MALAYSIAN JOURNAL OF SYARIAH AND LAW

Vol. 7, No. 2 (December) 2019 eISSN: 2590-4396

A refereed journal published by the Faculty of Syariah and Law,
Universiti Sains Islam Malaysia (USIM)

MALAYSIAN JOURNAL OF SYARIAH AND LAW

Malaysian Journal of Syariah and Law (MJSL) **Online ISSN: 2590-4396 and Print ISSN: 1985-7454** is a refereed journal published by the Faculty of Syariah and Law at Universiti Sains Islam Malaysia (USIM). It is published twice a year, in June and December. The main objective of its publication is to provide an appropriate channel for information and research publication, case studies and book reviews related to Syariah and Law based on original research and ideas by the respective authors.

The journal serves as a platform for sharing ideas and experiences related to the research, development and application of Syariah and Law worldwide.

The editorial board welcomes original contributions (written in Bahasa Melayu, English and Arabic) which have never been published or considered for publication by any other publishers.

Website: http://mjsl.usim.edu.my

E-mail: mjsl.editor@usim.edu.my


MJSL
USIM

Malaysian Journal of Syariah and Law
مجلة الشريعة والقانون بماليزيا

VOL 7 No.2 | DECEMBER 2019
ISSN: 1985-7454 | E-ISSN: 2590-4396
www.mjsl.usim.edu.my

THE HISTORY AND DEVELOPMENT OF ISLAMIC ASTRONOMY IN INDONESIA

Dahlia Haliah Ma'u[1]

[1]Lecturer of Islamic Family Law at Faculty of Sharia, IAIN Pontianak - Indonesia.

Email: lystia.lia@gmail.com

ABSTRACT

This paper discusses the history and development of Islamic astronomy in Indonesia. During the Dutch colonization in Indonesia there was a shift from *Hijri* to Gregorian (*Miladiyah*) calendar as the official national calendar. After the independent day of Indonesia, the government of Indonesia has gradually made amendments on the application of Islamic calendar. Ministry of Religious Affairs had been founded on January 3, 1946, where the ministry had an authority to arrange holidays that included the beginning of Ramadhan, Syawal and Zulhijjah. In the early 20th century, Islamic astronomy began to flourish in this country along with the return of the young scholars to Indonesia. The development of Islamic astronomy in Indonesia involves the Islamic calendar, prayers time, and the determination of the *Qibla*.

Keywords: Development of Islamic Astronomy, Islamic calendar, prayer time, determination of the qibla.

A. Introduction

The implementation of Islamic law which cannot be separated from the context of space, direction, and time, has provided a strong motivation towards the basics of Islamic astronomy development. For example, the Prophet PBUH commande *rukyatul hilal* at the end of *qamariyah* month, the obligation to perform the daily prayer on time, stay in 'Arafah (*wukuf*) and perform *qurban* during Hajj. Various instructions of the Prophet to determine the times of worship, was a part of Islamic astronomy that was also related to the process of acknowledging the phenomena of sun (Hasan, 2013) .

Related to this science (Islamic astronomy/*ilmu falak*), it should be understood that '*falak*' derived from the Arabic term which means circulation, path, or orbit. As Allah Swt says in surah Yasin (36) verse 40 "*it is not for sun to overtake moon, nor does the night outstrip the day* (Hasan, 2015). *They all float, each in an orbit*". In Islamic classical literatures (*turath*), this science often refers to *ilmu hai'ah*, *nujum* and *tanjīm*, *ta'dil*, *miqat*, and is also called arithmetics because the most prominent activities associated with this science are calculationse (Depag RI, 1981, p. 14) termed arithmetics and astronomy as a science that studies celestial objects on physics, movement, size, and everything connected with it. The term generally refers Astronomy or in the English term called as the Practical Astronomy. Later, astronomy only examines matters relating to worship, such as prayer times, qibla direction, eclipses, and the beginning of the months of Islamic calendar.

In development perspective, Syami (1997, p. 62) mapped out the historical development of astronomy into two phases: the first is the pre Islam (Ancient Egypt, Mesopotamia, China,

India, France, and Greece). The pre-Islam is more commonly known by their myths about the existence of *dewa*, divination fate (horoscope), determining the direction of the wind for a sail mission, for an introduction to natural phenomena, and so on. While the second is phase of Islam; the discourse of new astronomical indications of the determination of the Prophet's migration from Mecca to Medina as the basic foundation of Islamic calendar that was set by the Caliph Umar bin Khattab.

Astronomers at the early of Islam, appeared at Abbasid dynasty era (132-656 H / 750-1258 AD) precisely started during the reign of Caliph Abu Ja'far al-Mansur (754-775 AD) after the massive translation and birth of various new opuses, for example; "*Mukhtasar fi Hisab al-Jabr wa Muqabalah"* by Muhammad bin Musa al-Khwarizmi (780-850 AD). *"Jawami' 'Ilmin Nujum wa Harakat al-Samawiyah*" or "*Elements of Astronomy"* by Abdul Abbas Ahmad al-Farghani (800-870 AD). "*Kitab al-Zij ash-Shab"* by Muhammad bin Sinan al-Battani (d.317 H / 929AD), "*al-Zij al-Kabir al-Hakimi"* by IbnuYunus al-Misri (d.399H / 1009 AD). *"al-Qanun al-Mas'udi fi al-Hai'ah wa an-Nujum"* by Abu Raihan al-Biruni (d.440H / 1048 AD), and many others. It is noteworthy that during the reign of Caliph al-Ma'mun (813-833 AD) some opuses were produced in the observatory of al-Ma'mun, and a number of Greek works were translated including *Almageste* (Majid, 1997, pp. 151–152).

Scholar tradition carried out by the Islamic astronomers above dominates development of this science from time to time, including the development of Islamic astronomy in Indonesia. As the evidence, there are many opuses (books) of Indonesian Islamic astronomer have been wide spead in the archipelago. In addition, the role of Islamic astronomers who taught this science to his disciples and influenced the development of Islamic astronomy in Indonesia. To understand the history and development of this science, the principal questions that will be described in this paper are: 1. what is the historical development of Islamic astronomy in Indonesia? And 2. how is the dynamic development of determination of prayer times, *Qibla* direction, and the beginning of *qamariyah* month (Islamic calendar) in Indonesia?.

B. **Discussion**

1. Historical Studies of Islamic Astronomy (*Ilmu Falak*) in Indonesia

History recorded that before the arrival of Islam in Indonesia, The Indonesian archipelago had been familiar with Islam since the first century of Islamic calendar (7th century AD). The process of *da'wa* took place peacefully. In the 13th century, the first Islamic empire (kingdom), *Samudera Pasai* was founded at the northern Sumatra. After that, other Islamic kingdoms appeared, such as Demak (1500), Aceh Darussalam (1514), Banten (1568), Mataram (1582), Gowa (13th century), Ternate (15th century), Tidore (16th century), Pajang (16th century), Cirebon (17th century), and Tallo (17^{h} century). After that, the sultanates were founded such as Jambi (1500), Riau (1521), Banjar (1595), Bima (1620), Palembang (1662), Kutai (16th century), and many others. In the 18th century, Islam had almost spread all over Indonesia. The role of Islamic Scholars of the kingdoms were both as advisors and religious leaders which were named variously from one region to another (Dahlan, 1997, p. 710). There was a year caluculation according to the Javanese Hindu calendar or Soko year which begins on Saturday, March 14, 78 AD, the year of the coronation of King Syaliwohono (Aji Soko). And the calendar was used by Hindus in Bali to organize society and religion life (Miguel, 1947, p. 282). Soko Calendar is based on the circulation of apparent motion of the sun around the earth or the solar calendar (Muhyiddin, 2004, p. 118).

In 1633 AD or 1043 H or 1555 Soko, Sultan Muhammad popularly known as Sultan Agung Anyokrokusumo who ruled the kingdom of Mataram, combined Soko and Islamic calendar by begining the calendar from the Soko (1555) but using Islamic calendar system that is according

to the circulation of the moon around the earth. The system is known as the Javanese calendar or Islamic Javanese calendar and also called as Sultan Agung calendar, which is scientifically named as Anno Javanico (Azhari, 2007, p. 156).

Hambali explained that the Saka (Soko) almanac was used in Java until the 17th century, while Sultanate of Demak, Banten, and Mataram, used both Saka and Islamic almanacs. In 1633 AD (1555 Saka or 1043 H), the Sultan Agung (1613-1645) of Mataram eliminated Saka almanac and then created Javanese almanac that is identic to Islamic almanac. But the calendar began from the saka calendar of 1555. So that 1 Muharram 1043 H is Muharram 1555 Saka, which falls on July 8, 1633 AD. It suggests that the range between java and Islamic calendar is 512. The use of the calendar was then followed by the sultan Abdul Mafakhir Mahmud Abdul Kadir (1596-1651) from Banten. Thus the use of Saka almanac throughout Java had been replaced by Java Islamic almanac which was Islamic characterized, and is no longer affected by Hindu or Indian culture (Hambali, 2011, pp. 17–18).

According to Burhanuddin (2014) during the nineteenth century, as the creation of the colony in the Indies (the Dutch East Indies) progressed, encounters with Islamic affairs by the Dutch intensified. Next to military technology, and communication facilities --road, rail, telegraph and steamship-- the issues related to Islam and Muslims emerged as important considerations for the Dutch in their efforts to extend control in the Indies through their colonial administration. As a result, sufficient knowledge on the subject of Islam --to be more precise the nature of the influence of the *ḥajj*-- was crucially needed, on the foundation of which the Dutch formulated policies pertinent to Islamic issues in the region. colonization in Indonesia there was a shift of the use of official calendar from Islamic calendar to Gregorian calendar (*Miladiyah*). However, Muslims especially those of the Islamic kingdoms prefered use of the Islamic calendar. This was permitted by the colonial, and the sutan had the authority to make use the calendar especially to determine the starting of Islamic Holly days (Ichtijanto, 1981, p. 22).

After Indonesian independent day, the government of Indonesia gradually made the amendment of the use of Islamic calendar. And after the Ministry of Religious Affairs had been founded on January 3, 1946, the ministery had an authority to arrage holidays including the begining of Ramadhan, Syawal and Zulhijjah. This authority was based on government decision, year of 1946, number 2 / Um. 7 Um. 9 / Um, and was reinforced by *Keputusan Presiden* Number 25, year of 1967 number 148/1968 and number 10, year of 1971. The setting for holidays including the begining of Ramadhan, *Idul Fitri* and *Idul Adha* is used by Indonesian societies. However, the differences of the begining of *qamariah* still can be not avoided because of the existence of two systems: *hisab* and *rukyah* (Depag RI, 1981, p. 22).

Furthermore, the development of Islamic astronomy in Indonesia includes Islamic calendar, prayer time, the determination of the Qibla and eclipses. This development and the role of Indonesian Islamic scholar who had scientific journey to Middle East (Mecca, Medina, and Egypt) were inseperable. The Indonesian Islamic scholar learned Qur'an, hadith, tasawuf, and fiqh including Islamic astronomy. Returning to Indonesia, these scholars taught Islamic astronomy to their students.

According to the description above, Khazin (2004, p. 28) stated that along with the return of the young scholars to Indonesia who had stayed in Mecca in the early 20th century AD, Islamic astronomy began to grow and flourish in this country. They did not only have notes of tafsir, hadith, fiqh, tauhid, and tasawuf, but also records of Islamic astronomy that they got from Mecca when they learned there, and the they taught these knowledges to their students in Indonesia.

Furthermore, Khazin (2004, p. 29) described the arrival of Sheikh Abdurrahman bin Ahmad al-Misri (1314 H / 1898 AD) in Batavia, he brought Zij (astronomical tables) Ulugh Beik (passed away in 1420 H). These astronomical tabels were then introduced by Sheikh Abdurrahman to the young scholars in Indonesia. And his indonesian students were 1. Ahmad Dahlan as-Simarani or At-Tarmasi (passed away in 1911 AD), was from Semarang, but lived in Termas (Pacitan, East Java). He taught Islamic astronomy at Termas, Pacitan, and wrote a book entitled"*Tadzkiratul Ikhwan fi ba'dli Tawarikhi wal 'amalil Falakiyah bi Semarang*" which was finished on 21 September 1903 AD. He was KH. Ahmad Dahlan's teacher (the founder of Muhammadiyah, An Indonesian Islamic organization); 2. Habib Usman bin Abdillah bin 'Aqil bin Yahya (son in law of Sheikh Abdurrahman bin Ahmad al-Misri) who was popularly known as a Betawi *Mufti*. He taught Islamic astronomy in Jakarta, and compiled a book entitled "*Iqadzun Niyam fi Mayata 'alaqahu bil ahillah was Shiyam*" which was printed in 1903 AD by al-Mubarak Betawi press. His thought was summarized by his student, Muhammed Mansur bin Abdul Hamid Dumairi al-Batawiin in the book entitled "*Sullam an-Nayyirain fi Ma'rifati Ijtima'i wa al-Kusufain*" thas the first edition was published in 1925 AD by Borobudur-Batavia press.

The there were numerous opuses of Indonesian Muslim scholars in the 20th century such as Muhammad Ma'sum bin Ali al-Maskumambangi al-Jawi from Jombang, East Java. His most popular writing was *Badi'atul Mitsal fi Hisab as-Sinin wa al-Hilal*; Hasan Asy'ari, from Pasuruan, wrote books entitled *Jadwalul Auqot* and *Muntaha Nataijil Aqwal*; Yunus Abdullah from Kediri-East Java, his work was *Tashil al-Mitsal wa al-Aqwal*; and K.H. Zubair Umar al-Jailani from Bojonegoro, his book was *Al-Khulashah al-Wafiyyah fil Falak bijadwal al-lugharitmiyah*.

In Sumatra, the Muslim scholars known as Islamic astronomer was Sheikh Taher Jalaluddin al-Azhari[1] (1286-1377 H / 1869-1957 AD) with some of his opuses: *Pati Kiraan pada Menentukan Waktu yang Lima* and *Natijatul Ummi (The Almanac: Muslim and Christian Calendar and Direction of Qiblat According to Shafie Sect*. Sheikh Taher Jalaluddin was a student of Sheikh Ahmad Khatib Minangkabau who once studied in Mecca. Furthermore, Sheikh Taher Jalaluddin taught Islamic astronomy to Saadoe'ddin Djambek (1329-1397 H / 1911-1977 AD). Saadoe'ddin taught Islamic astronomy at Sharia Faculty of IAIN Sunan Kalijaga, and his most famous students were A. Mustadjib and Abdur Rachim. Later, they had some students who expert in Islamic astronomy in Indonesia, such as A. Sirril Wafa, Asadurrahman, Maskufah, Wahyu, Sofwan Jannah, Muhyiddin, Oman Fathurohman, Sriyatin, Susiknan, and many others . Related to this genealogy Indonesian Islamic astronomer can be read in Azhari (2008, pp. 445–446).

In addition, recent scholars who are famous in Indonesian Islamic Astronomy are KH. Slamet Hambali and Prof. Dr. Thomas Jamaluddin. Because of his exspertise in the field of Islamic astronomy, KH. Slamet Hambali was called as "*Kalkulator Berjalan*". When he was a student at the IAIN Walisongo, he was told by his lecturer, KH. Zubair Umar al-Jailani (first Rector of IAIN Walisongo), as his assistant at class of Islamic astronomy and *Mawaris*. Later, KH. Slamet Hambali wrote many Islamic Astronomy books, i.e. *Almanak Sepanjang Masa*, *Ilmu Falak I*, *Pengantar Ilmu Falak*, *Ilmu Falak' Arah Kiblat Setiap Saat*, and many others.

[1]Sheikh Taher Jalaluddin al-Azhari studied in Mecca for 14 years, since he was 11 years old under the guidance of Ahmad Khatib. He also studied Islamic astronomy at the University of al-Azhar, Cairo since 1895 for 4 years. His books were *Pati Kiraan pada Menentukan Waktu yang Lima*, *Natijatul Umur (The Almanac: Muslim and Cristian Calendar and Direction of Shafie sect*, *Jadawil Nukhbah at-Taqirat fi-Hisab al-Auqat wa al-samt al-Qibla*, and *Mathematical Tables* (Azhari, 2008, p. .205-206).

The latter, Prof. Dr. H. Thomas Jamaluddin (currently, he is a head of National Institute of Aeronautics and Space, LAPAN Indonesia), as an Indonesian Muslim astronomer he made a big effort in the unification of Indonesian Islamic calendar. Besides, he actively participates in attending the *hisab* and *rukyah* both national and international meetings. He is also one of the Islamic Crescent's Observation Project (ICOP) members in Jordan. His works in Islamic astronomy include *Hisab Rukyat di Indonesia serta Permasalahannya*, *Menggagas Fiqh Astronomi*, and *Astronomi Memberi Solusi Penyatuan Ummat*.

2. The dynamics of Islamic astronomy development

Sub discussion below regarding the dynamics of Islamic astronomy development in Indonesia concerning prayer times, the method of *Qibla* direction, and beginning of the month of Islamic calendar determination.

a. Prayer Times

The prayer time is essential for the validity of a person's praying. In the term of jurisprudence, prayer time is the time when worship must begin according to *muwassa'* category. If, worship cannot be performed at the beginning of time, it can be implemented in the middle or end of time. The Qur'an has explaning about prayer times in QS. al-Isra'(17): 78, Hud (11): 114, and Taha (20): 130. In this case, the Qur'an does not specify the limits of the prayer times. However, Hadith of the Prophet PBUH which functions as *tabyīnlil Qur'an* has explained time and total liabilities of the prayers. In other words, the explanations of the Prophet clarify the time and guidance of prayer (Ma'u, 2015).

The use of atithmethic for prayer times at Prophet PBUH'S era was not employed yet, but it was based on the phenomenon of the movement of the sun. Hadith that describes the prayer times based on the phenomenon of the movement of the sun is by narrated by Jabir bin Abdullah in an-Nasa'i(an-Nasa'i, tt, pp. 255–256) as below:

أَخْبَرَنَا يُوسُفُ بْنُ وَاضِحٍ قَالَ حَدَّثَنَا قُدَامَةُ يَعْنِي ابْنَ شِهَابٍ عَنْ بُرْدٍ عَنْ عَطَاءِ بْنِ أَبِي رَبَاحٍ عَنْ جَابِرِ بْنِ عَبْدِ اللَّهِ أَنَّ جِبْرِيلَ أَتَى النَّبِيَّ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ يُعَلِّمُهُ مَوَاقِيتَ الصَّلَاةِ فَتَقَدَّمَ جِبْرِيلُ وَرَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ خَلْفَهُ وَالنَّاسُ خَلْفَ رَسُولِ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ فَصَلَّى الظُّهْرَ حِينَ زَالَتِ الشَّمْسُ وَأَتَاهُ حِينَ كَانَ الظِّلُّ مِثْلَ شَخْصِهِ فَصَنَعَ كَمَا صَنَعَ فَتَقَدَّمَ جِبْرِيلُ وَرَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ خَلْفَهُ وَالنَّاسُ خَلْفَ رَسُولِ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ فَصَلَّى الْعَصْرَ ثُمَّ أَتَاهُ حِينَ وَجَبَتِ الشَّمْسُ فَتَقَدَّمَ جِبْرِيلُ وَرَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ خَلْفَهُ وَالنَّاسُ خَلْفَ رَسُولِ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ فَصَلَّى الْمَغْرِبَ ثُمَّ أَتَاهُ حِينَ غَابَ الشَّفَقُ فَتَقَدَّمَ جِبْرِيلُ وَرَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ خَلْفَهُ وَالنَّاسُ خَلْفَ رَسُولِ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ فَصَلَّى الْعِشَاءَ ثُمَّ أَتَاهُ حِينَ انْشَقَّ الْفَجْرُ فَتَقَدَّمَ جِبْرِيلُ وَرَسُولُ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ خَلْفَهُ وَالنَّاسُ خَلْفَ رَسُولِ اللَّهِ صَلَّى اللَّهُ عَلَيْهِ وَسَلَّمَ فَصَلَّى الْغَدَاةَ ثُمَّ أَتَاهُ الْيَوْمَ الثَّانِيَ حِينَ كَانَ ظِلُّ الرَّجُلِ مِثْلَ شَخْصِهِ فَصَنَعَ مِثْلَ مَا صَنَعَ بِالْأَمْسِ فَصَلَّى الظُّهْرَ ثُمَّ أَتَاهُ حِينَ كَانَ ظِلُّ الرَّجُلِ مِثْلَ شَخْصَيْهِ فَصَنَعَ كَمَا صَنَعَ بِالْأَمْسِ فَصَلَّى الْعَصْرَ ثُمَّ أَتَاهُ حِينَ وَجَبَتِ الشَّمْسُ فَصَنَعَ كَمَا صَنَعَ بِالْأَمْسِ فَصَلَّى الْمَغْرِبَ فَنِمْنَا ثُمَّ قُمْنَا ثُمَّ نِمْنَا ثُمَّ قُمْنَا فَأَتَاهُ فَصَنَعَ كَمَا صَنَعَ بِالْأَمْسِ فَصَلَّى الْعِشَاءَ ثُمَّ أَتَاهُ حِينَ امْتَدَّ الْفَجْرُ وَأَصْبَحَ وَالنُّجُومُ بَادِيَةٌ مُشْتَبِكَةٌ فَصَنَعَ كَمَا صَنَعَ بِالْأَمْسِ فَصَلَّى الْغَدَاةَ ثُمَّ قَالَ مَا بَيْنَ هَاتَيْنِ الصَّلَاتَيْنِ وَقْتٌ.

At present, this phenomenon is converted in the form of prayer times by Indonesian Islamic astronomer. The system of prayer times in Indonesia is changing and developing from time to time, from a manual system (using a calculator) to a computer programme.

The prayer times in Indonesia can be categorized in folowing models:

1) The prayer times model that can only be applied in a particular city, for example is that of designed by Muhammad Zubair, which is only applicable in Palu city, Central Sulawesi.
2) The prayer times model that is only applicalbe for a particular city and its surroundings. For example, the schedule by KH Ahmad Noor SS (for the region of Yogyakarta and its surroundings), KH Slamet Hambali and Ahmad Izzuddin (for Semarang, Yogyakarta and its surroundings), H. Turaichan Adjhuri (for Yogyakarta, Semarang and its surroundings), Mishbachul Munir (for Magelang and its surroundings), H.Abdul Rani Mahmud al-

Yamani (for Pontianak and its surroundings), Arius Syaikhi Payakumbuh (Bandar Lampung and its surroundings), and Zul Efendi (for Bukit Tinggi and its surroundings). The conversion system of the schedule have similarities in terms of plus and minus from one place to another.

3) The prayer times model which is not only applicable for a particular city but also for other cities in Indonesia. For example, the schedule arranged by PT Jemla Ferry Jakarta (for Jakarta and its surroundings), the schedule issued by the Ministry of Religious Affairs (for all Indonesian provinces), and the schedule made by *Anugrah Ilmu Group* in Semarang and Yogyakarta.
4) The prayer times model that is applicable for a particular city but its conversion system is also applicalbe for other big cities in Indonesia, as well as for some ASEAN capitals. For example, a schedule distributed by PT. Djarum in Surabaya.
5) The prayer times model that affect the difference of latitude 1˚ by Saadoe'ddin Djambek, latitude 2˚ by H. Turaichan Adjhuri, and latitude 5˚ by Misbachul Munir.

Furthermore, the use of prayer time model which is based on computer programs is becoming more popular. Indonesian Islamic Astronomer has made various computer programs for prayer time in the form of software such as Mawaqit Program 2001 by Dr. Ing. Khafid, Winhisab Version 2.0 by Ministry of Religious Affairs, *Ahilla* program by Muhyidin Khazin, NU software, Muhammadiyah software, Persis software, and many others. Muslims can easily access and know the prayer time by means of these software applications. It means that, the users benefit form modern development of Islamic astronomy.

b. The Method of determining *Qibla* direction

Historically, the method of determining *qibla* direction has developed gradually from traditional to modern method that in line with the development of science and technology. In the era of the Prophet PBUH, the determination of qibla direction was relatively easy to do because when there was a problem in determing *qibla* direction, the Prophet himself directly provided clues about *qibla* direction as he was always true since he made the decision based on a revelation. Besides, Islam had not been spreaded as many areas as nowadays. Therefore, the position of the *Kaaba* in Mecca was still easily predictable especially for those who lived in Mecca and its surroundings.

The following are some samples to determine qibla direction:

1. The method of determining Qibla direction is based on the phenomenon of the sun's shadow. This method consists of the position of the sun above the Kaaba, known as *yaum rashd al-qiblah,* while tracking the sun's position in the Kaaba is known as *rashd al-qiblah*. The position of the sun above the Kaaba (*yaum rashd al-qiblah*) is a day that is used to define, align, or recheck the direction of Qibla in particular places for performing such as mosque, field, house, office. On that day, the position of the sun turns symmetrically to the zenith of Kaaba. The phenomenon will happen when the latitude of Kaaba and the declination of the sun have . Thus, the direction of Qibla is in line with a stick’s shadows. Sun head exactly for the zenith of Kaaba (21˚25 'LU and 39˚50' BT) occurs bianually: on May 28th at 16:17:56 WIB and on July16th at 16:26:43 WIB. Determining Qibla direction based on the phenomenon of the sun over the Kaaba can be read in the article on website https://tdjamaluddin.wordpress.com/T.djamaluddin t_djamal@bdg.lapan.go.id.
2. Qibla direction by using spherical trigonometry.
3. Using the Compass as a means to determine Qibla direction

4. Employing *tongkat istiwa'* to determine Qibla direction. *Tongkat istiwa'* is an ordinary rod that is errected upright in the open ground in the daylight to determine appropriate direction by connecting two points of the stick's shadow when the sun heads to the east, in which the tip of the stick's shadow moves to the west point. Determining the west and east using *tongkat istiwa'* or sunlight is more accurate than compass.
5. *Qibla* measurement using GPS (Global Positioning System).
6. *Qibla* measurement using Google Earth Image.
7. Qibla measurement using right triangle. This method is designed by KH. Slamet Hambali. According to Hambali (2011), the basis to use right triangle in determining Qibla direction is according to the comparison of right triangle trigonometry. Further, to apply it, he said: 'suppose that the direction of Qibla is the hypotenuse of a triangle. Then to find which direction and how much the slope of the sides, the length of the other two sides should be acknowledged. Next, determining the length of one of the triangle sides both a and b must be based on each specification. Next step is connecting the both points of a and b sides, this set of steps are known as the hypotenuse or c. And the c is the *Qibla* direction that is sought.

c. The Determination of The Beginning of Months According to Islamic Calendar

In accordance with the development of Islamic astronomy in Indonesia, one of the focuses of Islamic astronomy aims to know the beginning of Islamic months systems which currently consist of more than twenty systems and references used by Indonesian Muslims. Furthermore, the systems are classified into three major groups. This classification appears in the forum of Islamic astronomy seminar on April 27th1992 at the Tugu, Bogor, organized by the Ministry of Religious Affairs. Futher clasification can be read in Tim Badan Litbang Agama dan Diklat Keagamaan (2004, pp. 6–8).as below:

1. ***Hisab Taqriby***. It is a method of calculation that refers to the theory of Ptolemy, the geocentric theory that stated that the earth as the center of the solar system, so that celestial objects such as the sun, moon, and stars move around the earth. However, the level of accuracy is low, since it does not involve the spherical trigonometry. Sultan Ulugh Beik was an Islamic astronomer who reffered to this theory and later was followed by other astronomers. Calculations were performed using early astronomical tables formulated by Ulugh Beik which was wellknown as Zij Sulthani (Jayusman, 2015). The method was mentioned and reffered by some Indonesian Islamic astronomers in their books such as *Sullamun Nayyirain* by Muhammad Manshur bin Abdul Hamid bin Muhammad ad-Damiri al-Batawiy, *Tadzkiratul Ikhwan* by KH. Dahlan al-Semarangi, *Fathurraufil Manan* by Abu Hamdan bin Abd. Jalil bin. Abd. Hamid al-Kuddusy, *as-Syams Wal Qamar* by al-Ustadz Anwar Katsir al-Malangi, *Jadawilul* Falakiyah by KH. Qusyairi al-Pasuruani, *Risalah Syamsul Hilal* by KH. Noor Ahmad bin Shadiq bin Saryani al-Jepara, and *Risalatul Qamarain* by KH. Nawawi Muhammad Yunus al-Kadiri.
2. ***Hisab Tahqiqy***. It is a calculation system of *Hisab Tahqiqy* that is more accurate than *hisab Taqriby*. The data used are the modern century data which are based on the heliocentric theory, and the level of accuracy is at a scale of fair due to the effect of using the rules of spherical trigonometry. The method was mentioned and reffered by some Indonesian Islamic astronomers in their books such as *al-Khulashah al-Wafiyyah fil Falak bijadwal al-lugharitmiyah* by KH. Zubair Umar al-Jailani, *Badi'atul Mitsal* by KH. Muhammad Ma'shum bin Ali al-Jombangi, *Hisab Haqiqiy* by KH. Muhammad Wardan Dipaningrat al-Yogyakarta, Nurul Anwar by KH. Noor Ahmad bin Shadiq bin Saryani al-Jepara, and *Ittifaq Dzatil Bain* by KH. Muhammad Zuber Abd. Karim al-Gresiki.

3. ***Hisab Kontemporer***. This method equals to *hisab tahqiqy*, the difference lies on the correction that is more precise and more accurate, and this method is applied in computer program which invoves the use of advanced equipment such as compass, theodolite, GPS, and other sophisticated tools. Meanwhile, the data are calculated using the theory of spherical trigonometry: all the data are programmed into computer to minimize errors, and for the accuracy reason, the calculation is in accordance with the reality in observation place. The method was mentioned and reffered by some Indonesian Islamic astronomers in their opuses such as *New Combinations* (New Comb) by KH. Bidron Hadi al-Yogyakarta (modification system of new comb, USA), *Almanak Nautika* by Jawatan TNI Angkatan Laut dinas Hidro-Oseanografi, Jakarta. This Almanak was first developed in Indonesia by Saadoe'ddin Djambek (the first chairman of *Badan Hisab dan Rukyah Departemen Agama RI*), *Ephemeris Hisab dan Rukyat* by *Tim Ahli Badan Hisab dan Rukyat Departemen Agama RI* Jakarta, and Hisab Awal Bulan by Saado'eddin Djambek).

In addition, the books written by Indonesian Islamic Astronomer on *Hisab Kontemporer* category has been available in the form of software. Therefore, it can be said that the existence of Islamic astronomy studies in Indonesia has significanlty developed. But, then, the problem immerges is related to the differences in determining of *hisab* and *rukyah* criteria.

To minimize the differences and maintain *ukhuwah Islamiyah*, the government makes a big effort to unite Indonesian Muslims through *sidang Isbat* (a meeting to discuss and determine the begining of Islamic mounth). *Sidang Isbat* is led by the Minister of Religious Affairs, and attended by Indonesian Islamic scholars, representatives of Islamic organizations, such as Nahdatul Ulama (NU), Muhammadiyah, Persis, Majelis Ulama Indonesia (MUI), Dewan Dakwah Islam (DDI), Dewan Masjid Indonesia (DMI), and astronomers from goverment agencies such as LAPAN, Observatorium Bosscha, ITB, Planetarium Jakarta, BMKG, Bakosurtanal.

The government's authority to determine the beginning of Ramadhan, Syawal, and Dzulhijjah is based on *fatwa of MUI Number 2/2004* which states that all Muslims in Indonesia have to obey this government's decision. Of course, this decision has a strong basic foundation in which the government is as *ulil amri* that must be obeyed as mentioned by surah An-Nisa: 59. Moreover, according to principle of *fiqhiyah* (*kaidah fiqhiyah*): *Hukm al-hākim ilzām wa yarfa' al-khilāf*" (Madkur, 1965, p. 336) the government's decision binds and eliminates the clash of ideas. Futher, other *fiqhiyah* principle that is *Tasharruf al-imam 'ala al-ra'iyah manuthun bi al-mashlahah* (al-Subki, 1414, p. 134). That means the policy of a leader toward his people is according to common welfare. Thus, the results of *isbat* must be obeyed by Muslims in Indonesia for the common goodness.

The decision of the begining of Islamic mounth in *Sidang Isbat* is according to *imkanur ru'yah* (*hilal* visibility) in which the cresent possition when the sun sets must in a particular degree that is possible to observe. Thus, wherever there is a testimony of a new moon appearence within Indonesian jurisdiction (*wilayatul hukmi*), the testimony can be accepted. This effort is a solution for both groups that conduct *rukyah* approach (observational approach) and *hisab* approach (calculating approach). In other words, both approaches have equal possition, and are inseparable. Each has both advantages and weaknesses especially when it is used seperately.

C. Conclusion

To sum up, I mention several important points in this article: ***First***, history recorded that before the arrival of Islam in Indonesia there was a year caluculation according to the Javanese Hindu calendar or Soko year which begins on Saturday, March 14, 78 AD, the year of the coronation

of King Syaliwohono (Aji Soko). And the calendar was used by Hindus in Bali to organize society and religion life. Soko Calendar is based on the circulation of apparent motion of the sun around the earth or the solar calendar. The development of Islamic astronomy in Indonesia includes Islamic calendar, prayer time, the determination of the Qibla and eclipses. This development and the role of Indonesian Islamic scholar who had scientific journey to Middle East were inseperable. The Indonesian Islamic scholar learned Qur'an, hadith, tasawuf, and fiqh including Islamic astronomy. Returning to Indonesia, these scholars taught Islamic astronomy to their students. ***Second,*** the dynamics of Islamic astronomy development concerning prayer times, the method of *Qibla* direction, and beginning of the month of Islamic calendar determination. The system of prayer times in Indonesia is changing and developing from time to time, from a manual system (using a calculator) to a computer programme. The method of determining *qibla* direction has developed gradually from traditional to modern method that in line with the development of science and technology. The Determination of The Beginning of Months According to Islamic Calendar consist of more than twenty systems and references used by Indonesian Muslims. Furthermore, the systems are classified into three major groups: *hisab taqriby, hisab tahqiqy*, and *hisab kontemporer*. *Hisab Taqriby* is a method of calculation that refers to the theory of Ptolemy, the geocentric theory that stated that the earth as the center of the solar system, the level of accuracy is low. *Hisab Tahqiqy* is more accurate than *hisab Taqriby*. The data used are the modern century data which are based on the heliocentric theory. And *Hisab Kontemporer* is equals to *hisab tahqiqy*, the difference lies on the correction that is more precise and more accurate, and this method is applied in computer program which invoves the use of advanced equipment.

REFERENCES

al-Subki, I. T. Abd. W. (1414). *Al-Asybah wa al-Nazhair*. Beirut: Dar al-Kutub al-‘Ilmiyah.

an-Nasa’i, I. A. A. R. A. bin S. (tt). *Sunan Nasa’i, Syarah Jalāl ad-Dīn* (Vol. 1). Beirut-Libanon: Dār al-Kutub al-’Ilmiyah.

Azhari, S. (2007). *Hisab & rukyat: Wacana untuk membangun kebersamaan di tengah perbedaan* (Cet. 1). Yogyakarta: Pustaka Pelajar.

Azhari, S. (2008). *Ensiklopedi hisab rukyat* (Cet. 2., ed. rev). Yogyakarta: Pustaka Pelajar.

Burhanudin, J. (2014). The Dutch Colonial Policy on Islam: Reading the Intellectual Journey of Snouck Hurgronje. *Al-Jami’ah: Journal of Islamic Studies*, *52*(1), 25–58.

Dahlan, A. A. (1997). *Ensiklopedia Hukum Islam*. Jakarta: Ichtiar Baru Van Hoeve.

Depag RI. (1981). *Almanak Hisab Rukyah*. Jakarta: Badan Hisab Rukyat, Proyek Pembinaan Badan Peradilan Agama Islam.

Hambali, S. (2011). *Ilmu Falak 1 Penentuan Awal Waktu Shalat & Arah Kiblat Seluruh Dunia* (Abu Rokhmad, Vol. 1). Semarang: Program Pascasarjana IAIN Walisongo Semarang. 1.

Hasan, M. (2013). Aplikasi Imkan al-Ru'yah Perspektif Fiqih dan Astronomi di Indonesia. *Al-Tahrir: Journal of Islamic Thought*, *13*(2), 369–391.

Hasan, M. (2015). Benda Astronomi dalam Al-Quran dan Perspektif Sains. *Jurnal THEOLOGIA*, *26*(1).

Ichtijanto. (1981). *Almanak Ilmu Falak*. Jakarta: Badan Hisab Rukyat Depag RI.

Jayusman, J. (2015). Kajian Ilmu Falak Perbedaan Penentuan Awal Bulan Kamariah: Antara Khilafiah dan Sains. *Al-Maslahah*, *11*(1).

Madkur, S. (1965). *Al-Ibahah 'inda al-Ushuliyyin wa al-Fuqaha*. t.tp: Dar al-Nahdhah al-Islamiyah.

Majid, 'Abdul Mun'im. (1997). *Sejarah Kebudayaan Islam*. Bandung: Pustaka. 1`.

Ma'u, D. H. (2015). Waktu Shalat: Pemaknaan Syar'I ke Dalam Kaidah Astronomi. *Jurnal Hukum Islam Istinbath*, *14*(2).

Miguel, covarrubias. (1947). *Island of Bali*. New York: Alfred A. Knopt.

Muhyiddin, K. (2004). *Ilmu Falak Dalam Teori dan Praktik* (Cet. 3). Yogyakarta: Buana Pustaka. 1.

Syami, yahya. (1997). *Ilmu Falak Safhat Min at-Turats al Ilmiy al-Arabiy wa Al-Islamiy*. Beirut: Dar al-Fikr al-'Arabiy.

Tim Badan Litbang Agama dan Diklat Keagamaan. (2004). *Hisab Rukyat dan Perbedaannya Depag, 2004),*. Jakarta: Depag RI.