

# THE ROLE OF ASTRONOMY IN ISLAM

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## Introduction

**“We have not created the heaven and the earth and all that is between them in mere idle play. None of this have We created without an inner truth: but most of them understand it not.” (44: 38-39)**

**“In the creation of the heavens and earth, and the alternation of the night and day, and the ships which sail the seas to people's benefit, and the water which Allah sends down from the sky -- by which He brings the earth to life when it was dead and scatters about in it creatures of every kind -- and the varying direction of the winds, and the clouds subservient between heaven and earth, there are signs for people who use their intellect.” (2:164)**

Need more be said? One of the purposes of the Holy Qur'an's revelation is to invite people to think. What can possibly be more straightforward than that regarding our conduct here on earth with respect to the use of our intellect to understand the world around us. The holy Qur'an delves into the many signs of Allah in nature, around us and within us to convey a deep sense of awe at the many signs of our Lord, apparent to those who use intellect. It is truly remarkable that the Qur'an revealed between 610 and 632 CE contains in it, scientific knowledge that has taken centuries to be discovered. The only explanation for this is that without a doubt, it is divine in origin. We Muslims believe that the Qur'an, in original Arabic, is the actual word of Allah, the Most High. A proper understanding of the Qur'an therefore also requires an understanding of science. It is not the purpose of the Qur'an to explain science to us but it encourages persons to reflect on the works of creation so that we may realize the greatness of Almighty God. Before we delve any further, it is necessary to make clear a very important distinction – that between *Astronomy* and *Astrology* – the two terms are often confused by many persons as meaning the same. They cannot be further from each other. Astronomy is a science and *halal* whereas astrology is a pseudo science and *haram*. Astronomy deals with the study of the heavens in an effort to understand the underlying principles governing the behaviour of the planets, stars and galaxies and the Universe in general. Astrology claims to predict the destinies of persons as a result of the ‘action’ of planets and so on, on their lives. There has not been to date any contradiction between Astronomy, as we understand it, and the Qur'an.

The Qur'an deals with many areas of science such as geology of earth, the animal and vegetable kingdom, human reproduction and Astronomy. This article concentrates on the position of Astronomy in Islam with emphasis on observed facts and not theories. A theory is used to explain an observed or hypothesized phenomena and it may be modified, changed, or rejected in due course depending on how appropriate it may be against observational data. Theories can be subjective in nature. An observation is a fact and is not liable to be changed but may be further refined.

This article does not deal with speculative Astronomy. Because like all sciences, we do not understand everything and there are many things that remain as models. It should be borne in mind that a thousand experiments will not prove a theory correct but one experiment can disprove it. Understanding the underlying principles behind the clockwork of the Universe endows us with a far deeper sense of awe and appreciation of the One that created it. The sentiment is similar to that expressed by Physicist Richard Feynman:

“I have a friend who's an artist and he's sometimes taken a view which I don't agree with very well. He'll hold up a flower and say. “Look how beautiful it is,“ and I'll agree, I think. And he says - “ you see, I as an artist can see how beautiful this is, but you as a scientist, oh, take this all apart and it

becomes a dull thing.“ And I think that he's kind of nutty. First of all, the beauty that he sees is available to other people and to me, too, I believe, although I might not be quite as refined aesthetically as he is, but I can appreciate the beauty of a flower. At the same time I see much more about the flower than he sees. I could imagine the cells in there, the complicated actions inside which also have a beauty. I mean it's not just beauty at this dimension of one centimeter, there is also beauty at a smaller dimension, the inner structure. Also the processes, the fact that the colors in the flower are evolved in order to attract insects to pollinate it is interesting - it means that insects can see the color. It adds a question: Does this aesthetic sense also exist in the lower form? Why is it aesthetic? All kinds of interesting questions which a science knowledge only adds to the excitement and mystery and the awe of a flower. It only adds; I don't understand how it subtracts.“ - Richard P. Feynman (1918-1988)

It not only adds, but enriches, it deepens. Understanding and developing an appreciation of creations of Allah using the tools of science can enrich and deepen a believer's consciousness of the Creator.

If there is any religion that invites man to the study and understanding of the heavens, it is Islam. An understanding of the discipline of Astronomy is essential for the appreciation of the religion of Islam. No other religion uses or relies on the heavens and the motion of the moon and sun for timekeeping and calendars as Islam does. Allah created this tremendous Universe that we live in and we are invited to reflect upon it, to understand it so that we may be able to practise our religion with conviction based on reason to the best of our abilities. By God's laws, the laws of Physics, we are glued to the planet earth yet Almighty God granted us eyes, intellect and knowledge that we may see far in excess of our ordinary reach- surely in these things are signs of the omnipotence of our Creator.

**“Allah is He, who created the sun, the moon, and the stars (all) governed by laws under His commandment.” (7:54)**

**“He has made subject to you, the night and the day; the sun and the moon; and the stars in subjection by His command.” (14:33; 16:12)**

## **Astronomy in the Qur'an**

Just pause and try and imagine the Arabian night skies – crisp and clear, twinkling gently and kindly ...invitingly, literally showing mankind the way. We see below a sampling of some of the mentions of Astronomy in the Qur'an. It is by no means a catalogue. The Qur'an tells us that the stars are there to guide us on land and sea.

**“And it is He who ordained the stars for you that you may be guided thereby in the darkness of the land and the sea.” (6:97)**

**“And marks and sign-posts and by the stars, (men) guide themselves.” (16:16)**

If you become familiar with the constellations and the stars in the sky, one can never be lost anywhere in the world. They are truly a guiding light in the canopy of the heavens. You can be anywhere in the world and immediately on looking up in the night sky and by recognizing stars, you can know what latitude you are at and where is north and thereby all the other directions. You can know what time of the year it is in the absence of any calendars. It is rather appropriate that the crescent moon and star is used as signs to represent matters of religion among Muslims. The moon holds a most important position for the reckoning of time among Muslims. The lunar calendar is one of the oldest and a natural calendar system and astronomers acknowledge that the Muslim calendar is the only purely lunar calendar in wide use

**“They ask you about new crescent moons, say they are to mark fixed times for mankind and Hajj.” (2:189)**

**“And He who made the night for rest and sun and moon for reckoning of time. This is the decree of the Exalted, the All-knowing.” (6:96)**

**“It is He who made sun a lamp, and moon a light and measured stages so you know number of years and count (of time).” (10:5)**

**“And He subjected the sun and the moon (to His law); each one runs its course for a term appointed.” (13:2), (31:29), (35:13), and (39:5)**

It is interesting to note that the Qur'an refers to many heavens and earths. It is remarkable that one of the more recent discoveries in Astronomy has been that of other worlds such as ours. It was as recently as 1995 that the first planet outside of our solar system was discovered. To date several such planets have been found and extrasolar planets seem to be the rule rather than the exception. How many many aeons ago the Qur'an mentioned this!

**“God is the One Who created seven heavens and of the earth a similar number. The command descends upon them so that you know that God has power over all things and comprehends all things in His knowledge.” (65:12)**

The Qur'an always refers to the sun and moon differently. The sun is referred to as *siraj* (light) and *zia* (signifies that light which exists by itself) while the moon is referred to as *nur* – which means derived light. This is very accurate since the sun is a celestial body that gives off its own light because of nuclear processes in its interior. However the moon shines only by reflected light.

**“And made the moon a light in their midst and made the sun as a (Glorious) lamp.” (71:16)**

At the time of revelation of the Qur'an, it was a commonly held belief that the earth stood still and that the sun orbited around us. After all it seemed logical. Man's ego was bigger than the universe or so he thought. It was easier to believe that he lived in the centre of the universe.

It was not until the 16th century that the astronomer Copernicus showed otherwise, that the earth orbited around the sun instead. Just pause and look at the time interval when that piece of information was in the holy Qur'an. Hostility to Science generally and Astronomy particularly was the misfortune of the Catholic Church in the early 16th and 17th century. Let us not imitate them.

**“It is He who created the night and the day, and the sun and the moon, all (the celestial bodies) swim along, each in its orbit.” (21:33)**

**“And the moon, we have measured for her mansions (to traverse) till she returns like the old, (withered, and curved-up like a sickle) date-palm. It is not permitted for sun to catch-up the moon, nor can the night outstrip the day; each swims along in (its own) orbit.” (36:39-40)**

The stars adorn our night skies and endow one with a sense of peace with their gentle twinkling. The Qur'an says:

**“Consider those (stars) that rise only to set. And move (in their orbits) with steady motion. And float (through space) with floating serene. And yet overtake (one another) with swift overtaking. And thus fulfil the (Creator's) behest!” (79:1-5)**

It is only on the scale of the galaxy that this verse comes to light! A galaxy is composed of millions and millions of stars. A galaxy like ours, the Milky Way is a spiral galaxy and rotates. Yes, the stars



The first verse that was ever revealed to Prophet Muhammad (UWBP) implores man towards the acquisition of knowledge:

**“Read in the name of thy Sustainer, who has created – created man out of a germ cell! Read – for thy Sustainer is the Most Bountiful One. Who has taught (man) the use of the pen – Taught man what he did not know!” (96: 1-5)**

**A quick browsing through the holy Qur’an shows many Surahs beginning with astronomical references: “Consider those (stars) that rise only to set” (79:1)**

**“Consider the heavens and that which comes in the night” (86:1)**

**“Consider the sun and its radiant brightness and the moon as it reflects the sun!” (91:1)” .....  
“Consider the sky and its wondrous make” (91:5)**

**“Consider the night as it veils (the earth) in darkness” (92:1)**

It is our moral obligation to study Astronomy! Given the exposition in the previous section, it would seem natural that Astronomy should get its impetus first and foremost from Muslim Scholars. And so it was in the early years of Islam. Sadly, this trend has suffered a serious decline in the last few centuries. It is really interesting to note that Muslims were in fact the first to differentiate and separate the science of Astronomy from the pseudo science of astrology. The development of Astronomy suffered a great decline and the last of the great Muslim astronomers was Fakhr al-Din al-Razi (d. 1228 CE). Let us venture back in time and see the richness of the pursuit of knowledge particularly in Astronomy in the early days of Islam. Contributions to Astronomy by Muslim scholars will naturally include contributions to Mathematics and Physics that are indispensable tools for the study of Astronomy. If the tradition of seeking knowledge as Islam emphasizes had continued, Astronomy would have continued to flourish among Muslim scholars and no doubt have been centuries ahead of our time as we have seen from the expositions in the previous sections as highlighted in the holy Qur’an.

Greek works were translated by Muslim scholars in Arabic and they also added encyclopaedias of their own. When Europe later re-awoke, they translated the Arabic works and the Arabic translations of the Greek works. Star names were not translated but transliterated so that to date many many stars names are Arabic in origin. A look through any catalogue of stars, and one is immediately struck by the numerous names that appear to be Arabic in origin such as Aldabaran and Deneb. In an astronomical catalogue of almost 250 stars, over 140 of them had names that were Arabic in origin. Many new stars were discovered by Muslims. The book on stars of 'Abd al-Rahman al-Sufi was in fact translated into Spanish by Alfonso X el Sabio. The Muslims carried out many observations that were contained in astronomical tables called Zij. One of the most keen observers was al-Battani. The zij of al-Ma'mun observed in Baghdad, the Hakimite zij of Cairo, the Toledan Tables of al-Zarqali and his associates, the el-Khanid zij of Nasir al-Din al-Tusi observed in Maraghah, and the zij of Ulugh-Beg from Samarqand are among the most famous Islamic astronomical tables. These tables had significant influence upon Western Astronomy up to the time of Astronomer Tycho Brahe.

In Astronomy the Muslims integrated the astronomical traditions of the Indians, Persians, the ancient Near East and especially the Greeks from the 8th century onward. The Almagest of Ptolemy, the name of which is Arabic in origin, was thoroughly studied and its planetary theory criticized by several astronomers of both the eastern and western lands of Islam. A major critique of the theory was developed by Nasir al-Din al-Tusi and his students especially Qutb al-Din al-Shirazi, in the 13th century.

The first astronomical observatory as a scientific institution was the observatory of Maraghah in Persia established by al-Tusi. Later European observatories indirectly followed this model. The most

famous astronomical instrument, the astrolabe was developed by Muslims to carry out observation. There existed even mechanical astrolabes perfected by Ibn Samh that can be considered as the predecessor of the mechanical clock.

The Muslims also applied their astronomical knowledge to questions of time-keeping and the calendar in making almanacs, this word too being Arabic in origin. The most exact solar calendar existing to this day is the Jalali calendar which was developed under the direction of 'Umar Khayyam in the 12th century. This is still in use in Persia and Afghanistan.

In the field of Mathematics, Muslims began by integrating Greek and Indian mathematics. The first great Muslim mathematician, al-Khwarazmi, who lived in the 9th century, wrote a treatise on arithmetic that brought the Arabic numerals to the West. He is also the author of the first book on algebra. The term algebra itself comes from the first part of the name of the book of al-Khwarazmi, entitled *Kirah al-jabr wa'l-muqabalah*. Abu Kamil al-Shuja' discussed algebraic equations with five unknowns. The science was further developed by such figures as al-Karaji until it reached its peak with Khayyam who classified by kind and class algebraic equations up to the third degree. The brothers Banu Musa who lived in the 9th century may be said to be the first outstanding Muslims in the field of geometry while their contemporary Thabit ibn Qurrah helped lay foundations of integral calculus. Muslims scholars also developed trigonometry that was established as a distinct branch of mathematics by al-Biruni. Calculus, trigonometry and geometry are the cornerstones of solving problems in Astronomy.

Other Muslim mathematicians such as Khayyam and al-Tusi examined Euclidean geometry that is the geometry of flat surfaces. The Muslim mathematicians, especially al-Battani, Abu'l-Wafa', Ibn Yunus and Ibn al-Haytham, also developed spherical Astronomy. Euclidean and spherical geometry are particularly useful in studying the overall geometry of the Universe in the study of cosmology.

The works of Ibn Sina, Abu'l-Barakat al-Baghdadi, Ibn Bajjah and others led to the development of the idea of impetus and momentum, principles in Physics that are applied to motion of bodies in Astronomy. Another area that is important in Astronomy is optics. It is very relevant in the development of tools for observation like telescopes that employ lenses or mirrors. Ibn al-Haytham (the Latin Alhazen) who lived in the 11th century was one of the greatest student of optics between Ptolemy and Witelo. Ibn al-Haytham's main work on optics, the *Kitab al-manazir*, was also well known in the West as *Thesaurus opticus*. Ibn al-Haytham studied the property of lenses, discovered the camera obscura, explained correctly the process of vision, studied the structure of the eye, and explained for the first time why the sun and the moon appear larger on the horizon (very simply put, it is because the thicker layer of atmosphere at the horizon acts as magnifying lens compared to overhead). His interest in optics was carried out two centuries later by Qutb al-Din al-Shirazi and Kamal al-Din al-Farisi. It was Qutb al-Din who gave the first correct explanation of the formation of the rainbow.

Muhammad ibn Jabir al-Battani , one of the top twenty astronomers in the history of civilization comments

*“ [Astronomy] has a well earned place among disciplines for its tremendous share in helping man calculate years and months, provide accurate time, mark seasons, observe increase and decrease in duration of days and nights, watch locations and eclipses of the sun and the moon, witness the movements of planets in their faring in alternating places and signs. Much more may be added by it through study and scrutiny that invariably leads to further proof and knowledge of the greatness, wisdom, and power of the Creator (SWT)”*

The holy Qur'an is full of gems of expositions in Astronomy - a sprinkling of which have been highlighted in this article. That in itself should be an inspiration to Muslim scholars to continue in the present day the pursuit of knowledge in the Sciences. Like in the days of yore, we should strive

to develop a culture that is scientifically rich in the understanding of natural phenomena by “men of understanding”.

In the past few years, there has been a concerted effort by many well-informed Muslims of the need to use Astronomy for the establishment of the beginning of the months. In this connection it is useful to note the following verse from the holy Qur’an:

**“The sun and moon (are subjected) to calculations.” (55:05)**

The informed Muslim community are now taking these matters very seriously and

there is an international effort via CFCO (Committee For Crescent Observation), an active society since 1978, and the more recent ICOP (Islamic Crescent Observation Project), both of which include members from all over the world whose job it is to observe the crescent young moon not only for the months indicating the beginning Ramadan or its end, but all year long. This issue has been a bone of contention time and time again among Muslims. In this connection, it would be useful to highlight the words of noted fiqh scholar Dr. Taha Jabir al-Alwani from his book *Ijtihad*<sup>1</sup> with respect to the sighting of the moon for the start and end of the holy month of Ramadan. Dr. al-Alwani in pointing out the necessity and significance of Ijtihad in relation to Time-Space factor uses the sighting of the moon as an example, and I quote him:

*Ijtihad (1993) Published by International Institute of Islamic Thought, USA. p. 27*

*“...It could never have been the prophet’s intention to make life so difficult when he established that rule. He was, at that time, addressing illiterate people, and the best they could do to establish the beginning of the month was to see the moon with the naked eye. They had no other means and Allah (SWT) did not wish to make matters difficult or impossible for them. But when there exists more accurate instruments to determine the same fact, it would be totally unacceptable, and indeed backward looking, if insistence is on using out-dated and inadequate methods. The message of Islam is intended for all people in all ages; it was never restricted to the first hijri century Arabs of Makkah. Therefore, to stick to the literal meaning irrespective of the time factor is a benighted approach which is conducive neither to enlightenment nor to progress.”*

One can be guided by astronomical calculations to help one to know when and where to search for the crescent moon. This has brought to light that many countries have hitherto been in error in establishing the beginning of the new month, Saudi Arabia included. Some have accepted they have been in error and are now revising their position on that count. It is important that we do not follow blindly but we seek to understand and convince ourselves of the correctness of methods employed. The modern era of internet access and electronic communication seeks to educate and unite us as Muslims like we never could before.

There are now several different softwares available for calculating the dates and times of new moons, prayer times and qibla direction. The study of Astronomy is not something to be afraid of - it enlightens us and guides to a deeper understanding and appreciation of our religion and recognition of the omnipotence of our Creator. There is nothing wrong if in searching for the crescent moon we know when and where to look for it. Over and over the Qur’an emphasizes the aspect “for men of understanding”. We need to listen to that, surely there is great importance and relevance for it to be repeated so many times

The Prophet Muhammad (PBUH) has said “ Seek knowledge from the cradle to the grave”. Islam is about a lifetime of learning. A lifetime of learning means we can never know or understand everything. It is a dynamic process and we must continue to strive at all times.

**“Verily, in the creation of the heavens and the earth, and in the succession of night and day,**

**there are indeed messages for all who are endowed with insight, (3:190)**

**(and) who remember God when they stand, and when they sit, and when they lie down to sleep, and (thus) reflect on the creation of the heavens and the earth: “ O our Sustainer! Thou hast not created (aught of) this without meaning and purpose. Limitless art Thou in Thy glory! Keep us safe, then from suffering through fire!” (3:191)**

**“Praise the name of your Lord, the Most High, Who creates and proportions well, Who determines and guides” (87:1-3)**

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Brother Khalid Shaukat and my father, Dr. Syed Abdul Haque read the manuscript and made valuable suggestions, and I say Subhan Allah, jazak Allah.