is not an astronomical calendar.³² From the previous explanation can be seen that astronomical knowledge in Greek Civilization was very complex. Not only did it produce figures and scholars, but also various astronomical instruments which were very advanced when seen at that time.

4. Knowledge Astronomy Chinese Civilization

The Chinese are the nation's most aggressive and accurate in observe phenomenon before Arab people.³³ In ancient Chinese civilization, the king of something dynasty give order special to astronomers for observe star. Two reasons the king gave order for observe star is for reason astrology and for make product like calendar.³⁴ Regarding when astronomical knowledge first

³⁰Arwin Juli Rakhmadi Butar-Butar, "Astronomi Di Masa Peradaban Yunani Kuno," OIF UMSU, 2020, <https://oif.umsu.ac.id/2020/10/astronomi-yunani/>.

³¹Lindsay Macdonald et al., "A Model of the Cosmos in the Ancient Greek Antikythera Mechanism" (London, 2021), <https://doi.org/https://doi.org/10.1038/s41598-021-84310-w>.

³²Tanikawa, "'Greek' Astronomy."

³³Pasachoff, Stavinschi, and Hemenway, "History of Astronomy."

³⁴Cheng Fang, Fang, and Cheng, "Past, Present and Future of Chinese Astronomy," *HiA* 16, no. H16 (2015): 19–29, <https://doi.org/10.1017/S1743921314004621>.



appeared in China, archaeologists have confirmed that knowledge about astronomy in China has existed since 4000 BC. The same thing is also mentioned in the "History of Astronomy", that complete records of astronomical observations in China began during the Warring States era (4th century BC) and continued to be developed from the Han era to the next period of power.³⁵

Proof that astronomy in China emerged in the century the is with found it a grave lower land located in Puyang, Henan. In the tomb, found stack shell shell around framework forming bones a dragon and a tiger. Archaeologist find that the dragon is sign for direction eye wind east and tiger as sign direction eye west wind. This matter in accordance with Chinese mythology that there are 4 directions eye every wind direction eye the wind guarded by the Gods.³⁶

Apart from direction eye wind, knowledge about astronomy like there are also many eclipses, comets and calendars found. Development knowledge about eclipse for the Chinese began recorded moment The Xia dynasty ruled, namely in 1600-1046 BC.³⁷ Explanation about eclipse is in a known book with Name *Shang shu (The Book of Documents)* and manuscripts bone oracle.³⁸ In one manuscript bone here, there is a number of notes show that eclipse Once occurred on October 2, 1198 BC, June 7, 1172 BC, and October 31, 1161 BC.³⁹ Apart from that, Chinese astronomers in 700 BC also did so research shadow the sun is used for calculation calendar with period 1500 years time. Chinese astronomers also succeeded determine lifespan day in a year namely 365¼ days in 350 BC. In the same year, a Chinese astronomer named Shi Shen succeeded compile catalog consisting of stars of the 800 entries considered as catalog oldest in the world.⁴⁰

First calendar developed by the Chinese calendar the sun, that is around 2300 BC.⁴¹ In 221-206 BC, the astronomical calendar further developed. Apart from explaining the movements of the sun and moon, the calendar at this time also explained the movements of the five planets.⁴² Around 140-104 BC, Lo Shia Hung appeared who compiled the famous Tai ch'u li calendar in 104 BC.⁴³ Apart from that, there are also calendars originating from the Shang Dynasty (18-12 BC). This calendar from the Shang Dynasty is a luni-solar calendar which still contains their myths or beliefs about the 60 heavenly and earthly branches used to count the days.⁴⁴

Apart from eclipses and calendars, the ancient Chinese also described sun spots in 1200 BC, recorded the appearance of a supernova star in the constellation Aquilla in 532 BC, discovered the

³⁵Pasachoff, Stavinschi, and Hemenway, "History of Astronomy."

³⁶Yunli Shi, "Ancient Chinese Astronomy – An Overview," 2015, 2031–42.

³⁷Emil Khalisi, "The Solar Eclipse of the Xia Dynasty: A Review," June 2020, <https://doi.org/10.48550/arxiv.2006.04674>.

³⁸Yuzhen Guan, *The Treatment of Eclipses in Early Chinese*, 2015.

³⁹Fang, Fang, and Cheng, "Past, Present and Future of Chinese Astronomy."

⁴⁰Hajar, *ILMU FALAK : Sejarah, Perkembangan Dan Tokoh-Tokohnya*.

⁴¹Mary Kay Hemenway Jay Pasachoff, Magda Stavinschi, *A History of Astronomy* (NASE Publication, nd).

⁴²Shi, "Ancient Chinese Astronomy - An Overview."

⁴³Nasution, "Perkembangan Ilmu Falak Pada Peradaban Pra Islam."

⁴⁴Shi, "Ancient Chinese Astronomy - An Overview."



path of Halley's comet in 240 and 164 BC, and created the compass in 100 BC. BC.⁴⁵ Can said that the 12th Century BC is peak development and progress knowledge astronomy in China. According to Chinese astronomers, the earth is the center of the universe, the sun, moon, and other celestial bodies move around the earth. Ancient Chinese thinking about planets can be said to be almost the same as the heliocentric theory.⁴⁶

From the explanation above, it can be said that Chinese astronomy focuses more on observation than theory. This can be seen from the many celestial events that this civilization managed to record. One of them was that they managed to record the appearance of a very bright supernova in 1006 AD. Then in 1054 AD, they observed a supernova, the remainder of which became known as the "Crab Nebula". From the observations made, they also found that the comet's tail was always in the opposite direction away from the position of the sun.⁴⁷

5. Knowledge Astronomy Indian Civilization

Indian Astronomy was influenced by Greek Astronomy starting in the 4th century BC after conquests of Alexander the Great. Indian-Greek influence on traditions astronomy seen with texts like *Yavanajataka* and *Romaka Siddhanta*, a translation Sanskrit from A Greek text. A few of earliest roots from Indian astronomy can estimated originate from period civilization in the Indus Valley or previously.⁴⁸ Astronomy later developed as a Vedanga discipline, or one of the "auxiliary disciplines" associated with Vedic studies, dated to 1500 BC or older. The oldest known text is the *Vedāṅga Jyotiṣa* written by Lagadha. This book details several parts of astronomy that are generally applied to determine the time of social and religious events.

Apart from that, there are also *Rig Veda* as one oldest work of Indian literature. *Rig Veda* 1-64-11 & 48 describes time as wheel with 12 sections and 360 radii (days), with the remaining 5, refers to the calendar sun⁴⁹. Indian ethnoastronomy that is no less interesting is the Hindu Calendar. The calendar used in ancient times has undergone many changes in the regionalization process, and currently there are several Indian regional calendars, as well as an Indian national calendar. In the Hindu calendar, the day begins with local sunrise. It was granted five "properties," called *angas*. The ecliptic is divided into 27 nakshatras which are called lunar houses or asterisms. This nakshatra represents the lunar cycle of the fixed stars, 27 days and 72 hours, and some of which are part of the 28th nakshatra. Nakshatra calculations appeared in the Rig Vedic period (from the 2nd to the 1st millennium BC).⁵⁰

⁴⁵Pasachoff, Stavinschi, and Hemenway, "History of Astronomy."

⁴⁶Hajar, *ILMU FALAK : Sejarah, Perkembangan Dan Tokoh-Tokohnya*.

⁴⁷Pasachoff, Stavinschi, and Hemenway, "History of Astronomy."

⁴⁸Pierre-Yves Bely, *A Question and Answer Guide to Astronomy* (Cambridge: Cambridge University Press, 2010).

⁴⁹BG Sidrath, "The Calendric Astronomy of the Vedas," *Bulletin of the Astronomical Society of India* Vol. 26 (1998).

⁵⁰Pasachoff, Stavinschi, and Hemenway, "History of Astronomy."



Indian astronomy experienced quite a wide spread. It is said that some elements of Indian astronomy reached China with the expansion of Buddhism during the last Han dynasty (25-220 AD), but most of the detailed integration of Indian astronomy was carried out during the Tang dynasty (618-907 AD).⁵¹ From the explanation previously can said that knowledge Indian astronomy more focused to sourced dates and calendars from *Vedanga Jyotiṣa* nor *Rig Veda*.

6. Knowledge Astronomy Civilization Mayans

The Maya are a Meso-American civilization recorded as the only nation to develop a written language overall in pre-Columbian America, as well as art, architecture, mathematical and astronomical systems. Mayan astronomy is one of the most well-known ancient astronomies in the world, mainly because of its famous calendar and is often misinterpreted as predicting the end of the world. The Maya appears to be the only pre-telescopic civilization to show knowledge of the Orion Nebula as something vague, i.e. not a star point.⁵²

Maya Astronomical Records were preserved in a powerful hieroglyphic writing system that was used for centuries before transatlantic contact occurred. During the first centuries after transatlantic contact, hieroglyphic writing was actively eliminated and replaced by writing using the Latin alphabet. By the end of the 19th century, literacy in the hieroglyphic writing system had disappeared and it took almost a century for modern Russian, European, and American scholars to decipher these astronomical records. In this latter process, the number system and calendar components were quickly deciphered, but the text itself remained impenetrable until the 1960s, and was not considered safely decipherable until the late 1990s. This means that, for nearly a century, Mayan astronomical scholarship was developed based on numbers and dates, without the ability to contextualize them.⁵³

In the historiography of Maya Astronomy, a collection of dates was discovered from monumental hieroglyphic inscriptions; above are inscriptions carved into wooden doorways, and painted on the walls. Until the last third of the 20th century, scholars developed the reading of the inscription by emphasizing astronomical content. However, according to Tatiana Proskouriakoff, the pattern in the dating portion of these hieroglyphic inscriptions supports a historical interpretation rather than an astronomical one. Later, by the beginning of the 21st century epigraphists had deciphered more than 90% of the hieroglyphs and found that the number of records understood to be explicit astronomical references had decreased substantially. However, a more subtle role for astronomy in Ancient Maya culture has been discovered. As in other ancient

⁵¹Pasachoff, Stavinschi, and Hemenway.

⁵²Pasachoff, Stavinschi, and Hemenway.

⁵³Gerardo Aldana and Santa Barbara, "MAYA CALENDAR AND MESSOAMERICAN ASTRONOMY," *Encyclopedia of the History of Science*, 2022, 1–48, <https://doi.org/10.34758/qyyd-vx23>.



civilizations, there were substantive political applications and motivations for astronomy. In other words, astronomy in the Ancient Maya was implemented for political purposes.⁵⁴

As has mentioned before, that The Ancient Mayans used astronomy as objective politics and for interest the required a system calendar. Calendar The Mayans are famous with calendar complicated as expected originate from 8th century BC. Technology calendar This formed in the period formative middle, with Izapa as an important site in track trade in this period. By Vincent Malmstrom, Izapa considered as place birth Mayan calendar. In this period calendar used as reference for stabilize trade that depends on productivity food of course relate with season. During period formative middle this too, is known count 260 days as device earliest date.⁵⁵



Figure 1. Count of 260 Mayas

The 260-day count is also known as *ch'ol q'ij* and *tzolk'in*. Sequences are read in paired columns from left to right. In operation, the 260 Day Calculation combines thirteen numbers with twenty days signs. Day signs are symbols that represent natural entities found in the local environment, such as jaguars, winds, and reeds. The count works by cycling through each part of the count each day to produce a total of 260 different combinations. Regarding the origin of this '260 calculation', scholars differ in opinion. Some say that this calculation is because the autumn zenith trajectory along the line 14.8 degrees North from the equator occurs 260 days after the vernal zenith trajectory. Then Chol Mayan called this calculation of 260 days the average distance from birth.⁵⁶

Can concluded that stands out the most from the ancient Mayan civilization is calendars and dates that they use as objective politics; on the side of course needs ibody and determination season.

7. Knowledge Astronomy Pre -Islamic Arab Civilization

Just like previous civilizations, the Arabs before Islam also did not know scientific astronomy. The pre-Islamic Arabs relied entirely on empirical observations of the heavens, especially the rising and setting of certain stars. Their knowledge of natural phenomena is limited to meeting their needs

⁵⁴Aldana and Barbara.

⁵⁵Aldana and Barbara.

⁵⁶Aldana and Barbara.



and earning a living. For example, many of inland Arabs work as herdsmen. Due to the need for grass as animal feed, they recorded the changing seasons to know where it would rain.⁵⁷

The Arabs had a good knowledge of the lunar manzilah. They divided it into twenty-eight manzilahs, where one manzilah is worth twelve degrees and more minutes.⁵⁸ To determine the year, the Arabs did not know numbers. They based the name of the year on memorable and memorable events in that year, for example the year of the elephant (*'am fiil*) to commemorate the incident when Abraha's elephant troops attacked the city of Mecca. They also know the *Nasi* year as the name for a leap year which is a form of adjustment to the four seasons.⁵⁹

Astronomical knowledge in pre-Islamic Arab civilization was also influenced by astronomers from Babylonia who at that time fled to Arab territory due to attacks from the Persian army.⁶⁰ Thus, it is very natural that the practice of astronomy in this civilization was not much different from astronomy in the Babylonian Civilization; where this knowledge is used to make farming and animal husbandry easier by marking the change of seasons.

8. Contribution Knowledge Astronomy Ancient Civilizations Before Islam towards Development Islamic Astronomy Science

The development of Islamic Astronomy began with the birth of Islam itself. The need for worship whose time is determined by celestial bodies, makes Muslims inevitably have study celestial bodies. In its early development, Astronomy or Islamic Astronomy was directly related to the study of astrology or necromancy (astrology), where astrology itself was born from the Babylonian civilization. Then astrology continued to exist as a tradition across civilizations from Babylonia, Greece, Persia to India.⁶¹ Apart from that, the determination of 1 day 24 hours, 1 hour 60 minutes, and 1 minute 60 seconds by the Babylonians is also a very significant contribution in development Islamic Astronomy Science. The reason with exists determination this, Muslims are not confused about determining the time of worship.

Another ancient civilization that contributed to Islamic astronomy was the knowledge of astronomy in the Ancient Egyptian Civilization. The greatest contribution of Ancient Egyptian Civilization was the Solar Calendar system which was compiled from observations of the star Sirius. The appearance of the star Sirius in the eastern sky (before sunrise) is used as a marker for the beginning of the year. The Ancient Egyptian calendar, which had 365 days, was later adopted by Julius Caesar, and became the Gregorian calendar. The Ancient Egyptians were also the first to recognize intercalation or intercalation, which was then continued by the Pre-Islamic Arabs. Later,

⁵⁷Watni Marpaung, *Pengantar Ilmu Falak*, 1st ed. (Jakarta: Prenadamedia Group, 2015).

⁵⁸Hajar, *ILMU FALAK : Sejarah, Perkembangan Dan Tokoh-Tokohnya*.

⁵⁹Ehsan Hidayat Hidayat, "SEJARAH PERKEMBANGAN HISAB DAN RUKYAT," *ELFALAKY*, 2019, <https://doi.org/10.24252/ifk.v3i1.9777>.

⁶⁰Kebudayaan Bangsa Arab Sebelum Datangnya Islam," Darus.id, 2021, <https://www.darus.id/2021/01/kebudayaan-bangsa-arab-sebelum-datangnya-islam.html>.

⁶¹Arwin Juli Rakhmadi Butar-Butar, *Esai-Esai Astronomi Islam*, ed. Gunawan (Medan: UMSU Press, 2017).



after Islam came, intercalation was abolished with the revelation of verse 37 of Surah at-Taubah.⁶² If in this civilization the Solar Calendar (*Syamsiyyah*) is known, then in Islamic Astrology the Lunar Calendar (*Qamariyah*) is known which is based on the rotation of the moon as stated in verse 5 of the Surah Yunus. Even though it has different standards, the Ancient Egyptian calendar still gives color to the Islamic calendar system⁶³

Apart from the calendar system, another contribution of the Ancient Egyptian Civilization to Islamic Astrology was the sundial which in Islamic Astronomy is known as *Mizwalah*. Sundials by the Ancient Egyptians were used to indicate times of worship in the worship of the gods, meanwhile in Islamic Astrology, the working principle of using the sun's shadow is used for various things. Starting from looking for the sun's shadow for prayer times, to determining the direction of the Qibla.⁶⁴

The knowledge of Astronomy or Islamic Astronomy that exists today cannot be separated from the contribution of Ancient Greek civilization. The various knowledge about celestial bodies and the shape of the earth that emerged from Greek philosophers and scientists in the 6th century BC, has influenced thought patterns and become a reference for later Muslim astronomers.⁶⁵ For example, Jabir al-Battani, who was given the honorary title "Arab Ptolemy" because his works were greatly influenced by the thoughts of the Greek philosopher, Ptolemy. However, he did not adhere to the philosopher's thoughts, so he criticized a lot of Ptolemy's works, especially the *Almagest*.⁶⁶

Another ancient civilization that contributed to Islamic Astrology was the Chinese Civilization. Knowledge about eclipses from Chinese Civilization is very useful in Islamic Astrology which is then used to determine eclipse prayer times. The development of Islamic astronomy cannot be separated from the contribution of astronomy books originating from Indian civilization. In fact, Alimuddin in his writings stated that Indian civilization had the strongest influence on Islamic Astrology. The Astronomy Book "Sindhind" was translated and summarized into Arabic during the reign of the Caliph al-Mansur of the Abbasid Dynasty.⁶⁷

Apart from Indian Civilization, Islamic Astronomy Science was also influenced by Persian Civilization. This can be seen from the many Persian astronomical terms that continue to be used in Islamic Astrology to this day, such as *Zij* (Ephemeris) and *Auj* (Aphelion). The Persian

⁶²Butar-Butar.

⁶³Ahmad Luthfi, "Mengenal Sejarah Dan Perkembangan Ilmu Falak," *Al-Mizan: Jurnal Ekonomi Syariah* 5, no. II (2022).

⁶⁴Hasrian Rudi Setiawan Arwin Juli Rakhmadi, "Pemanfaatan Instrumen Astronomi Klasik Mizwala Dalam Pengukuran Arah Kiblat Dan PengakurAsian Arah Kiblat," *Maslahah: Jurnal Pengabdian Masyarakat* I, no. 2 (2020).

⁶⁵Muslim, Hakim, and Suparman, "The Dynamics and Development of Astronomy from the Pre-Islamic Era to the Contemporary Era."

⁶⁶Butar-Butar, *Esai-Esai Astronomi Islam*.

⁶⁷Alimuddin, "Sejarah Perkembangan Ilmu Falak," *Al Daulah : Jurnal Hukum Pidana Dan Ketatanegaraan* Vol2, no. 2 (2013): 181–94.



astronomy book which gave much color to Islamic astronomy and attracted the attention of the Arabs was *Zij Syah/Syahryaran*.⁶⁸ *Zij* itself is an astronomical table that contains data on the daily, monthly, and annual movements of celestial bodies (moon, sun, planets, etc.). These data are used by Muslim astronomers to determine and calculate prayer times.

Furthermore, the science of Islamic astronomy which was born in Arab civilization was inseparable from the astronomical knowledge of previous ancient civilizations. Even though the Arabs themselves did not know and did not have scientific astronomy before Islam came. Existing knowledge is empirical, and limited to the division of years based on the appearance of certain stars. This kind of knowledge is known as *anwa'* and after Islam, Arab astronomers studied this knowledge using mathematical and other scientific methods.⁶⁹ It can be said that the contributions of astronomical knowledge from ancient civilizations before Islam were perfected and adapted to the postulates by Muslim astronomers, resulting in the birth of Astrology as it is known today.

D. Conclusion

From the explanation above, it can be concluded that the astronomical knowledge that existed in several ancient civilizations before Islam was very simple and still far from scientific. People in ancient civilizations before Islam dominantly used astronomical knowledge to determine the change of seasons, which in some civilizations gave rise to the output of a calendar. Knowledge of the changing seasons makes it easier for them to farm and raise livestock. Not only that, they also used astronomical knowledge to determine times of worship (worship of gods) as was done by the Ancient Egyptians; also predicting fate through Star rice (Babylonian Civilization). There are also those who use astronomical knowledge for political purposes, such as the Mayan Civilization. Several ancient civilizations also gave birth to many scholars who later influenced modern astronomy or Islamic astronomy.

The contribution of astronomical knowledge in ancient civilizations before Islam to Islamic astronomy can be seen from the following things. Mesopotamian and Babylonian civilizations with their contribution to zodiac knowledge, Egyptian civilization with the calendar and *Mizwalah* and Greek civilization with its many philosophers and theories about the universe. Added to this are contributions of knowledge of eclipses from Chinese Civilization, astronomy books and ephemeris from Indian and Persian Civilizations, as well as knowledge about lunar *manzilah* in the Ancient Arabs. All forms of knowledge give color and have a big role in Islamic Astronomy Science. The existing knowledge of astronomy, by Islamic Astronomers, was modified and adapted to Islamic guidance, giving birth to the Science of Islamic Astronomy which helps Muslims in determining times of worship.

⁶⁸(Butar-Butar, 2017)

⁶⁹Ahmad Dallal, "Science, Medicine, and Technology," in *The Oxford History of Science*, ed. John L. Esposito (Oxford: Oxford University Press, 1999).



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