

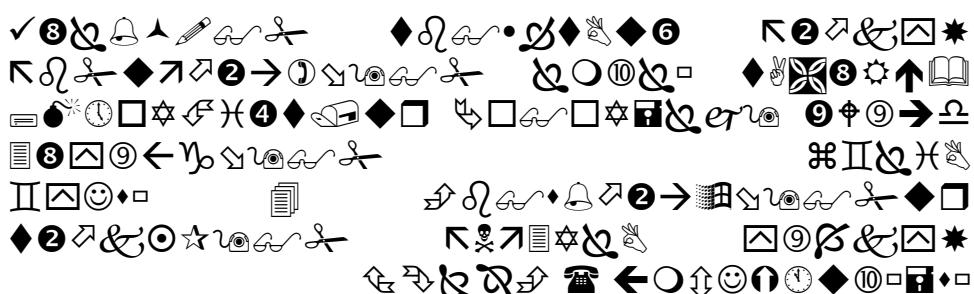
## CHAPTER II

### THE CRESCENT OBSERVATION IN MALAYSIA

#### A. Definition of *Rukyat al-Hilal*

Etymologically, the word of "rukyat" is derived from the arabic word "رُأَيْ- يَرَى- رَأِيَا- وَرَؤْيَةٌ" which means to see, understand, think, suspect, and thought.<sup>1</sup> Rukyat, as well as an observation, also becomes part of an observation, particularly as a look visually (with the naked eyes).

In *Oxford Learner Dictionary*, observation is the act of watching somebody/something carefully for a period of time, especially to learn something<sup>2</sup>. The main point of the observation here is the act of watching or knowing the *hilal* for a period time. Allah says in His Holly Qur'an Chapter al-Baqarah verse 185 :



<sup>1</sup> Ahmad Warson Munawwir, *Kamus al-Munawwir*, Surabaya : Pustaka Progressif, 2002, p. 460.

<sup>2</sup> A S Hornby, *Oxford Advanced Learner's Dictionary*, United Kingdom : Oxford University Press, ed. 6, 2000, p. 910.

Means : Ramadan is the (month) in which was sent down the Qur'an, as a guide to mankind, also clear (Signs) for guidance and judgement (between right and wrong). So everyone of you who is present (at his home) during that home should spend it in fasting. (al-Baqarah [2]: 185)<sup>3</sup>

The term of *rukyat* becomes important because it mentioned in many text redaction in the holly Qur'an and hadith (prophetic tradition). In the Holly Qur'an, the word *ray*, and its derivation is mentioned for about 187 times, 146 times (78%) mean as cognitively look (*rukyat bi al-Ilm*) and 41 times (22%) mean as visually look (*rukyat bi al-fi'li*). In the Hadith, it mentioned up to 62 times; with its derivation, *rukyat* is mentioned no less than 195 times. Which it is related with Islamic calender and determination of the beginning of lunar month is mentioned for about 49 times, with classification below : *raa* (20), *raaita* (13), *raaiti* (1), *raaitu* (11), *raaituni* (1), *raituna* (1), *raaw* (4), *raaitum* (10), *yara* (19), *tara* (15), *taraina* (1), *tarawna* (1), *ara* (2), *araniy* (3), *arakum* (1), *taraya* (1), *yarayna* (3), *taraw* (2), *taraay* (1), *tarayna* (1), *ru'yan* (39), dan *ru'yat* (62).<sup>4</sup>

Terminologically, the definition of *rukyat* is broadly divided into three meanings, *firstly*, *rukyat* is seen with the eye (the naked eye). This can be done by anyone. *Secondly*, *rukyat* is seen through the heart or

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<sup>3</sup> Abdullah Yusuf Ali, *The Holy Qur'an*, Kuala Lumpur : Percetakan Zafar, 2004. p. 50.

<sup>4</sup> See: Susiknan Azhari, *Kalender Islam; Ke Arah Integrasi Muhammadiyah-NU*, ed. 1 Yogyakarta : Museum Astronomi Islam, 2012, p. 75. More information in A.J Wensinck, *Al-Mu'jam al-Mufahrash li Alfadz al-Hadith an Nabawiyi*, Leiden : E.J Brill, 1943, p. 199-206.

intuition. *Thirdly*, rukyat is seen by science. It can be reached by a man who has enough knowledge.<sup>5</sup>

In the context of determination of the beginning of lunar month, the word “rukyat” is always juxtaposed with the *hilal* (*crescent*), it becomes *rukyat al -hilal* (*the crescent observation*). In Arabic language, *rukyat al-hilal* consists of two words, namely *rukyat* and *hilal*.<sup>6</sup>

Absolutely, the crescent observation’s method cannot be separated from astronomical calculation (*hisab*), it’s useful to determine the position of the new Moon, both of the direction and height above the horizon. Therefore, the writer considers it will be important to explain the concept of astronomical calculation (*hisab*).

Etymologically, the definition of *hisab* is *calculation* or *arithmetic*.<sup>7</sup> In *Oxford Learner Dictionary*, calculation means the act of process of using numbers to find out an amount.<sup>8</sup> So that, arithmetic well known as sums involving the adding, multiplying of the number.<sup>9</sup> In the classical literature, *Ilm al-Ḥisāb* has some similar words, such as ‘Ilm al-Haiyah, ‘Ilm al-Falak<sup>10</sup>, ‘Ilm ar-Rashd<sup>11</sup>, ‘Ilm al-Miqāt, and *Astronomy*.

<sup>5</sup> Susiknan Azhari, *Ilmu Falak Perjumpaan Khazanah Sains Islam dan Modern*, Yogyakarta : Suara Muhammadiyah, 2007, p. 114.

<sup>6</sup> Hilal, an Arabic term, refers to the bright waxing crescent when it becomes visible to a normal observer by naked-eye or other tools.

<sup>7</sup> Muhyiddin Khazin, *Kamus Ilmu Falak*, Yogyakarta : Buana Pustaka, ed. 1, 2005, p. 30.

<sup>8</sup> A S Hornby, *Oxford Advanced Learner's Dictionary*, op.cit, p. 176.

<sup>9</sup> *Ibid.* p. 57

<sup>10</sup> ‘Ilm al-Falak is also called ‘Ilm al-Ḥisāb (الحساب = calculation) because it uses calculation. Muhyiddin Khazin, *Ilmu Falak dalam Teori dan Praktik*, Yogyakarta: Buana Pustaka, Ed. III, p. 1

<sup>11</sup> ‘Ilm al-Falak is also called ‘Ilm al-Raṣd (الرَّصْد = observation) because it needs an

Learning about geometric position of celestial objects to determine the time schedule on Earth is the part of '*Ilm al-Haiyah*'.

Terminologically, the main concept of using *hisab* in this study is the method to determine the new Moon or crescent by mathematical study.<sup>12</sup> In the holly Qur'an, the word *hisab* is widely used to describe the day of *hisab* (*Yaum al-Hisab*). The word "hisab" appears 37 times, and all of them mean calculation.<sup>13</sup> Meanwhile, in another reference, the word *hisab* which derived from *h-s-b*, as a noun, is referred up to 25 times in the holly Qur'an.<sup>14</sup>

No	Chapter's Number	Chapter	Verses Number
1	2	Al-Baqarah	202, 212
2	3	Ali-Imrān	19, 27, 37, 199
3	5	Al-Maidah	4
4	6	Al-An'ām	52, 69
5	10	Yūnus	5
6	13	Ar-Ra'd	18, 20, 40, 41
7	14	Ibrāhīm	41, 51
8	17	Al-Isrā	12
9	21	Al-Anbiyā'	1

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observation. Ahmad Izzuddin, *Ilmu Falak Praktis (Metode Hisab Rukyat Praktis dan Solusi Permasalahannya)*, Semarang: Kamala Grafika, 2006, p. 1

<sup>12</sup> See Susiknan Azhari, *Kalender Islam; Ke Arah Integrasi Muhammadiyah-NU*, ed. 1 Yogyakarta : Museum Astronomi Islam, p. 52

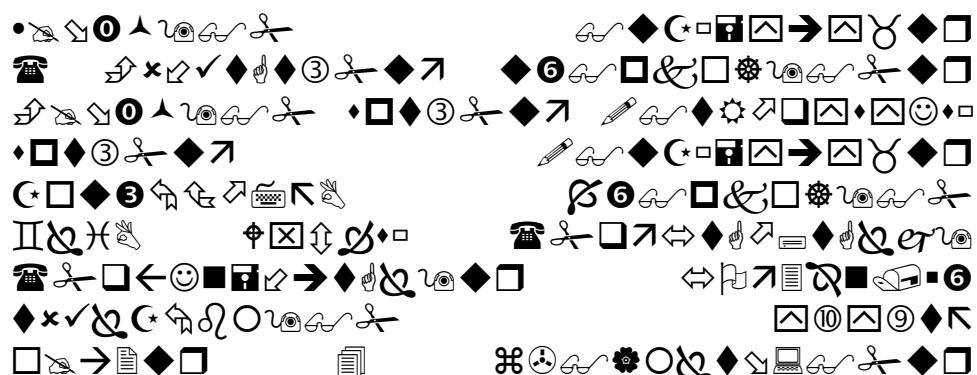
<sup>13</sup> Tono Saksono, *Mengkompromikan Rukyat & Hisab*, Jakarta : Amythas, 2007, p. 120.

<sup>14</sup> *Ibid*

No	Chapter's Number	Chapter	Verses Number
10	23	Al-Mukminūn	117
11	24	An-Nūr	38, 39
12	26	Asy-Syuarā	113
13	38	Sād	16, 26, 39, 55
14	39	Az-Zumar	10
15	40	Ghāfir	17, 27, 40
16	65	Aṭ-Ṭalāq	8
17	69	Haqah	20, 26
18	78	An-naba	27, 36
19	84	Al-Inshiqāq	8
20	88	Al-Ghashiyah	26

Column 2.1. List of chapters and verses that mention the word “*hisab*”<sup>15</sup>

As one of the verse of Qur'an that shows the calculation which has meaning as *hisab* in both chapter al-Isrā' verse 12 and chapter Yūnus verse 5 :



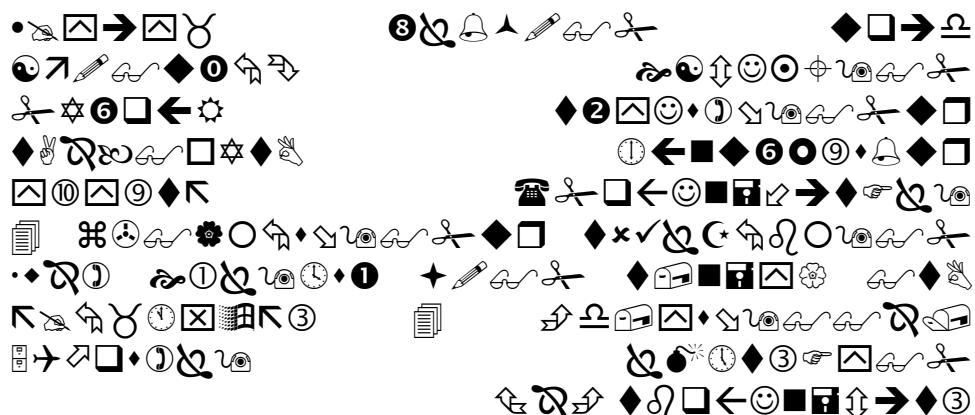
<sup>15</sup> *Ibid.*, p.121.



Means : “And We have made the Night and the Day s two (of Our) signs : the sign of the night We obscured, while the sign of the day We have made the enlighten you; that ye may seek bounty from your Lord, and that ye may know the number and count of the years: all things have We explained in detail. (al-Isra (17) : 12)<sup>16</sup>

M. Quraish Shihab gives an explanation for phrase *ayatain* as the clear sign to every people for knowing and researching the creation of God, both of day and night carefully, this can be done by calculating.<sup>17</sup>

For phrase و لتعلموا عدد السنين و الحساب Hasbi ash-Shiddieqy explains that God created night and day alongside each other so that people know the number of years, months and days by calculation.<sup>18</sup>



Means : It is He who made the Sun to be a shining glory and the Moon to be a light (of beauty), and measured out stages for her; that ye

<sup>16</sup> Abdullah Yusuf Ali, *op.cit.*, p. 337.

<sup>17</sup> M. Quraish Shihab, *Tafsir Al-Mishbah*, Ciputat : Lentera Hati, 2012, p.41

<sup>18</sup> Muhammad Hasbi ash-Shiddieqy, *Tafsir al-Qur'an al-Majid an-Nur*, book. 15, Semarang : Hayam Wuruk, ed. II, 2000, p. 230.

might know the number of years and the count (of time). Nowise did God create this but in truth and righteousness. Thus doth He explains His signs in detail. For those who understand. (Yunus (10) : 5)<sup>19</sup>

The above verse embraces all two key words we are disputing blatantly so far. It simply says that the crescent position may be calculated, and this is in compliance with Allah's command so that we know the reckoning of time of paramount importance is that Allah wants us to make use of our utmost intellectual capacity as human beings. These two words are *wa qaddarahu* (وَقَدْرَهُ) that simply means and measured out (this is exactly the same word as that is used in the above quoted hadith), and *hisab* (الْجِسَابُ) that simply means the reckoning (of time). Further than that, these two words are enhanced within the same verse to show that Allah explains His *ayah* (signs, proofs, revelation, guidance, etc) for people who have enough knowledge. It is very obvious, the above verse is trying to say that Allah loves His servants who have knowledge, those who think deeply to know the number of years and the reckoning of time with the help of whatever exists in the whole universe that has been created for us.<sup>20</sup>

Both of mentioned verses before and others related to the concept of astronomical calculation in the holly Qur'an surely able to lure the

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<sup>19</sup> Abdullah Yusuf Ali, *op.cit*, p. 248.

<sup>20</sup> Tono Saksono, *Astronomical Calculation as a Foundation to Unify International Muslim Calendar : a Science Perspective*, the paper presented at the International Symposium: *Towards the Unified International Muslim Calendar*, Sahid Hotel, 4-6 September 2007, Jakarta.

Moslem scholars to study more about the Qur'an verses that relate to the universe.

In the classical period,<sup>21</sup> there were many important books, such as *Kitab al-Mukhtaṣar fi Hisāb al-Jabr wa al-Muqābalah* written by Abu Ja'far Muhammad ibn Musa al-Khawarizmi around the year 825 AD/ 210 H in Baghdad, *Kitab al-Fusul fi Hisāb al-Hind* written around the year 952-3 AD / 341 H by Abu al-Hasan Ahmad bin Ibrahim al-Uklidisi, *Usūl Hisāb al-Hind* written by Abu al-Hasan Kushyar bin Labban al-Djili around 1000 AD/ 390 H, *Sumtu al-Qiblah fi al-Hisāb* written by Ibn Haitham around the year 1039 AD / 430 H, *al-Qanūn al-Mas'udiy fi al-Haiyah wa an-Nujūm* written by Abu al-Rayhan Muhammad bin Ahmad al-Biruni around the year 1049 AD / 973 H.<sup>22</sup>

Besides that, there were many important books from the middle period, such as : *Marasim al-Intisabfi 'Ilm al-Hisāb* written by Yaish bin Ibrahim bin Yusuf al-Umawi around the year 1373 AD/ 774 H, *Kasyf al-Haqaiq fi Hisāb ad -Daraj wa al-Daqāiq* written by Ibnu al-Majdi around the year 1358-1447 AD/ 760-851 H, *at-Tadzkirah fi 'ilm al-Haiyah* by Nasiruddin at-Tusi around the year 1201-1274 AD / 597-672, and many others which written by famous Moslem scholars at that time, such as Ibn

<sup>21</sup> According to Nourouzzaman Shiddiqi, the classical period starts from the birth of the prophet Muhammad PBUH to the capture of Baghdad by Hulagu power. *The middle period starts* the capture of Baghdad by Hulagu power until the end of 17 th century, the modern period starts from the beginning of 18 th century until nowadays. See more Nourouzzaman Shiddiqi, *Pengantar Sejarah Muslim*, ed.1, Yogyakarta : Nur Cahaya, 1983, p. 66-67.

<sup>22</sup> Susiknan Azhari, *Kalender Islam; Ke Arah Integrasi Muhammadiyah-NU*, op.cit., p. 54.

al-Sarraj, Ibn Shatir, Jamal al-Din al-Maridini, and Muhammad Taragai Ulugh Beg.<sup>23</sup>

The last, in the modern period, we have so many fenomenal book such as *al-Hisābat al-Falakiyah li Ahillāti asyhuri Ramadān wa Shawwal wa Zi al-Hijjah*, in Indonesia there were *Hisab ‘Urfi dan Hisab Hakiki* by Muhammad Wardan, *Hisab Awal Bulan* by Saadoe’din Djambek, *al-Khulaṣah al-Wafiyah* by Zubair Umar al-Jailani, *Badiyatul Mitsal* by Ma’sum bin Ali, *Fath Rauf al-Mannān* by Abu Hamdan Abdul Jalil, *Sullām an-Nayyirain* by Muhammad Manshur bin Abdul Hamid, *Nūr al-Anwār* by Noor Ahmad SS, *Irsyād al- Murīd* by Ahmad Ghozali Muhammad Fathullah, and many other.<sup>24</sup>

It seems to be a proof that the existence of astronomical calculation or *hisab*, truly sustain the success in determining of lunar month, particularly assist in the implementation of crescent observation. Ghozalie Masruri<sup>25</sup>, ever said, both of *hisab* (astronomical calculation) and *rukyat* (astronomical observation) are important, but in determination of the beginning of lunar month, especially for Ramadhan, Shawwal and Zulhijah, the using of astronomical calculation method only serves as a helper of implementation of astronomical observation or crescent observation. Then, the astronomical calculation cannot be independent

<sup>23</sup> *Ibid.*, p. 55.

<sup>24</sup> See more Susiknan Azhari, *Sejarah Perkembangan Ilmu Falak di Dunia Melayu (Kasus Indonesia)*, in Koleksi Kertas Kerja Seminar Persatuan Falak Syar'i Malaysia 1406 H/1986 AD-1425 H/2004 AD, Kuala Lumpur : Persatuan Falak Syar'i Malaysia, p. 221-222.

<sup>25</sup> He was a Chairman of *Lajnah Falakiyyah PBN*

method in determining the beginning of lunar month. In other words, it must be continued by astronomical observation to validate the results of calculations.<sup>26</sup>

In other word, Syamsul Anwar also explained that from an astronomical perspective, the implementation of crescent observation is surely difficult and it must be done by other more modern method, that is reckoning or calculation. Using rukyat as the basis for determining the beginning of lunar month contains a lot of problems and it seems impossible to unite the Muslim calendar in the future. More specifically, Syamsul Anwar said that the use of rukyat method as the basis for determining the beginning of lunar month is relating to the current state of society which considers rukyat as an easy means for determining the beginning of the month lunar. As for this present day people can use the calculation as a method of determining the beginning of the month in accordance with the progress of the science of astronomy and mathematics in the world.<sup>27</sup>

Baharudin Zainal also explains that the combination between *hisab* and *rukyat* become a harmonious combination of Islamic astronomy in order to thrive to be establish method in the future. In accordance with its origin, Islamic astronomy which is part of modern astronomy today is an

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<sup>26</sup> Ghozalie Masruri, *Pedoman Rukyat dan Hisab Nahdatul Ulama*, Jakarta : Lajnah Falakiyah PNU, 2006, p. 2-3.

<sup>27</sup> Syamsul Anwar, *Interkoneksi Studi Hadis dan Astronomi*, Yogyakarta : Suara Muhammadiyah, 2011, p.195.

observational science. The observational science will be evolved well only with scientific observations, in other words, denying *rukyaat* or crescent observation which in principle is the observation process same with eliminating the soul from the body. So far, it will have an impact for Islamic astronomy into something unattractive and difficult to understand.<sup>28</sup>

## B. The *Rukyat al- Hilal* in Malaysia

In the early stages, the implementation of crescent observation or *rukyat al-hilal* in Malaysia is done by the traditional Moslem scholars, such as muftis, kathis and the expert of astronomy and Islamic laws. The process of *rukyat al-hilal* or crescent observation has been done officially since 1934 by Syed Tahir Alwe bin Al-Hadad<sup>29</sup> on the minarets of Sultan Abu Bakar mosque , Johor Bahru.<sup>30</sup>

Since the National Council for Islamic Religious Affairs was established in 1970, official committees have been appointed to sight the new Moon of Ramadhan and Shawwal in three places, Teluk Kemang

<sup>28</sup> Baharudin Zainal, *Ilmu Falak*, Selangor : Darul Ehsan, 2004, p. 132.

<sup>29</sup> He was an expert of Islamic astronomy in Malaysia at that time, he was Born in Qaidon, Hadralmaut. on August, 7<sup>th</sup> 1884. In 1935, he has authored the book *Ahkam Shariat Johor*. He is also the author to the book of *Anwar al-Qur'an* in 1956. He also produced many books, especially in the fields of history, among them are; '*AI-Qaul al-Faslul'*, '*Uqud al-Mas'* and many others. See <http://apps.islam.gov.my/efalak/?q=en/erhk-dato>, accessed on January, Tuesday, 14<sup>th</sup> 2014, at. 09.00 WIB.

<sup>30</sup> Jabatan kemajuan Islam Malaysia (JAKIM), *Kaedah Penentuan Awal Hijrah*, Kuala Lumpur : Percetakan Nasional Berhad, 2001, p. 8.

(Negeri Sembilan), Johor Bahru (Johor) and Kampung Pulau sayak (Kedah). By the end of 2011 AD, the places of crescent observation activity was increased to 29 points, every states have at least one place for a crescent observation activity.<sup>31</sup>

No	Observation's Place	Latitude			Longitude		
		d	m	s	d	m	s
1	Al-Biruni Negeri Sabah, Tanjung Dumpil, Putatan, Sabah	5	54	19	116	02	12
2	Menara Universiti Malaysia Sabah Kampung Sungai Pagar, Labuan	5	16	46	115	10	14
3	Tanjung Lubang, Miri, Sarawak	4	21	39	113	57	30
4	Tanjung Batu, Bintulu, Sarawak	3	12	51	113	02	43
5	Teluk Bandung, Kuching, Sarawak	1	45	13	110	18	39
6	Pontian Kecil, Johor	1	29	15	103	23	18
7	Bukit Tanjung Batu, Nenasi, Pekan, Pahang	3	12	22	103	26	48
8	Gunung Brincang, Cameron Highland, Pahang	4	31	04	101	23	03
9	Bukit Pelindung, Kuantan, Pahang	3	49	53	103	21	46
10	Bukit Besar Kuala Terengganu	5	18	19	103	08	08

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<sup>31</sup> *Ibid*

No	Observation's Place	Latitude			Longitude		
		d	m	s	d	m	s
11	Bukit Kemuning, Kemaman, Terengganu	4	19	03	103	28	00
12	Pulau Perhentian, Besut, Terengganu	5	54	53	102	43	08
13	Merang, Setiu, Terengganu	5	32	09	102	56	55
14	Bukit. Peraksi, Pasir Putih, Kelantan	5	51	32	102	29	03
15	Bukit Kampung Tembeling, Kuala Krai, Kelantan	5	15	19	102	16	18
16	Menara Perbadanan,Kota Bharu, Kelantan	6	07	46	102	14	12
17	Tanjung Bidara, Melaka	2	18	00	102	05	00
18	Teluk Kemang, Negeri Sembilan	2	26	44	101	51	21
19	Menara Kuala Lumpur	3	09	11	101	42	19
20	Bukit Jugra, Selangor	2	50	10	101	25	07
21	Bukit Malawati, Kuala Selangor, Selangor	3	20	29	101	14	44
22	Balai Cerap Selangor, Sabak Bernam	3	50	00	100	50	00
23	Pantai Pasir Panjang, Perak	4	21	43	100	34	55
24	Menara Telekom, Alor Setar, Kedah	6	07	29	100	22	08
25	Pulau Sayak, Kuala Muda, Kedah	5	39	36	100	19	36

No	Observation's Place	Latitude			Longitude		
		d	m	s	d	m	s
26	Pemandangan Indah, Langkawi	6	20	11	99	44	34
27	Pantai Aceh, Pulau Pinang	5	24	44	100	11	52
28	Kuala Sungai Baru Simpang 4, Perlis	6	19	43	100	09	27
29	PICC, Putrajaya	2	51	50	101	41	21

Column. 2.2. The place of crescent observation in Malaysia<sup>32</sup>

The crescent observation activity is traditionally done with the naked eye alone. Once the Department of Survey and Mapping Malaysia involved in the implementation of crescent observation, theodolite was used for that purpose.<sup>33</sup>

Before 1970 AD, the determination of beginning of Ramadhan and Shawwal in Malaysia is using the method of *rukyat*. And according with *rukyat* method which based on astronomical calculation or *hisab*, the new Moon will be sighted at 29 on Sha'ban, Ramadhan and Zulhijah and in other months. If the new Moon is unvisible, but in mathematics and

<sup>32</sup> <http://apps.islam.gov.my/efalak/?q=en/erhk-lokasi>, accessed on Monday, January, 06<sup>th</sup> 2014, at 08.30 WIB

<sup>33</sup> Jabatan kemajuan Islam Malaysia, *Kaedah Penentuan Awal Hijrah, op. cit.*, p. 8.

astronomical calculation it may have seen the new Moon, then the arithmetic tables can be used.<sup>34</sup>

According to the Istanbul declaration in 1978, it was agreed that the criteria of expected visibility or crescent visibility (*Imkān ar-rukya*) adopted that the new Moon which meet the requirements of crescent visibility is height of new Moon after Sunset its shall not be less than 5° above the horizon and the distance curve between Sun and Moon at Sunset no less than 8°. the new Moon is already exist and can be sighted if it fulfills the requirement.<sup>35</sup>

However, this criterion has been modified by Malaysia government. Malaysia government agreed to adopt the requirements of the new Moon's height at Sunset shall not be less than 5.5 ° above the horizon and the distance curve between Sun and Moon is less than 7.5 ° at Sunset or age of the Moon after a conjunction of non- less than eight hours. Furthermore, in the informal meeting of ministers of religion of Brunei Darussalam, Indonesia, Malaysia and Singapore ( MABIMS ) held on 3<sup>th</sup> and 4<sup>th</sup> February 1992, the ruling has been made to provide coordination in the determination of the beginning of Ramadhan, Shawwal and Zulhijjah in the member countries based on *rukya* and *hisab*.

This is a positive step in improving the unity of Moslems in the region. One important element in the implementation *rukyah* and *hisab* is

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<sup>34</sup> *Ibid.*, p. 9.

<sup>35</sup> *Ibid*

the use of *Imkān ar-rukyat* criteria.<sup>36</sup> The method of *rukyat* and *hisab* which based on the *Imkān ar-rukyat* criteria is the determination of the beginning of a new month, when the new Moon at Sunset in a state that allows to be sighted.

After analyzing some crescent data and discussing a suitable criteria, the criteria that have been agreed for adoption by the member of JAKIM on 29<sup>th</sup> Zulkaidah 1412 or June 1<sup>st</sup>, 1992 in Labuan Malaysia is the conjunction occurred on the 29<sup>th</sup> of Sha'ban, Ramadhan Zulkaidah before Sunset and new Moon is considered to be visible when the result of the new Moon's calculation meets one of the following conditions:<sup>37</sup>

1. When the Sun sets, the height of the Moon above the horizon is not less than 2° and distance curve (Moon and Sun) not less than 3°.

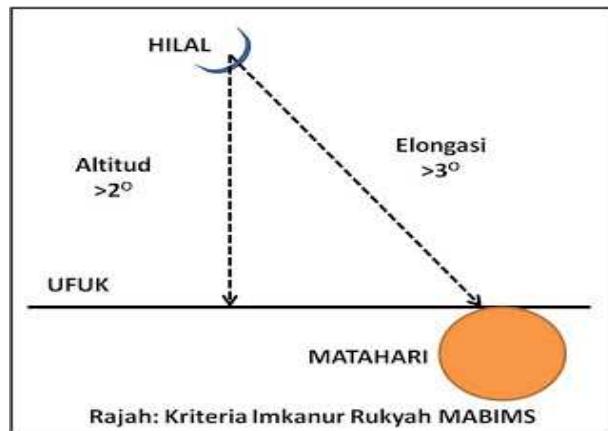
OR

2. When the Moon sets, the age of the Moon is no-less than 8 hours (after the conjunction occurs).

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<sup>36</sup> *Ibid*

<sup>37</sup> *Ibid.*, p. 9-10.



Picture.2.1  
The concept of *imkān ar-rukyah* based on MABIMS criteria<sup>38</sup>

### C. The Legal Ground of Implementation of Crescent Observation

### 1) From Holly Qur'an

## Chapter al-Baqarah verse 185:

✓ ⑧ କାଳି ପାତା ଶୁଣି ଦିନ ଶବ୍ଦ ଶବ୍ଦ 6  
ରହିଛି ଦିନ ଶବ୍ଦ 2 → ଜାଗନ୍ନାଥ ଶବ୍ଦ 10 ଶବ୍ଦ  
ଖାଦ୍ୟ ପାତା ପାତା ପାତା ପାତା ପାତା  
ଜାମ ପାତା ପାତା ପାତା ପାତା

Means : Ramadhan is the month in which was sent down the Qur'an, as a guide to mankind, also clear signs for guidance and judgment (between right and wrong). Every one of you who is present (at this home) during that month should spend it in fasting. (al-Baqarah [2] : 185)<sup>39</sup>

The above verse only reveals the broad idea of the prescribed fasting during the month of Ramadhan, without detailing as to when

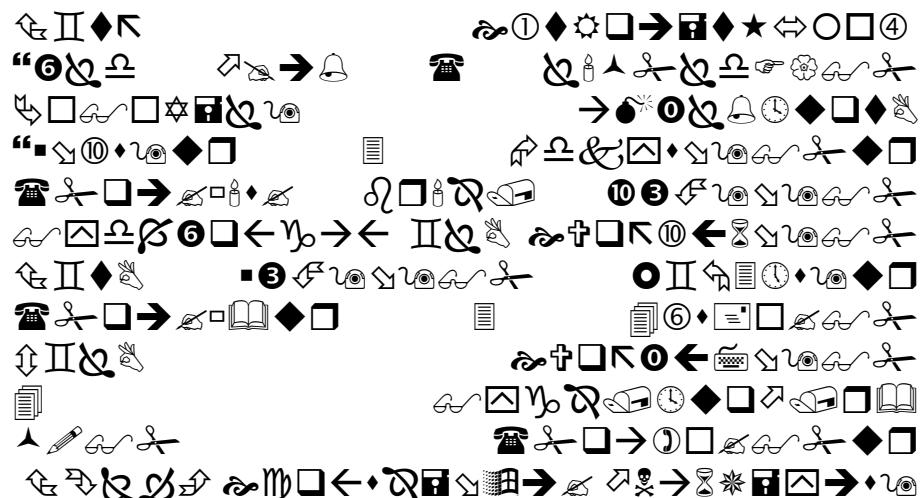
<sup>38</sup> [bicaraassyira.blogspot.com](http://bicaraassyira.blogspot.com), accessed on Monday, January, 06<sup>th</sup> 2014, at 09.00 WIB

<sup>39</sup> Abdullah Yusuf Ali, *Op.cit.*, p. 50.

the Moslems have to start the fasting. That is become debatable to both of using astronomical calculation method or astronomical observation in determining the beginning of Ramadhan month.

Muhammad Ali as-Shobuniy gives two interpretation for phrase *fa man Syahida minkum as-Syahro*. *Firstly*, Moslems are intended in the verse above who can see the new Moon of Ramadhan. *Secondly*, Moslems are still alive when the coming of Ramadhan. Therefore, he should fast.<sup>40</sup>

Chapter al-Baqarah verse 189 :



Means: "They ask you thee concerning the New Moons. Say :they are but signs to mark fixed periods of time in (the affairs of) men, and for pilgrimage. It is no virtue if ye enter your houses from the back: it is virtue if ye fear God. Enter houses through the

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<sup>40</sup> Muhammad Ali as-Shobuniy, *Durrat at-Tafaasir*, Beirut : al-Maktabah al-'Ashriyyah, 2008, p. 28.

proper doors : and fear God : that ye may prosper. (al-Baqarah [2] : 189)<sup>41</sup>

Muhammad Ali as-Shobuniy explained the meaning sense of “*mawaqit*” as the time markers used to determine when the implementation time of worship such as fasting in Ramadhan, giving tithe, and hajj. It is because the rotation and revolution of the Moon is surely regular and systematic.<sup>42</sup>

## 2) From Prophetic Tradition

This explanation as written on the prophetic tradition narrated from Imam Moslem r.a.:

حدثني حميد بن مساعدة الباهلي حدثنا بشر بن مفضل حدثنا سلمة (وهو ابن علقة) عن نافع عن عبد الله ابن عمر قال: قال رسول الله ص.م.: الشهر تسع وعشرون. فإذا رأيتموا الهلال فصوموا وإذا رأيتموه فأفطروا، فإن غم عليكم فاقدروا له. (رواه مسلم)<sup>43</sup>

Means : “Narrataed to me Humaid bin Mas’adah Al-Bahiliy, Narrated to us Bisyrū bin Mufadhdhal, narrated to us Salamah bin ‘Alqamah, from Nafi’ from Abdullah bin Umar, He said: I heard Muhammad Rasulullah PBUH said: “the number of lunar month is 29 days, When you see a new Moon then you must do the fasting, and when you see it, then break your fast; in case the sky is cloudy, then calculate for it.” (Narrated by Moslem)

Moslem scholars are in different interpretation for phrase “*faqdurū lahu*”. Some scholars that included Imam Ahmad ibn Hanbal

<sup>41</sup> Abdullah Yusuf Ali, *op. cit.*, p.51.

<sup>42</sup> Muhammad Ali as-Shobuniy, *op. cit.*, p. 29.

<sup>43</sup> Muslim bin Hajjaj, *Shahih Muslim*, book II, Beirut : Dar al-Kutub Al-Ilmiyah, 1992, hlm. 760.

explains the phrase "*faqdurū lahu*" has the meaning " to make narrow and estimate the existence of the Moon behind clouds" Ibn Suraij and some scholars, among others, consists of Muthraf bin Abdullah and Ibn Qutaibah argued that the meaning of "*faqdurū lahu*" 'is to make estimation by conducting calculations on its *Manāzil* (or orbital positions of the Moon)." While Imam Malik, al-Shafi'i, Abu Hanifa, and *jumhur* scholars agree that the phrase "*faqdurū lahu*" is to complete the days of the month of Sha'ban with thirty days, as explained in other redaction below:<sup>44</sup>

حدثنا يحيى بن يحيى. أخبرنا إبراهيم بن سعد عن ابن شهاب عن سعيد بن المسيب عن أبي هريرة رضي الله عنه، قال: قال رسول الله ص.م.: إذا رأيتموا الهلال فصوموا وإذا رأيتموه فأفطروا، فإن غم عليكم فصوموا ثلاثين يوماً. (رواه مسلم)<sup>45</sup>

Means : “Narated to us Yahya bin Yahya, narrated to us Ibrahim bin Sa'd, from Ibnu Syihab, from Sa'id bin Musayyab, from Abi Hurairah RA, he said: Rasulullah PBUH said: “when you see a new Moon then you must do the fasting, and when you see it, then break your fast; in case the sky is cloudy, then do the fast for thirty days.” (Narrated by Moslem)

حدثنا يحيى بن يحيى. قال: قرأت على مالك عن نافع عن ابن عمر رضي الله عنهما عن النبي ص.م. أنه ذكر رمضان فقال: لاتصوموا حتى تروا الهلال ولا نفطروا حتى تروه، فإن أغمي عليكم فاقدروا له. (رواه مسلم)<sup>46</sup>

Means “Narated to us Yahya bin Yahya. he Said: I Said to Malik, from Nafi’, from Ibnu Umar RA, from prophet Muhammad PBUH. that He mentions Ramadhan, while said: “do not fast till you see the new Moon, and do not break fast till you see it,

<sup>44</sup> Yahya bin Syarof An-Nawawi, *Shahih Muslim bi Syarhi an-Nawawi*, Beirut : Dar al-Kutub Al-Ilmiyah, 1995, p. 166.

<sup>45</sup> Muslim bin Hajjaj, *op. cit.*, p. 762.

<sup>46</sup> *Ibid.*, p. 759.

in case the sky is covered by clouds, then calculate for it.”  
 (Narated by Moslem)

Ibnu Rushd in his *masterpiece Bidayat al-Mujtahid wa Nihayat al-Muqtashid*, also strengthen the argumentation of jumhur and some scholars other who said that the means of phrase “*faqdurū lahu*” is “*akmilu al-iddata Šalātīna*” complete the days of the month of Sha’ban with thirty days. Meanwhile, some other scholars believe that the main point of phrase “*faqdurū lahu*” is “*udduhu bil hisāb*” or conducting an astronomical calculation. Furthermore, Ibnu Umar explains that the meaning of “*faqdurū lahu*” is “*an yushbiha al-mar’u Šāman*” (that someone implementing fast on the next day). Thus, Ibnu Rushd denied Ibnu Umar’s perception.<sup>47</sup>

Furtermore, Ibnu Rushd shows an logical reason behind the rise of variety interpretations. He stated that the hadith (prophetic tradition) that use the word “*faqdurū lahu*” is still ijmaliy (global), but the hadith that use the word “*fashūmū Šalātīna yauman*” is surely *tafshiliy* (specific), which spesific explanation truly can give clear explanation for something global<sup>48</sup>

#### D. Some Factors Affect the Crescent Visibility

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<sup>47</sup> Muhammad bin Ahmad bin Muhammad bin Ahmad bin Rushd al-Qurthubiy al-Andalusiy, *Bidayat al-Mujtahid wa Nihayat al-Muqtashid Juz I*, Beirut : Dar Ibn ash-Shashah, 2005, p. 228.

<sup>48</sup> See : Baharudin Zainal, *Ilmu Falak*, Selangor : Dawama, ed. 2, 2004, p. 128.

The implementation of the crescent's observation is not always run as well as we hope without any problems and troubles. In general, there are two problems that greatly affect to the crescent visibility, we conclude into the internal factor and external factor, which will be explained more below.<sup>49</sup>

### 1. Internal Factor

The internal factors will give more contribution to ensure the success of implementation of crescent observation, especially for the crescent visibility. The internal factors for this context is refer to the *subject, human or observers* who conduct the observation. The process of observing basically consists of two aspects; physical and psychological aspect.<sup>50</sup>

Firstly is about the observer's psychological. The observer's psychology becomes an important thing to describe the real condition of the observation. The observer not only must be healthy (eyes),- being not myopic and blind-, but also must be honest and careful. The good observer is also depend on his experience in observing the

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<sup>49</sup> Farid Ruskanda, *Teknologi Rukyat Secara Objektif dalam Rukyat dengan Teknologi, Upaya Mencari Kesamaan Pandangan tentang Penentuan Awal Bulan Ramadhan dan Syawal*, Jakarta : Gema Insani Press, 1994, p. 26-27.

<sup>50</sup> *Ibid.*, p. 27.

related object, the more experience will give the better quality of an observation.<sup>51</sup>

Related to the physical aspect is closely linked to the tool used when observation. the observers also need to prepare the essential tools that helps the process of observation, based on the function, the tools of crescent's observation is divided into three classification namely, *finding tool*, *clearing tool* and *capturing tool*.<sup>52</sup>

*Finding tools* is the tools that help the observer to find the position of new Moon which has been predicted by astronomical calculations, the *finding tools* such as GPS (global positioning system)<sup>53</sup>, hilal map, etc.

*Clearing tools* help the observer to clarify the observed object, the clearing tools such as theodolite<sup>54</sup>, telescope<sup>55</sup>, *rubu' mujayyab*<sup>56</sup>, etc. and the last is capturing tools, which help the observer to record the observed object, that's new Moon or crescent. The capturing image is important for the observers to avoid themselves from the hallucinations, such as Camera, CCD etc.

<sup>51</sup> Jabatan Kemajuan Islam Malaysia, *Kaedah Penentuan awal Hijra*, op.cit, p.25

<sup>52</sup> Interview with Joko Satria Ardianto, the researcher of Baitul Hilal Teluk Kemang, Space Physics Laboratory, University of Malaya, on September 25<sup>th</sup> 2013.

<sup>53</sup> GPS ia a space-based satellite navigation system that provides location and time information in all weather conditions, anywhere on or near the Earth where there is an unobstructed line of sight to four or more GPS satellites.

<sup>54</sup> Theodolite is a precision instrument for measuring both horizontal and vertical angles, as used in triangulation networks.

<sup>55</sup> A telescope is an instrument that aids in the observation of remote objects by collecting electromagnetic radiation (such as visible light).

<sup>56</sup> *Rubu' Mujayyab* well known as Sinus Quadrant as an ancient Calculator in Muslim World. Widely use in daily life, such as clock, calculator, mimar.

## 2. External factor

According to Mohammad Zambri, there are many factors that affect the visibility of the new Moon. It can be divided into two main factors, ie factors scientific/astronomical and non-astronomical factors.<sup>57</sup>

Scientific factors / criteria for determining the new Moon in the astronomical observation is as follows:

- a) Light curve (elongation means splitting the Moon from the Sun).
- b) Visibility curve (altitude Moon from the Sun).
- c) The Moon Altitude from the local horizon
- d) The width of the new Moon
- e) The age of the new Moon
- f) The Moon's intervals after Sunset
- g) The distance of the Moon from the Earth
- h) The distance of the Earth from the Sun
- i) The latitude and longitude of the observer.<sup>58</sup>

Furthermore, there was a non-scientific factors. In general, non-scientific factors/external is very difficult to control, and depending on the situation when the observations. Non-scientific factors include as follows :

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<sup>57</sup> Mohd. Zambri bin Zainuddin, *Hilal dan Faktor-Faktor yang Mempengaruhi Kenampakan*, a material subject in lecturing Islamic Astronomy for Islamic astronomy student in University Malaya

<sup>58</sup> *Ibid.*, p.1.

- a) The weather conditions are not good
- b) Atmospheric pollution
- c) Humidity of the air
- d) The height of the observed location
- e) Physical and psychological observer<sup>59</sup>

## **E. A Glance Information about Moon and Its Movement**

### 1. Knowing the Moon

The Moon is our nearest neighbor in space, a natural satellite orbiting the Earth at an average distance of 382,400 kilometers. Although the Moon is a satellite of the Earth, it is almost six times more massive than Pluto. The Moon is so large that it would be regarded as a planet in its own right if it orbited the Sun separately from the Earth. In this sense, the Moon can be regarded as the smallest of the terrestrial planets, at the opposite extreme from the Earth.<sup>60</sup>

The Moon is a world of grays without the vivid colors of the Earth's landscape, the Moon's surface is never hidden by lunar clouds or haze, nor does the spectrum of Sunlight reflected from it show obvious signs of gases. The Moon has no atmosphere for two reasons. First, its interior is too cool to cause volcanic activity, which was probably an important source of much of the Earth's early atmosphere.

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<sup>59</sup> *Ibid.*, p 2.

<sup>60</sup> Stephen E. Schneider and Thomas T Arn, *Pathways to Astronomy*, ed. 1 New York : McGraw-Hill, 1957, p.279

Second, and more important, even if volcanoes or comet impacts had created an atmosphere in its youth, the Moon's small creates to weak a gravitational force for it to retain the gas. A planets escape velocity depends on its mass and radius. Being smaller and less massive than the Earth, the Moon has an escape velocity only about a fourth that of the Earth's. Thus atoms in any atmosphere the Moon might have once possessed would have escaped relatively easily.<sup>61</sup>

The lack of atmosphere has several important consequences for the Moon's physical characteristics. Without an atmosphere's greenhouse effect, the average temperature of the Moon's surface is only about 250 K (about -10°F) versus the Earth's mean temperature of about 290 K (about 60°F). Without an atmosphere to retain heat, there are dramatic temperature changes between day and night, reaching about 390 K (about 240° F), hot enough to boil water, during the two-week-long lunar day, and dropping to about 120 K (about-240° F) during the equally long lunar night.<sup>62</sup>

Near the North and South poles of the Moon, there are craters that are never lit by the Sun, and the temperature probably remains close to about 40 K (about -390 °F). Remaining at such low temperatures, it is possible for water ice to survive, perhaps buried below the surface. NASA space probes have found probable evidence

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<sup>61</sup> *Ibid.*, p. 285.

<sup>62</sup> *Ibid.*

for ice in this regions based on their reflectivity to radio waves and neutrons emitted when high-energy particles interact with hydrogen atoms within about a meter of the surface. The amount of neutrons detected suggests that there is a significant amount of water near both poles. If a large source of water could be found, it could improve the possibilities for someday building a base on the Moon.<sup>63</sup>

## 2. The Rotation and the Revolution of the Moon

The Moon constantly changes its lighted shape and position in the sky, because it rotates on its axis once each orbit around Earth from West to East.<sup>64</sup> For a rotation's period it takes time as its revolution.

The Moon takes 27.32 days, completely 27 days 7 hours 43 minutes 12 second to complete one revolution about Earth, this is called its sidereal period or *Syahr Nujūmī*. However, because of the changing relationship between Earth, the Moon, and the Sun due to Earth's orbital motion, it takes 29.53 days, completely 29 days 12 hours 44 minutes 2,8 seconds to go from one full Moon to the next , this is called its *synodic period* or *Syahr Iqtirāni*.<sup>65</sup>

Let us see what the Qur'an says about the Moon, it tells us about the Moon moves and changes its places. This movement gives it different phases. Allah said in His holly Book chapter Yasin verse 39 :

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<sup>63</sup> *Ibid.*

<sup>64</sup> Jeff Hester and friends, 21<sup>st</sup> Century Astronomy, New York : W.W. Norton Company, 2006. p. 45.

<sup>65</sup> *Ibid.*, p.48.

Means : “And the Moon, we have measures for her mansions (to traverse) till she return like the old (and withered) lower part of a date stalk” (Yāsin (36) : 39)<sup>66</sup>

The verse above denote that the Moon moves and its shape changes gradually from a crescent to a full Moon, while during the reminder of its course it wanes until it appears at the end of the month curved and pale like the old branch of a palm tree, it's also as an exact explanation of the phases of the Moon which ae caused by the revolution of the Moon around the Earth.<sup>67</sup>

The Qur'an not only tells us that the places of the Moon are due to the various places to which it moves, but it also tells us that with the Sun and the Earth it runs in a special orbit, with none of the three overtaking the other.

<sup>66</sup> Abdullah Yusuf Ali, *op. cit.*, p. 539.

<sup>67</sup> Ahmad Mahmud Soliman, *Scientific Trends in the Qur'an*, London : British Library, 1985, p. 24.

Means : “It is not permitted to the Sun to catch up the Moon, nor can the Night outstrip the Day: each just swims along in (its own) orbit (according to law) ”(Yāsin (36) : 40)<sup>68</sup>

The Qur'an reveals these facts when the world was in utter ignorance, not only of the solar system<sup>69</sup> but also of the Earth on which they lived, at a time when some of the inhabitants of our globe were worshipping the Moon as a goddess.<sup>70</sup>

For Moslem civilization, the revolution of the Moon is used to be a calender system, which called by lunar Month, Hegira Month or lunar calender. Calendar based on the passage of the Moon's revolution is to ensure that the *conjunction*, visibility of the new Moon or full Moon to determine the beginning of the month. The basic unit for this calendar is the Moon (month).<sup>71</sup>

Calendars are cyclical phases of the Moon and do not take into account the movement of the Sun. Compilation of Islamic calendar (Calendar Hegira) is fully based on the method. Islamic calendar is not affected by the cycle of seasons as the Gregorian calendar. A year of

<sup>68</sup> Abdullah Yusuf Ali, *loc. cit.*

<sup>69</sup> Solar system consists of the Sun, the eight planets and their satellites.

<sup>70</sup> *Ibid.*, p. 24-25.

<sup>71</sup> This almanac is initiated by Umar bin Khattab by making the migration of prophet Muhammad PBUH from Mecca to Medina as the beginning of the year. Read more in : Slamet Hambali, *Almanak Sepanjang Masa*, Semarang : Program Pascasarjana, 2011, p. 51-68.

Islamic calendar consists of 12 months beginning with the crescent visibility.<sup>72</sup>

Because the Islamic calendar is not associated with the tropical year, the days of the Islamic calendar will be shifted back 11 days every year. This is because every month Islam contains 29.5 days on average so there are  $12 \times 29.5 = 354$  days, 12 Islamic months per year. Compared to the day of the Gregorian year (365 day) then there is a difference 11 days refers to the solar year. Because the Islamic calendar is not associated with the tropical year, the days of the Islamic calendar will be shifted back 11 days every year. This is because every month Islam contains 29.5 days, on average there are  $12 \times 29.5 = 354$  days, 12 Islamic months per year. Compared to the day of the Gregorian year (365 day) then there is the difference 11 days refers to the solar year.

12 Each year consists of 12 months (with no leap month) in which was given the name the following month;<sup>73</sup>

No	Months	Period	Leap year	No Leap Year
1	Muharram	30	30	30
2	Safar	29	59	59
3	Rabi al-Awal	30	89	89
4	Rabi al-Akhir	29	118	118

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<sup>72</sup> Ibid., p.13.

<sup>73</sup> Ibid., p. 63.

5	Jamadi al-Awal	30	148	148
6	Jamadi al-Akhir	29	177	177
7	Rajab	30	207	207
8	Sya'ban	29	236	236
9	Ramadhan	30	266	266
10	Shawwal	29	295	295
No	Months	Period	Leap year	No Leap Year
11	Zulkaidah	30	325	325
12	Zulhijah	29/30	355	354

Column. 2.3. List of names and period of lunar month<sup>74</sup>

For Islamic calendar, there are seven (7) days in a week, with each day beginning when the Sun goes down. The first day begins at Sunset on the day Saturday and ends at Sunset on Sunday. Determine the first day of the Islamic month is very important because it will set the day, to be Islamic greatness example determines the start of the Ramadhan fasting, Idul Fitri gairom and Idul Adha gairom.<sup>75</sup>

### 3. The Moon's Phases

Sometimes the Moon appears as a circular disk in the sky. At other times it is nothing more than a thin silver, at still others its face it

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<sup>74</sup> *Ibid.*

<sup>75</sup> Zambri Zainuddin, and friends, Laporan *Kajian Cerapan Hilal dan Pembiasaan Cahaya di Ufuk Tempat : Kompleks Baitul Hilal Telok Kemang*, Port Dickson, Negeri Sembilan Tahun 2000 - 2012 Masehi.

dark. The Moon has no light source of its own, like planets, including Earth, it shines by reflected Sunlight. Like Earth, half of the Moon is always in bright daylight, and half of the Moon is always in darkness. The different phases of the Moon result from the fact that the illuminated portion of the Moon that we see is constantly changing. Sometimes (during a new Moon) the side facing away from us is illuminated, and sometimes (during a full Moon) the side facing toward us is illuminated. The rest of the time, only part of the illuminated portion can be seen from Earth, and the important that the phases of the Moon is determined by how much of its bright side we can see.<sup>76</sup>

Morrison and Owen in book “*The Planetary System*” explains when the Moon goes through a complete set of phases from new to full and back to new, in general is divided into four phases, *new Moon, first quarter Moon, full Moon, last quarter Moon.*<sup>77</sup>

Broadly, the specific explanation about Moon’s phases which divided into eight phases, namely:

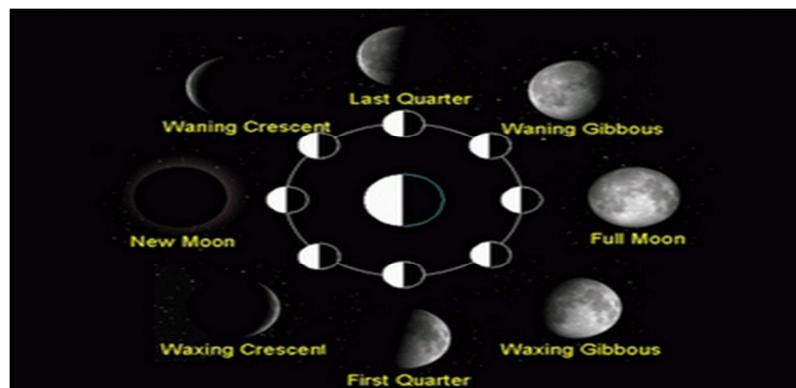
- a) New Moon
- b) Waxing crescent
- c) First quarter Moon
- d) Waxing gibbous

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<sup>76</sup> Jeff Hester and friends, 21<sup>st</sup> Century Astronomy, op.cit., p. 46.

<sup>77</sup> David Morison and Owen, *The Planetary System*. p. 6-7. read other book such as : Idatul Fitri and Corri Sunna, *Buku Pintar Tata Surya*, Yogyakarta : Diva Press, 2011, p.59-66.

- e) Full Moon
- f) Waning gibbous
- g) Third quarter Moon
- h) Waning Crescent<sup>78</sup>



Picture.2.2

The revolution of Moon cause the different of phases of Moon<sup>79</sup>

When the Moon is between Earth and the Sun, the illuminated side of the Moon faces away from us, and we see only the dark side. This is called a *new Moon*. To look a *new Moon* can only be seen from the illuminated side of Earth, It appears close to the Sun in the sky. And so it rises in the east at Sunrise, crosses the meridian near noon, and sets

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<sup>78</sup> Jeff Hester and friends, 21<sup>st</sup> Century Astronomy, op. cit., P. 46-48.

<sup>79</sup> [nuraisyah-pgsdupi.blogspot.com](http://nuraisyah-pgsdupi.blogspot.com), accessed on Monday, January, 06<sup>th</sup> 2014, at 09.00

in the West after Sunset. A *new Moon* is never visible in the nighttime sky.<sup>80</sup>

As the Moon continues on its orbit around Earth, a small part of the portion being illuminated becomes visible. This shape is called a *crescent*. Because the Moon as a *waxing crescent Moon*.<sup>81</sup> From our perspective, the Moon has also moved away from the Sun in the sky. Because the Moon travels around Earth in the same direction in which Earth rotates, we now see the Moon located to the east of the Sun. A waxing crescent Moon is visible in the western sky in the evening, near the setting Sun but remaining above the horizon after the Sun sets.<sup>82</sup>

As the Moon moves farther along in its orbit, more and more of its illuminated side becomes visible each night, so the crescent continuous to fill out. At the same time, the angular separation in the sky between the Moon and the Sun grows. After about a week, the Moon has moved a quarter of the way around the Earth. And then, it will be seen half the Moon illuminated in daylight and half the Moon as dark, it's a phase that we call *first quarter Moon*. *First quarter Moon* refers not to how much of the face of the Moon that we see illuminated, but rather to the fact that the Moon has completed the first quarter of its cycle from new Moon to new Moon.<sup>83</sup>

<sup>80</sup> *Ibid.*, p. 47.

<sup>81</sup> Waxing here means : growing in size and brilliance.

<sup>82</sup> Jeff Hester and friends, *21<sup>st</sup> Century Astronomy*, *op.cit.*, p. 47.

<sup>83</sup> *Ibid.*, p. 48.

As the Moon moves beyond first quarter, we are able to see more than half of its bright side, this phases is called a *waxing gibbous Moon*. The gibbous Moon continues nightly to grow until finally Earth is between the Sun and the Moon and we see the entire bright side of the Moon, that's well known by *full Moon*. The Sun and the Moon now appear opposite each other in the sky. The full Moon rises as the Sun sets crosses the meridian at midnight, and sets in the morning as the Sun rises.<sup>84</sup>

The second half of the Moon's orbits proceeds just like the first half but in reverse. The Moon continues in its orbit. Again appearing gibbous but now becoming smaller each night. This phase is called a *waning gibbous Moon*.<sup>85</sup> A *third quarter Moon* occurs when we once again see half of the illuminated part of the Moon and half of the dark part of the Moon. The third quarter Moon rises at midnight, crosses the meridian near Sunrise, and sets at noon. The Moon continues on, visible now as a *waning crescent Moon* in the morning sky, until the Moon again appears as nothing but a dark circle rising and setting with the Sun, and the cycle begins again.<sup>86</sup>

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<sup>84</sup> *Ibid.*

<sup>85</sup> Waning gibbous Moon means becoming smaller.

<sup>86</sup> Jeff Hester and friends, 21<sup>st</sup> Century Astronomy, *loc.cit.*