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Fiqh and Astronomical Rashdul Qibla; Determining the Direction of the Qibla by Using a Stellarium

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Abstract

The existence of celestial bodies has many functions, such as worship interests as a guide to prayer time. When praying, it is necessary to face the Qibla, the Kaaba. Finding the direction of the Qibla is facilitated by Rashdul Kibla, which is based on observations of celestial bodies, including the Sun and constellations. The Stellarium application is one of the technological developments that can be used as a medium in determining the Qibla direction. This study aims to describe the concept of fiqh and astronomy rashdul qibla and the use of stellarium application as a medium for determining the qibla direction. Through a qualitative approach with descriptive-analytical method, this research describes the fiqh of rashdul qibla, astronomy of rashdul qibla and how to use the stellarium application as a medium for determining the qibla direction. The data source of this research is obtained through documentation of written works of fiqh and astronomy concepts that provide explanations related to rashdul qibla and the stellarium application. The results showed that the determination of the Qibla direction through rashdul qibla will be easier and measurable. The astronomical Qibla direction is part of the form of measuring, comparing and finding the Qibla direction whose accuracy is not in doubt. Stellarium is part of an IT-based application that can be used as a means of determining the Qibla direction whose calculation accuracy can be adjusted to the place where the Qibla direction is sought.

Kata kunci : Fiqh, Astronomy, Rashdul Qibla, Stellarium.

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A. Introduction

Islam believes that religion and science are inextricably linked. This can be seen in several verses of the Qur'an and many cosmological verses (kauniyat) that allude to the study of science. Among the sciences alluded to in the Qur'an are those related to astronomy, such as the creation of the universe, the shape of the earth, moonlight, the sun, stars [1], and others[2]. It is undeniable that some Muslim experts believe in the classification of knowledge, but the real purpose is the specification and specialisation of learning, which leads to the professionalization of expertise in a science. It is very clear that Islam does not recognize the dichotomy of science, so that in the term of sharia science, cosmography (Falak Science)[3] is studied, in which the calculation and determination of prayer times, the beginning of the Hijri calendar month, the occurrence of eclipses, the direction of the Qibla, and several other fiqh[4] sciences are discussed.

The epistemological coherence between fiqh and science[5] is the result of modern thinking that requires Muslims to gain new knowledge. The development of this modern thought has stimulated and inspired thinkers. Fiqh is not simply defined as Islamic law, but is much broader than that, as its scope extends to education, politics, and science and technology. Fiqh is not simply defined as Islamic law, but it is much broader than that, as the scope of discussion of fiqh extends to the fields of education, politics, and science and technology. Historically, fiqh also includes the science of religion, Sufism and the science of kalam. Thus, fiqh is closely related to technology when it comes to matters of worship. For example, technology in determining the direction of the Qibla. The direction of the Qibla, which is the mouth of its study in cosmography, as a family of Sharia science and commonly called exact science because it combines mathematics and physics, where the object of study is, although related to certain worship in Islam, which includes the calculation of prayer time, azimuth of the Qibla or rashdul qibla, the beginning of the

[1] Stars are celestial bodies that shine not due to reflection because they have their own energy source. T. Djamaluddin, *Semesta pun Berthawaf*, (Bandung: PT Mizan Pustaka, 2018), 22.

[2] Zakir Naik, terj. *Miracles of al-Qur'an and as-Sunnah* (Solo: Aqwam, 2018), 12-24.

[3] Ahmad Izzuddin, *Ilmu Falak Praktis; Metode Hisab-Rukyat Praktis dan Solusi Permasalahannya*, (Semarang: PT Pustaka Rizki Putra, 2012), 1.

[4] Muktar Yahya dan Fatchurrahman, *Dasar-dasar Pembinaan Hukum Fiqh Islami*, (Bandung: PT al-Ma'arif, 1986), 15.

[5] Lajnah Pentashihan Mushaf al-Qur'an Badan Litbang dan Diklat Kementerian Agama RI dengan Lembaga Ilmu Pengetahuan Indonesia (LIPI), *Tafsir Ilmi, Penciptaan Jagat Raya dalam Perspektif al-Qur'an dan Sains,* (Jakarta: PT Sinergi Pustaka Indonesia, 2012), xxiv.

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Hijriyah month, and eclipses, but because cosmography studies astrolabe (movement and position) of celestial bodies. So it is included in the category of practical astronomy and observational astronomy[6], which naturally has to be found out through calculations of mathematics and physics through calculations of mathematics and physics. Astrology is the oldest science, known since the time of the Prophet Idris.[7] Named Idris, as mentioned in the book of Tarikh al-Hukama, that it is taken from the word "darasa" (study), so that he is known as a person who likes to study and write in the study of the suhuf-suhuf which was revealed to Prophet Adam a.s. and Prophet Shits then known as Hurmus Al-Haramisah, because he is an expert in astrology. The existence of cosmography according to Ahmad Izzuddin, quoting Robert H. Baker (1953: 1-2), can be broadly divided into two types, namely First, theoretical astronomy, which is the science that discusses the theory and concept of heavenly bodies, the subject of discussion in this science is not only earth science, space and astronomy, there is also astrology (necromancy), cosmogony, astrometry and astrophysics - which includes cosmogony, cosmology, cosmography, astrometry, astromechanics and astrophysics. And the second is practical astronomy, which is the science of calculating the position and relationship of celestial bodies to each other.[8]

The application of cosmography that has been done by the Prophet SAW and the Companions includes the theory of determining the Qibla direction using celestial objects as a guide, namely the ijtihad of the Prophet SAW which was carried out when he was in Medina, praying to the south because Medina is north of Makkah making the position of the direction to the Kaaba facing south. On this basis until nowadays syar'i[9] that Qibla as a valid requirement in prayer. As the Prophet SAW said that the Qibla is located between east and west. [10] And then the determination of the Qibla direction was developed through the star Canopus or Najm Suhail, which always rises from the South, while in other places it is guided by the direction of Sunrise, namely the solstice in summer

[6] Ahmad Izzuddin, *Ilmu Falak Praktis*, 2-3.
[7] Nur Hidayatullah al-Banjary, *Penemu Ilmu Falak*, (Yogyakarta: Pustaka Ilmu Yogyakarta), 122-138.
[8] Ahmad Izzuddin, *"Fiqih Hisab Rukyat"*, Makalah Orientasi Hisab Rukyat PTAI se-Indonesia pada tanggal 12 April 2011 di Bogor.
[9] Muhammad bin Muhammad bin Muhammad bin 'Abdur Rahman Ar-Ra'ini, *Mawãhib Al- Jalīl* juz. 2, (Bairut: *Dãr al-Kutub al-'Ilmiyah*, 2003), 199.
[10] Abdullah bin Muhammad bin Ishaq al-Sheikh, *Lubabut Tafsir min Ibni Katsir* Cet. I, (Kairo: Muassasah Daar al-Hilal, 1994), Pen. M. Abdul Ghoffar E.M., *Tafsir Ibnu Katsir Jilid I Cet. IV*, (Bogor: Pustaka Imam Asy-Syafi'i, 2005), 294.

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(Inqilab al-Shaity). [11] In this case, it is not just talking about the Kaaba as a Qibla, but also contains lessons and wisdom for people who think about it, where the Prophet once reminded Bilal when he was revealed a verse related to astronomy, namely Q.S. Ali Imran (3): 190, he stated, "Woe to the one who recites this verse but does The application of cosmography that has been done by the Prophet SAW and the Companions includes the theory of determining the Qibla direction using celestial objects as a guide, namely the Ijtihad of the Prophet SAW that was carried out when he was in Medina, praying to the south because Medina is north of Makkah making the position of the direction to the Kaaba facing south. On this basis, until today, syar'i that Qibla as a valid requirement in prayer. As the Prophet SAW said that the Qibla is between East and West. And then the determination of the Qibla direction was developed by the star Canopus or Najm Suhail, which always rises from the south, while in other places it is guided by the direction of the sunrise, namely the summer solstice (Inqilab al-Shaity). In this case, it is not only about the Kaaba as the Qibla, but it also contains lessons and wisdom for people who think about it, as the Prophet once reminded Bilal when he was revealed a verse related to astronomy, that is, Q.S. Ali Imran (3): 190, he said, "Woe to the one who recites this verse but does not reflect upon it." [12] In addition, in line with technological developments, computerised applications are used to determine the direction of the Qibla.

In addition to being a place of trade[13], the city of Makkah is also visited every year for worship, where the city has a holy building in the form of the Kaaba[14] which is used as a place of Tawaf as well as a Qibla for Muslims in every prayer. The Kaaba as the Qibla of prayer is located at the coordinates 21° 25 '21.17 " LU (north latitude) 39°49'34.56" BT (east longitude). [15]

Considering the previous explanation, this research aims to describe

[11] Jayusman, *"Akurasi Metode Penentuan Arah Kiblat: Kajian Fiqh al-Ikhtilaf dan Sains",* ASAS, Vol.6, No.1, Januari 2014, 72.

[12] Lajnah Pentashihan Mushaf al-Qur'an Badan Litbang dan Diklat Kementerian Agama RI, *Al-Qur'an di Era Global: antara Teks dan Realitas*, (Jakarta: Lajnah Pentashihan Mushaf al-Qur'an, 2013), 511.

[13] Abdul Hafiz Sairazi, Fakultas Syariah UIN Antasari Banjarmasin, "Kondisi Geografis, Sosial Politik dan Hukum di Makkah dan Madinah pada Masa Awal Islam", Journal of Islamic and Law Studies Volome 3, Nomor 1, Juni 2019, 122.

[14] W.J.S. Poerwadarminta, *Kamus Umum Bahasa Indonesia;* Edisi Ketiga; diolah kembali oleh: Pusat Bahasa Departemen Pendidikan Nasional, (Jakarta: Balai Pustaka, 2007), 508.

[15] Sub Direktorat Pembinaan Syariah dan Hisab Rukyat, Direktorat Urusan Agama Islam dan Pembinaan Syariah, Dirjend Bimas Kemenag RI, *Buku Saku Hisab Rukyat*, Tangerang Banten: CV Sejahtera Kita, 2013), 30.

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the fiqh concept of rashdul qibla, the astronomical concept of rashdul qibla and the use of stellarium application in determining the qibla direction. In particular, this research contributes to the use of the stellarium application as one of the medias for determining the Qibla direction, besides that this research also contributes to the science of fiqh and astronomy of rashdul qibla for the expert of cosmography (falak science) activists and also the Islamic community.

B. Research and method

This study discusses the fiqh of rashdul qibla, the astronomy of rashdul qibla, and the use of the Stellarium application as a medium for identifying the direction of the qibla using a qualitative approach in a descriptive-analytical manner. The data for this study was obtained from the documentation of written works on fiqh and astronomical principles explaining rashdul qibla and the Stellarium application.

C. Result and Discussion

Rashdul Qibla in Fiqh Perspective

Certain celestial bodies are very interesting, especially when they can be clearly seen at night, in addition to soothing[16] the heart when they are seen because of their beauty, and a means of contemplating the creation of Allah. It is different during the day, because the sunlight dominates other celestial bodies, so that they cannot be seen. However, the beauty of the celestial bodies can only be enjoyed by people who live in the equatorial or subtropical zone, which is directly enjoyed between night and day for relatively the same length of time, as if it never changes throughout the ages, all places on earth every year on 21 March and 23 September experience day and night of the same length, for twelve hours, except in the polar parts of the earth. So when the Sun is at the northernmost point of the Earth, 23.5° LU (northern latitude) on 21 June, the day is longer than the night. [17] Conversely, when the Sun is at the southernmost part of the Earth for twenty-four hours, it receives no sunlight. This happens because of the Sun's annual apparent movement of the Earth along the ecliptic.

Celestial bodies have been introduced by Allah since the creation of the Prophet Adam, who is immortalised in Surah al-

[16] Ismail Habib Mahmud dan Farzdiq Raukan al-Azawi, *Hujiyatu alfazish Shahabiy fi Naqli akhbarin Nabi,* Konferensi ilmiah kedua Fakultas Sains Islam, (al-Ramady: Tikrit, 2012), 2172.

[17] Thoha Firdaus dan Arini Rosa Sinensis, "Perdebatan Paradigma Teori Revolusi: Matahari Atau Bumi Sebagai Pusat Tata Surya?", *Titian Ilmu: Jurnal Ilmiah Multi Sciences Vol. IX No. 1, STKIP Nurul Huda,* 23 – 32, 2017.

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Baqarah (2): 30-34, even many are used as names of surahs in the Qur'an, for example al-Shams (Sun) Q.S. 91, al-Qamar (Moon) Q.S. 54, al-Burūj (Star Cluster) Q.S. 85, al-Najm (Star) Q.S. 53, and others. [18] The study of the celestial bodies is not only a way of doing science, but also a way of understanding the regularity of motion, regular natural phenomena and sporadic natural phenomena. Objects in the sky vary greatly in size, from atomic to about 10^{25} metres across. The celestial bodies that are well known to earthlings include Mercury, Venus, Mars, Jupiter, Saturn, Uranus, Neptune, the Moon and the Sun. The Sun has and gives off its own light. The Sun is the centre of the solar system[19], because the planets,[20] and planetary satellites, including other objects such as asteroids, comets, meteoroids, and interplanetary material orbit around the Sun[21]. The Sun is a giant glowing ball at the centre of the Solar System with a diameter of 1.39 million km.[22] As stated in the Qur'an, Surah Yasin (36): 38-40[23], it always remains on its circular orbit. The alignment of the Sun and the Earth is always on their respective orbits, so that the rotation of the Earth does not follow the day that comes after it. The existence of this harmony, so that the Sun appears from the Earth throughout the year to form an annual apparent motion. The apparent motion of the Sun relative to the Earth is very significant. So, in determining the direction of the Qibla, it will be easier by the Sun's Rashdul Qibla,[24] which is the state of the Sun at the zenith point of the Kaaba or vice versa, at its nadir. Rashdul Qibla based on the sun is very easy to do in good weather conditions, because the rays are strong, so as to produce shadows of objects can be seen sharply, which is used as a description of the line of Qibla direction, and the signal of rashdul Qibla has been implicitly conveyed by Allah in the Qur'an.[25]

Fiqh of Facing the Qibla

After the Prophet Muhammad was in Medina, on 11 February 624, Allah SWT commanded Muhammad to change the

[18] Departemen Agama RI, Direktorat Jenderal Pembinaan Kelembagaan Agama Islam, *Islam untuk Disiplin Ilmu Astronomi*, (Jakarta: 2000), 1-20.

[19] Khalil Badawi, *Mausū'atu Dā'roti al-Ma'ārif al-Syāmilah: al-Mausū'ah al-Falakiyah*, (Oman: *Dāru 'lmi al-Ṡaqāfah,* 1999), 26. Lihat juga di A. Gunawan Admiranto, *Eksplorasi Tata Surya*, (Bandung: Mizan Media Utama, 2016), 17.

[20] A. Gunawan Admiranto, *Eksplorasi Tata Surya*, (Bandung: Mizan Media Utama, 2016), 18.

[21] Leif J. Robinson, *Astronomy Encyclopedia*, (Spanyol: Philip's, 2002), 393.

[22] Ian Morison, *Introduction to Astronomy and Cosmology*, (United Kingdom: University of Manchester, UK, 2008), 133. Baca juga di *Tafsir Ilmi, Penciptaan Jagat Raya dalam Perspektif al-Qur'an dan Sains*, (Jakarta: PT Sinergi Pustaka Indonesia, 2012), 48.

[23] Surah Yasin (36): 38-40.

[24]. KH. Ahmad Warson Munawwir, Kamus Al-Munawwir Arab-Indonesia (Cet-1), (Surabaya: Pustaka Progressif, 1984), 501-1089.

[25] Q.S. Yunus (10) ayat 5

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direction of the Qibla from Baitul Muqaddas, Masjid al-Aqshā Jerusalem, to Masjid al-Ḥarām, the Kaaba.[26] Thus, the performance of prayer at that time before Baitul Maqdis, which lasted for sixteen months, while others argue that it lasted for seventeen months after the Prophet was in Medina. According to the Prophet's companions, this change in the direction of the Qibla occurred suddenly during the Zuhr prayer, while according to another opinion, it occurred during the Asr prayer. The change of the Qibla during prayer as reported in the authentic hadith of Imam Bukhari narrated by al-Barra'i. [27] Since Allah determined the direction of the Qibla in prayer, when the Messenger of Allah SAW performed the Dhu'hur prayer, it was two raka'at in the neighbourhood of Bani Salamah[28]; during the Ashr prayer, when he was in the mosque of Medina (Nabawi), then since then, the inhabitants of Quba' began to change their Qibla[29] to the direction of the Kaaba, when praying the Fajr prayer, after the news of the change of Qibla reached them, namely, since the Qibla was shifted to the Kaaba on the 10th of Sha'ban in the second year H[30], after the Prophet SAW migrated to Medina, until now, all Muslims face the Qibla to the Kaaba in prayer. There are two conditions for facing the Qibla while praying, the first is inside the Grand Mosque and the second is outside the Haram land, away from the Kaaba. In the situation of being near the Kaaba, all scholars agree that one must face the Kaaba in prayer. Among them, according to the Maliki madhhab, it is obligatory for the Qibla to face the building of the Kaaba. While according to the Ash-Shafi'i madhhab, it is obligatory for anyone who is near or far from the Kaaba to keep facing the direction of the Kaaba's building, the difference is for those who are far from the Kaaba, only enough to face the direction of the Kaaba's

[26] Dan Gibson, *Early Islamic Qiblas,* (Kanada: Independent Scholars Press, 2017), 3. Baca pula *The History of al-Tabari,* Vol 1, translated by Franz Rosenthal, (New York Press, 1989), 24-26.

[27] Ibnu Hajar al-Asqalani, al-Imam al-Hafizh, *Fathul Bāri Syarah: Shahih al-Bukhari/al-Imam al-Hafizh Ibnu Hajar al-Asqalani; Penjelasan Kitab Shahih al-Bukhari,* Penerjemah: Amiruddin, Lc., Jilid 3, (Jakarta: Pustaka Azam, 2003), 101-102. Lih. Imam Hafizh Ahmad bin Ali bin Hajar al-Asqalani, *Hadyu al-Sāri, Fathu al-Bāri, Syarh Ṣahīh al-Imām Abī 'bdillah Muhammad bin Ismā'il al-Bukhāri, Juz I, Kitabush Shalat, Bab Qiblat ahli al-Madīnah,* (al-Maktabah al-Salafiyah, t.t.), 498.

[28] Abdullah bin Muhammad bin Ishaq al-Sheikh, *Lubabut Tafsir min Ibni Katsir* Cet. I, (Kairo: Muassasah Daar al-Hilal, 1994), Pen. M. Abdul Ghoffar E.M., *Tafsir Ibnu Katsir Jilid I Cet. IV,* (Bogor: Pustaka Imam Asy-Syafi'i, 2005), 289.

[29] Ibnu Hajar al-Asqalani, *Fathul Bāri Syarah: Shahih al-Bukhari/al-Imam al-Hafizh Ibnu Hajar al-Asqalani; Penjelasan Kitab Shahih al-Bukhari,,* Jilid 3, (Jakarta: Pustaka Azam, 2003), 110-111.

[30] Prof. Dr. Wahbah az-Zuhaili, *al-Fiqhu al-Islāmi wa adillatuh,* (Damaskus: Darul Fikr, 1997), Abdul Hayyie al- Kattani, dkk; penyunting, Budi Permadi *Terj. Fiqih Islam wa adillatuh,* bab Ibadah, Jilid 3, (Jakarta : Gema Insani, 2011), 31.

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building or its vertical area.[31].

Fiqh Rashdul Qibla

Qibla, which means the direction of the Kaaba, or the building of the Kaaba, according to some fiqh experts, has a great influence on the validity or invalidity of a person's prayer, especially for anyone who lives in the city of Makkah and its surroundings, [32] as long as it is possible (in a state of no excuse), And if it is not possible, he is required to perform Ijtihad to face the building of the Kaaba, because it is not enough for him to just point to the Kaaba by estimation, as long as his existence is near the Kaaba, specifically in the city of Makkah and its surroundings. This is based on the words of Allah SWT in Q.S. al-Baqarah (2) verses 149-150[33] and several Sahih Hadiths, as the basis for the law of Qibla in prayer, therefore, in finding the Qibla direction for those who are far from the Grand Mosque must use science, namely using several methods of astrology from mathematical, based on certain celestial objects to how to use information technology tools. In measuring the Qibla direction, it will be easier through the provisions of the time in which the object exposed to the sun leads to the direction of the Kaaba, namely the position of the sun directly above the Kaaba. Measuring the direction of the Qibla using this method is commonly called Rashdul Qibla. Although the term is actually too restrictive, as if it limits the science, as if the word "rashdu" is identified with the sun, even though the meaning of the word "rashdu" itself is search, reconnaissance, observation, watching, and peeping. Thus, rashdul qibla is not limited to the daytime, but can also be done at night, as Allah indicates through His words in al-Qur'an Surah al-Nahl (16): 16. The signal in the verse is a form of contextual gratitude and shows that the rules for facing the Qibla can be based on celestial bodies. And another hint Allah SWT says through Q.S. al-Hijr (15): 16. And emphasised by His words in Q.S. al-An'am (6): 97.

There are other celestial bodies besides the Sun, such as stars, which can be used with the stars explained by Allah in His Word as mentioned above, as a guide to time and direction. Among its uses, the stars can be used as a guide to time, namely by looking at the rising and setting of the group of stars, for example on 21 March every year the star Aries sets with the Sun at 6:00 pm (18:00), indicating that spring has arrived, and the next season each star sets earlier than

[31] Syaikh Abdurrahman al-Juzairi, *Fikih Empat Madzhab, Jilid 1* /Editor, Fedrian Hasmand; penerjemah, Nabhani Idris, (Jakarta : Pustaka Al-Kautsar, 2017), 326-327.

[32] Syaikh Abdurrahman al-Juzairi, *Fikih Empat Madzhab, Jilid 1*, 325.

[33] Q.S. al-Baqarah (2) ayat 149-150.

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the Sun around 010 04'00". The stars can also be used as directions, including the fixed stars outside the zodiac, namely the Southern Cross (aṣ-Ṣalibul Januby Crux), which can be found by drawing a straight line from the Gamma Crucis to the Alpha Crucis and intersecting the horizon, then the point of intersection indicates the north direction. From this it is clear that the context of the word "لِتَهْتَدُوْا بِهَا" in the verse means "as a guide", the intended guide has a role or purpose, and the main purpose is prayer, because prayer is required to face the Qibla, and the Qibla can be known, among other things, through the stars (celestial bodies) that Allah SWT has created. When He said, "The stars are used for guidance in the darkness of land and sea," it means that the stars can be used as navigational indicators, like compasses, either for worship, namely prayer, or for mu'amalah, such as navigation, wandering, and others. And it becomes even clearer when we look at the words of Allah in the Qur'an Surah Yunus (10): 5 which confirms that the creation of the heavenly bodies was measured, calculated by Him, so that it can be used as a measure (calculation), including the calculation (measurement) of the direction of the Qibla. In addition to explaining the difference between the sun and the moon, the verse explains that the sun emits light while the moon reflects the light received from the sun, which is clarified by Q.S. Nūh (71): 16 and Q.S. al-Furqān (25): 61, that both are celestial bodies and have their own circular lines, as explained in Q.S. Yāsin (36). 39: 39. With the knowledge of their circular line, the number of years can also be known as described in Q.S. al-Rahmãan (55): 5. With the knowledge of the number of years, etc., the time of day is also known, as well as the times of prayer, fasting, the time to perform pilgrimage, the time to plant, including the direction of the Qibla, which can be known through these heavenly bodies. [34]

From the explanation through the above arguments, it can be seen that rashdul qibla is part of the shar'i command, because praying towards the qibla is part of the circumstances for the validity of prayer, and the direction of the qibla for those who live far from the Grand Mosque requires measurement, while measuring the direction of the qibla will be easier and more accurate is through astronomical rashdul qibla.

Concept of Astronomical Qibla Direction

The unveiling of the dark veil of the Universe, where natural phenomena still in need of explanation, after the knowledge of

[34] Kementerian Agama RI, *al-Qur'an dan Tafsirnya (Edisi yang Disempurnakan) Jilid IV,* (Jakarta: Lentera Abadi, 2010), 261.

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the theory of elliptical orbits of the planets and changes in the speed of the planets as they orbit the Sun by Johannes Kepler [35], then led to the discovery of the theory of gravity by Isaac Newton[36]. In turn, the heliocentric theory of Nicolaus Copernicus (1543 AD) was finally revealed, the so-called Copernican revolution (Polish lawyer and astronomer). In fact, this theory had been put forward by Aristarchus in the 13th century BC, which was the opposite of the geocentric theory initiated by Aristotle (384-322 BC)[37], the reverse of the geocentric theory, saying that the sun was the centre of the solar system. The vastness of the Universe invited the curiosity of scientists to study it and then to gain new knowledge in the form of the modern theory of cosmology, initiated by Alexander Friedmann[38] in 1920 and also known as the standard model of cosmology, by observing the stars as objects that can be directly recognised when looking at the sky, of course in addition to the Moon and the Sun.

Since the Qibla of Prayer is in Makkah on earth, and since the earth is closely related to other celestial objects, including stars and others, the determination of the position of a point on earth is in principle also closely related to the observation of stars, in this case constellations. These observations are called astronomical observations, which are in the form of research, search or matching of certain celestial bodies, among which aims to know and determine the azimuth of a direction between two points on the Earth, it is necessary to give the initial direction (north orientation) and control the size of the angle on the size of the polygon or triangulation, of course guided by the properties of the Earth that evolves against the Sun and rotates periodically. The Earth's axis of rotation is not parallel to the ecliptic when the planet orbits the Sun, but forms an angle of 66' 30" with the ecliptic plane, so the equator does not coincide with the

[35] Johannes Kepler (1571-1630) adalah penemu konsep hukum pergerakan planet-planet yang berbentuk orbitnya berbentuk elips. Lihat: James R. Voelke, *Johannes Kepler and the New Astronomy*, (New York: Oxford University Press, 1999), 65.

[36] Isaac Newton (1642-1726/27) adalah penemu gravitasi dan kalkulus, yang telah menunjukkan pada teorinya bahwa gravitasi adalah milik setiap orang atau benda angkasa di alam semesta, baik yang besar atau yang kecil. Lihat: Gale E. Christianson, *Isaac Newton and the Scieantific Refolution,* (New York: Oxford University Press, 1996), 37.

[37] Slamet Hambali, "Astronomi Islam dan Teori Heliocentris Nicolaus Copernicus", *al-Ahkam, Jurnal Pemikiran Hukum Islam,* Volume 23, Nomor 2, UIN Walisongo Semarang (2013), 226-229.

[38] Tentang Diskursus Kosmologi: Beberapa Catatan Kritis, Diakses 9 Pebruari 2020, http://lsfcogito.org/tentang-diskursus-kosmologi-beberapa-catatan-kritis/

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ecliptic plane, but forms an angle of 23' 30" with the ecliptic plane, and when viewed from the horizon coordinate system it looks like (Figure 1).

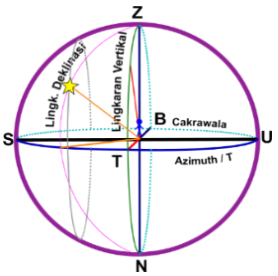

Figure 1. Horizon Coordinate System.

In general, the use of observing Rashdul Qibla has two moments, one is annual and the other is daily. The annual rashdul qibla that has been agreed upon based on the observations through the sun is set on 27th/28th May and 15th/16th July in every year. As for using the daily Qibla rashdul event through several ways, namely after calculating the Qibla rashdul hours of a particular place, at a specified time, day and date, then the next to know when the Qibla rashdul hour occurs, must observe the shadow of an object perpendicular to the ground at the time of the Qibla rashdul hour. It will then be understood that the direction of the Qibla at that location is indicated by the shadow of the perpendicular object. To find this out using several formulas, including:

Formula I: Cotg A = Sin Lt ÷ Tan AQ, or

Formula II: Cos B = Tan Dek × Cos A ÷ Tan Lt, or

Formula III: WRH = ((B + A) ÷ 15) + 12, then made into local time (WIB) using the formula: WD - e + (BD-BT) ÷ 15, then the time of the daily Rashdul Qibla can be known.

Then the results will look like in the illustration (Figure 2), the position of the sun line is seen to cut the circle of the Qibla line of a place that is calculated, the result is that all objects that stand upright, then at that time the shadow is the direction of the Qibla. In other words, rashdul qibla is known by calculations where the position of the sun is on the line that connects the place that is calculated with the Kaaba, the time can also change.

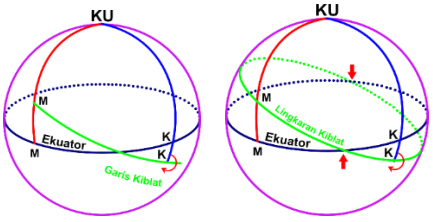

Figure 2. Illustration of The Intersection of Rashdul Qibla Lines.

Using the Stellarium Application

The progress and development of Information Technology (IT) is very rapid,

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this is characterised by the many emerging software, even its development is very significant, which is faster than hardware, so it is evident that the development of software every month there is always the latest version, and was created to meet the needs of users in different fields of work. The existence of IT advances today helps make it easier for someone to learn or do many things that were once very difficult to reach or still very expensive, for example, for those who like to observe celestial objects, software is very helpful because not all of them can afford to buy a sophisticated telescope because the price is relatively high. And even if they can afford it, it can also be connected to the telescope so that the accuracy of observations of celestial objects observed through the telescope can be synchronised with the software. One of the advances in information technology that supports the observation of celestial objects is Stellarium. Stellarium is an open source, free planetarium software that can now be embedded not only in a computer, but also in a mobile phone, tablet or ipad. The software realistically displays the celestial horizon in three dimensions[39], which is like looking at the planets with the naked eye, binoculars or a telescope, as described by Matthew Gates: "Stellarium is a free, open-source planetarium for your computer. It displays a realistic 3D sky, just as you would see with the naked eye, binoculars or a telescope. It is used in planetarium projectors. Just set your coordinates and "go". [40] This programme has been used in various planetariums, and by setting the coordinates the next location can easily explore celestial objects. Stellarium can also be called miniature astronomy. This software was created in 2001 and is available under the GNU (General Public License). This means that the software has an open source code and can be used by anyone for various purposes. As well as having advantages, this application also has disadvantages. Among the disadvantages, this application is an interface software, which is an application that can only be known and used by certain people. Stellarium is one of the astronomy software that can be used to simulate the sky both day and night (Figure 4). Due to its ease of use, Stellarium is considered to be a user-friendly sky simulation software. In terms of application, the conceptual framework of this paper can be described in the figure below:

[39] "Stellarium Astronomy Software," accessed Desember 27, 2019, http://stellarium.org/id/.

[40] "Stellarium Astronomy Software," n.d., http://www.stellarium.org/id/.

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Stellarium Application Shooting the Celestial Object Visual

Figure 4. Illustration the use of Application

In order to use the Stellarium application, the programme must first be installed, either in the form of the Stellarium application for mobile phones, ipad/tablets or computers, as each programme is different, by downloading it from the web address: https://stellarium.org/. Next, you can set the location of the observer or the place to be observed, each icon (interface symbol) in Stellarium can function according to the observer's wishes.[41]

Rashdul Qibla through Stellarium

In observing the Qibla, it will be easier to use the Sun, so the comparison of the accuracy of the Qibla will also use the Sun as a benchmark, because in addition to being well known, the Sun is easier to prove. Therefore, in this case, the first illustration is shown using the Sun's Qibla, and for the next illustration, the Qibla at night will also be shown using the stars. Below is an illustration of the Sun-based Qibla as shown in (Figure 5) and (Figure 6), viewed from the coordinates of the Kaaba (210 25' 21.17" NL (LU) and 390 49' 34.56" EL (BT)) in the city of Makkah in Saudi Arabia:

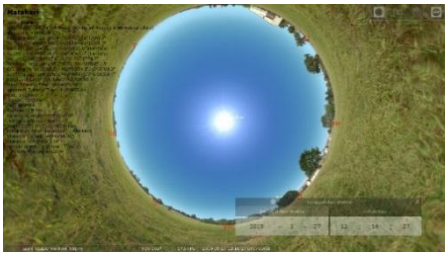


Figure 5. Display of rashdul qibla at the coordinates of Makkah City on May 27, 2019 at 12:16:27 Makkah time.

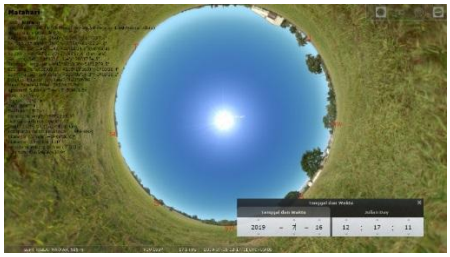
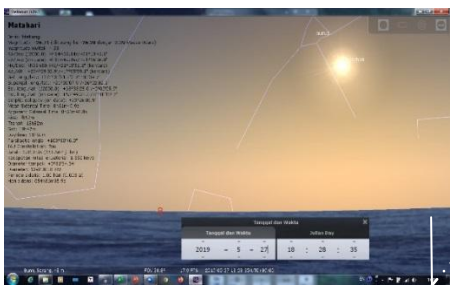


Figure 6. Display of rashdul qibla at the coordinates of Makkah City on July 16, 2019 at 12:17:11 local time.

In (Figures 7 and 8) below, the Sun is seen at the point of rashdul qibla illustrated from the City of Serang which is located at the coordinates -6°8′12″SL (LS) and 106°9′1″EL (BT):



[41] Georg Zotti, Alexander Wolf (editors), *Stellarium 0.19.3 User Guide,* (Copyright 2014-2019 Georg Zotti), 2019.

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Figure 7. View of rashdul qibla as seen from Serang City on May 27, 2019 at 16:28:35 WIB. Pointing from West to Right 25018'12.83"

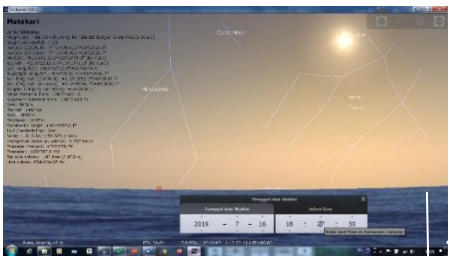

Figure 8. View of rashdul qibla as seen from Serang City on July 16, 2019 at 16:27:30 WIB. Pointing from West to Right 25018'12.83"

While the rashdul qibla at night is guided by stars, namely constellations, one of which is based on the results of observations through Stellarium, which always seems to occupy the position of the sun's rashdul qibla (azimuth), the star Kornephoros (Antilicus-Rutilicus), a category of double stars from a star cluster (constellation) Hercules (Figure 9).

Figure 9. Constellation of Hercules

In May, when the Sun was in the rashdul qibla in the afternoon, the star of Kornephoros occupied the rashdul qibla position in the early morning of the same date (Figure 10), that is, on 27 May 2019, 30 June 2019, 31 July 2019, 31 August 2019, 01 September 2019, and 02 October 2019 (Table 1).

Figure 10. Double Star Kornephoros Occupies the Rashdul Qibla.

This happens every month, but in January, February, March, April, November and December it cannot be seen because the star's position is in the afternoon, especially from Banten. While in May, June, July, August, September and October is the right time to observe it..

D. Conclusion

Qibla is a prerequisite for the validity of prayer, so the effort to measure or find the right Qibla direction is part of the necessity of performing prayer. Efforts to measure the Qibla direction, especially for mosques, mushalla or surau, will be easier through rashdul kibla. Astronomical Qibla direction is part of the form of measuring, comparing

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and finding the Qibla direction whose accuracy is not in doubt because natural phenomena, in this case celestial bodies, have been placed by Allah SWT on their circular lines so that they can be easily observed at any time, especially with the help of IT-based applications (information technology), when it happens that the position of the star occupies the Qibla declination. Stellarium is part of an IT-based application that can be used as a tool or infrastructure for determining the direction of the Qibla. This is in addition to being an open source application (can be used for free), also in its use, the accuracy of the calculation can be adjusted to the place where the Qibla direction is sought. And of course, it is hoped that through this research, it will contribute to the activists of Phalac science as well as the Islamic community to be able to develop IT-based Qibla direction measurements, so that it can function as a reference for Rashdul Qibla.

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