IIUM Journal of Religion and Civilisational Studies (IJRCS) 6:1 (2023); 57-83.
Copyright © IIUM Press

Imam Ahmed Raza Khan and the Revival of the Islamic Astronomy in India

Naseeb Ahmed Siddiqui[1]

Abstract: Revisionist historians of medieval Islamic astronomy acknowledge the impact of the *Maragha* astronomical movement led by Naṣīr al-Dīn Ṭūsī. The advanced work conducted at the *Maragha observatory*, which benefited from earlier Muslim astronomers' critique of Greek astronomy, became a direct source for the 13th to 16th -century astronomers working in different parts of the Islamic world. However, after the Copernican revolution and its reception in the West, this 'new heliocentric astronomy' initiated debates in the Muslim lands due to the motion ascribed to the Earth. By the end of the 19th century, Muslims in Syria and Egypt started to accept heliocentric astronomy as a fact without proper investigation. Similarly, Muslim travelers from British India learned this new astronomy and propagated it without critical analysis. As a result, the Muslim community faced criticism for not upholding the legacy of their ancestors in the field of astronomy, as they did not contribute a critical analysis of Copernican astronomy. This article introduces Ahmed Raza Khan, as a mathematician, and astronomer from India, who played a pivotal role in revitalizing the Islamic astronomy of the past. Engaging in the discourse of new astronomy, he meticulously examined the works of renowned figures such as Copernicus, Isaac Newton, and Kepler, as well as the established principles of modern physics and astronomy. It is worth noting that Ahmed Raza Khan's perspectives differed in various aspects from those of his Islamic predecessors. This introduction of Ahmed Raza Khan and his contributions to astronomy aims to inspire critical research and shed light on the overstated assertions made by historians regarding the transfer of knowledge from the West to the East. Additionally, it sheds light on why Indian Muslims paid limited attention to colonial astronomy.

[1] *Naseeb Ahmed Siddiqui* is a PhD student at the Ontario Tech University, Ontario, Canada. He can be reached at siddiquinaseeb@gmail.com

Keywords: Ahmed Raza, Copernican astronomy, *Maragha* movement, Islamic astronomy, Geocentric model, heliocentric model.

Introduction

Islamic astronomy refers to the scientific study and exploration of celestial objects and phenomena conducted by Muslim scholars during the Islamic Golden Age, which spanned from the 8th to the 14th centuries. Especially, shortly after the fall of Baghdad to the Mongols in 1258 AD (all the years are in AD), in the northwest of Iran, an astronomical observatory now known as '*Maragha observatory*' was founded in 1259. This was led by the famous mathematician and astronomer Naṣīr al-Dīn Ṭūsī under the patronage of Ilkhanid Hulagu. The major figures who worked include the architect of the observatory Mu'ayyad al-Dīn al-'Urḍī (d. 1266), Quṭb al-Dīn al-Shīrāzī (d. 1311), and Yaḥyā bin Abī al-Shukr al-Maghribī (d. 1283) (Saliba, 1983). In 1957, Edward Kennedy accidentally discovered the treatise *Nihāyah al-Sūl fī Taṣḥīḥ al-Uṣūl* by Ibn al-Shāṭir, a prominent astronomer from Damascus who lived until 1375 (Saliba, 1987). Prior to this, Kennedy had already discussed Ibn al-Shāṭir's *al-Zij al-Jadīd* in 1956 (Kennedy, 1956), and Victor Roberts also contributed to the study of Ibn al-Shāṭir's work in 1957 (Roberts, 1957). The recovery of the treatise shed light on various aspects of Ibn al-Shāṭir's planetary model, and subsequent research by Kennedy, Roberts, Abbud, and others further expanded the understanding of his contributions to astronomy (Kennedy and Roberts, 1959; Abbud, 1962; Roberts, 1966). Swerdlow's (1973) comment on Copernicus' ambiguous understanding of his models suggests that there is a link with the work of Ibn al-Shāṭir, which Copernicus seems to use, and Roberts (1975) predicted this link as well. There were many theoretical and mathematical similarities between the Copernican and Ibn al-Shāṭir's models. This led George Saliba to investigate, at length, the theoretical and observational work of Ibn al-Shāṭir (Saliba, 1987). By surveying the life of Guillaume Postel and Ignatius Nehemias, who used to travel both the East and West, especially Italy, Saliba noted that Copernicus might have been aware of the works of Muslim astronomers (Saliba, 2007; http://www.columbia.edu/~gas1/project/visions/case1/sci.4.html#t32). Besides the mathematical similarities, Copernicus used the same comet argument employed by al-Ṭūsī to discredit Ptolemy (Ragep, 2001). This argument persisted among Muslim astronomers,

as evident in the works of al-Khafrī (Saliba, 1994). Such similarities were more than mere coincidences. George Saliba wrote 'Islamic Science and the Making of European Renaissance', discussing the recent advancements and discoveries in Islamic astronomy and its impact on Copernican astronomy (Saliba, 2007). Similarly, Kennedy's 'Studies in The Islamic Exact Sciences' (Kennedy, 1983) concludes that the theoretical, observational, and mathematical aspects of Western astronomy depended, in no small part, on the research of Muslim astronomers.

However, the controversy surrounding the Copernican model, which proposed the centrality of the sun and the motion of the Earth, challenged the long-held view in the Earth's static nature. The concept of a static Earth was not solely influenced by Greek astronomy but also by the interpretation of the Quran and Hadith within the Muslim community. As both sources seemed to align with the notion of a stationary Earth, it was challenging to deviate from this position. The religious interpretation of static Earth can be found in *tafsīr* (commentaries) of Quran, like *Tafsīr al-Jalālayn* in verse 27 of the 27th chapter, *Tafsīr Ibn Kathīr*, *Jāmī' al-Bayānʿan taʾwīl ay al-Qurʾān* (*Tafsīr al-Ṭabarī*) in 41 of 41st chapter, *Tafsīr al-Gharīb al-Qur'ān* and *al-Tafsīr al-Kabīr* of Imam Fakhr al-Dīn al-Rāzī in verse 22 of the 2nd chapter. This underscores that Muslim exegetes were aware of the ongoing research in astronomy in their time. Some, like the author of *Tafsīr al-Gharīb al-Qur'ān*, Niẓām al-Dīn Ḥasan al-Nīsābūrī was a mathematician and astronomers. The same is true for Imam Fakhr al-Dīn al-Rāzī and Jalāl al-Dīn Suyūṭī. Al-Nīsābūrī had written a commentary on al-Ṭūsī's *Taḥrīr al-Majisṭī* and his astronomical tables named *Kashf-i-ḥaqa'iq-i Zi-i Ilkhani* (Campion et al., 2007). Al-Nīsābūrī also studied under the famous astronomer Quṭb al-Dīn al-Shīrāzī, a student of al-Ṭūsī (Samsó, 2010). All the Muslim astronomers defended the static earth theory by trying to rule out errors from the geocentric model to the extent that they developed a new version of planetary motions. It would seem that there was an unspoken consensus where no one bothered to raise the issue of earth motion. There is only one explicit reference to this in Abū Sa'īd Sijzī's heliocentric Astrolabe discussed by al-Bīrūnī. However, al-Bīrūnī dismissed the possibility on mathematical grounds (Biruni, 1910). The upshot is that one can now appreciate why understanding the Earth's motion is vital.

During the late 19th century, George Saliba analyzed the reception of Copernican astronomy by Muslim and Christian scholars in Egypt and Syria. Muslim scholars sought to emphasize the novel aspects of Copernican astronomy by drawing connections to the works of al-Ghazālī and al-Izjī. Their intention was to present these new ideas within a religious framework, thereby facilitating their acceptance based on religious grounds (Saliba, 1987). The introduction of Copernican astronomy saw a fluid reception within religious circles. However, the focus of the debate was not on the theoretical or mathematical aspects of the new astronomy. Instead, the primary concern revolved around the religious interpretation of Earth's motion. This marked a significant departure from the reception of Greek sciences from Muslim intellectuals, as there was a lack of serious analysis of Copernican astronomy from the outset.

On the contrary, the reception of Copernican astronomy in British India was more complex. The British colonization oversaw a transfer of Western knowledge to India, especially astronomy, which saw the establishment of several observatories. Rajesh Kochhar described it as state-funded observatories in Madras and other places (Kochhar, 1991). However, the claim that India's awareness of Copernican astronomy began with the British is incorrect. It does not reflect the intellectual struggle by Indian Muslims during the late 19th and beginning of the 20th century. Historian Razaullah Ansari asserts that Copernican astronomy from the 18th to late 19th century was studied by at least nine Muslim scholars who wrote in Arabic and Persian. One such scholar is al-Ḥusaynī al-Iṣfahānī (d. 1790), who visited Europe during 1772/1773 and recorded the development in astronomy in his book *Risālah dar aḥwāl-i mulk-i farang wa Hindustan*. In this treatise, he detailed the ongoing work in astronomy, such as the work of Isaac Newton and the heliocentric theory. Similarly, Abū Ṭālib bin Ḥusayn of Lucknow completed a book named *Taḥqīqat-i jadīdah dar 'ilm-I hay'at* as early as 1793. Along with this book, he wrote four books on modern astronomy in 1772, 1797, 1798, and 1807. Ansari identifies the last book as *Qanūn-i-Naṣīrī* or *Kitāb dar 'ilm-I hay'at* written in 1868. A Muslim mathematician and astronomer named Gulam Husayn Jaunpuri wrote *Anis al-Aḥbāb fī Bayān Masā'il Aṣturlab* in 1818, in which he discussed the problem of the Astrolabe and other developments in astronomy (Ansari, 2014). Raja Rattan Singh

also summarised and produced the work *Ḥadā'iq al-Nujūm* (Gardens of Astronomy), printed in 1841 (Ansari, 1998, 2002).

It is clear that while Muslim scholars openly embraced the technical astronomical knowledge from the West, it seems that they neglected to subject this information to critical analysis. The exaggerated accounts of Western progress promoted by colonial administrations convinced Muslim scholars of the validity of Western intellectual achievements. In contrast, the principles of legitimate knowledge transfer, which involve scrutiny, analysis, and improvement, were not adhered to. Interestingly, Muslim scholars scrutinized Greek astronomy in the past, and the West subsequently examined the fruits of their labor. However, when it came to the Copernican system, its merits and shortcomings were seemingly accepted without question. In this context, the role of Ahmed Raza Khan assumes great significance. This article will introduce his biography, essential works, and treatise on the critique of Copernican astronomy and modern science. It should be noted that a detailed analysis of Ahmed Raza Khan's astronomical work is not the primary focus of this article.

Ahmed Raza Khan: Life and Works

Ahmed Raza Khan, born in 1856 in Bareilly, Western United Province, arrived in the world just a year prior to the momentous revolt against the British. His lineage boasted a history of ancestral soldiers serving under the Mughal emperor. However, Riza Ali, Ahmed Raza Khan's grandfather, chose to depart from the path of a soldier and instead devoted himself to religious studies. Consequently, the family's focus shifted toward religious pursuits. Under the tutelage of his father, Maulana Naqi Ali Khan, Ahmed Raza Khan received his early education, and at the remarkably young age of 13 years and 10 months, he emerged as a scholar in his own right. Later on, the scholars of Makkah and Medinah entitled Ahmed Raza Khan as a *Mujaddid* (The Reviver) (Hallaq, 1984) of the 14th century Hijra (Sahab, 1997; Zafar ud-Din, 1938). Usha Sanyal studied his life and influence in British India in her seminal work (Sanyal, 2020,2005). As per the Imam Ahmed Raza Research Institute (http://imamahmadraza.net/wfproducts.aspx?md=4), 21 Ph.D. and six master dissertations have been completed on his various works.

Ahmed Raza Khan is said to have written over 1000 books (Sahab, 1997) on more than 50 branches of knowledge. Below is the approximate number of treatises for the different fields:

1. Tafsīr of the Quran (11)
2. *'Aqā'id* (Belief) (54)
3. Ḥadīth and Principles of *Aḥādīth* (53)
4. Fiqh, Principles of Fiqh, Dictionary of Fiqh
5. *Farā'iḍ* and Tajwīd (214)
6. Tasawwuf, *Wazīfas*, Morals (19)
7. Reviews of Books (40)
8. Language, Arabic Grammar, Dictionaries, History
9. Poetry and Special Benefits, Travelling (55)
10. Inspired Knowledge (Jafar) (11)
11. Logarithms (8)
12. Astronomy, Astrology (22)
13. Mathematics, Geometry (31)
14. Philosophy, Sciences, Logistics (7)
15. Algebra (4)

(http://www.alahazrat.net/islam/writing-work-of-imam-ahmad-raza.php)

Ahmed Raza Khan, a polymath with extensive knowledge, was among the many great Muslim scholars who possessed a deep understanding of both the religious and modern sciences of their era. This multidisciplinary background nurtured their curiosity and proficiency in diverse fields. However, the question of Earth's motion remained largely unexplored following the advent of Copernican astronomy. Most Muslim scholars endeavored to reconcile the new astronomical ideas with religious teachings, drawing inspiration from the Quran and Ḥadīth, as emphasized by George Saliba. However, the issue of Earth's motion in India was dramatically revived due to the bold and unexpected prediction made by American Professor Albert F. Porta on

October 18, 1919. Porta predicted a syzygy that was anticipated to occur on December 17, 1919, sparking widespread attention and discussion. The news of the prediction was narrated to Ahmed Raza Khan by his student Zafaruddin Bihari:

> "On December 17, Mercury, Mars, Venus, Jupiter, Saturn, and Neptune align in conjunction on the same side of the sun, with a separation of 26° between them. This rare alignment is expected to exert a significant gravitational pull on the sun, causing it to gradually shift its position. Notably, Uranus will be positioned directly opposite this planetary congregation, creating a unique configuration unseen in recorded human history. The combined electromagnetic forces generated by Uranus and the six planets are believed to create a phenomenon where a hole forms in the sun. Furthermore, a remarkable sunspot will become visible on December 17, observable even without the aid of telescopes. The appearance of such a sunspot visible to the naked eye is unprecedented and will have significant effects on atmospheric patterns around the Earth. These disturbances may lead to the occurrence of hurricanes, thunderstorms, heavy rainfall, and increased volcanic activity. After several weeks, the Earth will gradually return to its normal state, overcoming the disruptions caused by this celestial event." (Raza, 1919; New York Times, December 14, 1919; Marlborough Express, December 3, 1919; The Pittsburgh Press, November 29, 1919; The Puke Times, December 5, 1919)

The prediction led Ahmed Raza Khan to investigate Copernican astronomy and especially the motion of Earth. He complied four books, as listed below:

1. *Mu'īn-i-Mubin Bahar Daur-i- Shamas-o-Sukūn-i-Zamīn* (1919)
2. *Fauz-i-Mubin Dar Radd-i-Harkat-i-Zamīn* (1920)
3. *Al-Kalimah al-Mulhamah fī al-Ḥikmati al-Muḥkamah li Wihā'yi al-Falsafati al-Mash'amah* (1920)
4. *Nuzūl-i-Āyāt-i-Furqān Basukūn-i-Zamīn-o-Āsman* (1921)

I do not intend to describe at length the arguments presented by Ahmed Raza Khan in these books. Rather, I wish to illustrate how he single-handedly revived the spirit of critique.

Mu'īn-i-Mubin Bahar Daur-i- Shamas-o-Sukūn-i-Zamīn (A Fair Guide on the Revolving Sun and the Static Earth)

This is the first treatise on this matter specifically written to refute the predictions of Professor Albert. Initially, Ahmed Raza Khan published the refutation in a magazine which later on complied into a short treatise. In this, Ahmed Raza Khan says, after analysing the arguments posed by Professor Albert:

> "Professor has based his arguments on the sun-centered solar system in which other planets revolve around it. According to this system, those six planets will be mutually placed at 26 degrees, but this premise is nothing but false and against the Quran. Neither the sun is at the centre nor do planets go around it. On the contrary, the centre of the Earth is the centre of knowledge, and every planet with the sun goes around it. Allah Taala azzawajal says in Quran, "The sun and the moon are scheduled."" (Raza, 2020, 1919, p. 3)

Ahmed Raza Khan started his premises based on the Quran and asserted that Professor Albert's argument was based on Copernican planetary theory. He denied the planetary theory based on the sun and proposed that it is not the sun, but the Earth lies at the center of the planets. He then indulged in astronomical and mathematical debates by basing his calculations on the geocentric model, where the Earth is at the center of the solar system. Ahmed Raza Khan calculated the positions of the planets for 17th December, 1919, as given in Figure 1 and Figure 2. Ahmed Raza Khan claimed that the mutual position of planets would be 122°, which is significantly different from Professor Albert's claim of 26°. Similarly, Ahmed Raza Khan knew that the law of gravitation was the underlying fabric of the heliocentric theory. So, he analysed the law of gravitation and says:

> "Did all the planets agree to attack the sun? It is absolutely wrong. If the law of gravitation (*Jajebi'yat*) is correct, then it must apply to all. If the combined power of these six planets can destroy the sun, then what stops them from destroying Saturn, which is smaller than the sun a thousand times over? Mars is smaller than Saturn, and Mercury is the smallest of all. These must be shattered into pieces. It is absurd to believe that the weaker will be spared in exchange for the stronger (the sun), who will lose the battle against the six planets. Gravitational law denies any conjunction of this type." (Raza, 1919, p. 5)

Position			Planet
Minute	Degree	Constellation	
15	11	the lion	Neptune
54	17	the lion	Jupiter
39	11	The stem	Saturn
10	9	Libra	Mars
19	9	Scorpio	Venus
30	3	Sagittarius	Mercury
30	24	Sagittarius	Sun
26	28	Aquarius	Uranus

تقویم			کوکب
دقیقہ	درجہ	برج	
۱۵	۱۱	اسد	نیپچون
۵۴	۱۷	"	مشتری
۳۹	۱۱	سنبلہ	زحل
۱۰	۹	میزان	مریخ
۱۹	۹	عقرب	زہرہ
۳۰	۳	قوس	عطارد
۳۰	۲۴	"	شمس
۲۶	۲۸	دلو	یورینس

Figure 1: Positions of Planets on December 17 1919, based on the Geocentric model (On the left is the English translation and on the right is the original table)

Position		Planet
Minute	Degree	
20	129	Jupiter
53	129	Neptune
42	142	Venus
50	153	Mercury
17	154	Mars
43	155	Saturn
57	330	Uranus

وسط		کوکب
دقیقہ	درجہ	
۲۰	۱۲۹	مشتری
۵۳	۱۲۹	نیپچون
۴۲	۱۴۲	زہرہ
۵۰	۱۵۳	عطارد
۱۷	۱۵۴	مریخ
۴۳	۱۵۵	زحل
۵۷	۳۳۰	یورینس

Figure 2: Average Position of Planets on December 17, 19119, based on the Geocentric Model (On the left is the English translation, and on the right is the original table)

Professor Albert also predicted electric and weather catastrophes due to unexpected sunspots (*New York Times*, December 14, 1919). To counter such a claim, Ahmed Raza Khan offered several observational references proving that such sunspots were seen in the past and nothing happened. He quoted 'Allāmah Quṭb al-Dīn al-Shīrāzī, who recorded a

black spot the size of the moon slightly above the center of the sun in his book *al-Tuḥfah al-sahiyah fī al-hayʾah*. Bin Maja of Andalusia (Spain) recorded seeing two dots on the sun, and he understood them as Venus and Mercury. Hershell II saw a dot on the sun, and then Samet saw it on 29th July, 1807. Koski reported a dot on January 20, 1865, and provided the following drawing in Figure 3.

Figure 3: July 29, 1807, a spot seen by Samet (Raza, 1919, p. 12)

Professor Albert's position was discussed and supported by the leading astronomers in America, as per the *New York Times.* It is inconceivable to think that a single man challenged this position and maintained that the Earth is static and denied any catastrophe based on sunspots of any kind and size. Ahmed Raza Khan supported his position with astronomical and mathematical calculations. Also, one should remember that Ahmed Raza Khan was awarded the title of *Mujaddid* (The Reviver) and has a large following in British India. Publishing such a view was a risk to his credibility. He would have compromised his standing in the sub-continent if he had been wrong, and his followers would begin doubting his ability. In short, he has a lot to lose. Nevertheless, Ahmed Raza Khan not only published his views but also asked Muslims to pay no heed to those prophecies premised on what he believed were the false arguments of the Earth's motion and gravitation law. On December 17, the date of Professor Albert's prediction, no catastrophe occurred, which persuaded people to believe in the geocentric model. Such criticism created opportunities to revisit the notion of blind acceptance of modern science. This treatise has several

other arguments, but only a few are highlighted to contextualize Ahmed Raza Khan's encounter with the earth motion issue. It should also be noted that Ahmed Raza Khan published those arguments in a magazine that was later compiled into a short treatise. The arguments formulated in this response were then also transferred into the specifically written larger book on the subject, which is being introduced next.

Fauz-i-Mubin Dar Radd-i-Harkat-i-Zamīn (A Fair Success in Refuting the Motion of the Earth)

Since Ahmed Raza Khan paved the way for the critique of Copernican astronomy through his direct encounter with Professor Albert's predictions, he advanced his critique further in the book *Fauz-i-Mubin Dar Radd-i-Harkat-i-Zamīn*. This book is a mathematical, astronomical, philosophical, and logical refutation of Copernican astronomy and a discussion of ancient philosophy. He states in the Preface of the book:

> "This magazine, a historical epoch, was titled "*Fauz-e-Mubeen Dar Radd-e-Harkat-e-Zameen*" (The clear success in the falsification of the movement of the Earth), containing a foreword, four sections (chapters), and one concluding chapter. The foreword will include conceptions of modern astronomy which will be used in this book. The first chapter will contain a discussion on the repulsion force leading to the falsehood and absurdity of the motion of the Earth. There will be 12 proofs on this subject. In the Second Chapter, there will be arguments over the conception of attraction leading to 50 proofs of the falsehood of the motion of the Earth. The Third Chapter is comprised of 43 proofs on the absurdity of the motion of the Earth, By the Praise of Allah; thus, there are, in all, one hundred and five (105) proofs against the motion of the Earth, of which 15 have been discussed in the past in other books in which we have made corrections and alterations as required and out of these there are ninety (90), very clear & perfect. They are our own making, by the Grace of Allah. In Chapter Fourth, there is resistance to those doubts the modern astronomers tender in support of the correctness of the motion of the Earth. At the end of it, there are some proofs from the Heavenly Books in affirmation and support of the revolution of the sun and the stillness of the earth." (Raza, 1920, 2005, p. 8-9)

Ahmed Raza Khan aims to falsify the motion of the Earth by resisting and corroborating through modern science. His argument revolves around the law of universal gravitation, which he criticized because in the absence of gravity, there is no second cause to support the celestial motion, and it becomes impossible to prove the motion of the Earth.

In The Forward, Ahmed Raza Khan examines the notions of repulsion, attraction, innate force, weight, heaviness, centrifugal force, centripetal force, tides due to attraction, pressure, weightlessness, and many fundamentals of modern science. He explains the notion and argument of modern science and its incoherence and falsehood. Ahmed Raza Khan engaged in the discussion of weight and heaviness because modern science started to use gravitation as a support for weight but ended up considering it the creator of weight. He quotes the statement of William Hershel that "on the stars, means between Mars and Jupiter a man can jump up to sixty feet without any trouble" (Raza, 2005, p. 27). Ahmed Raza Khan refutes this concept of weightlessness in point number 15 according to modern science; he says:

> "This idea of weightlessness is totally and wholly the clear falsification that the body has no weight on its own and it gets existence due to attraction. This is evident by the numerous declarations on the parts of astronomy. (A) That the density of the gold on the planet Mercury is nearly two times that of the Earth. But being smaller, the attraction of it is 3/5th of the attraction of the Earth. The weights go on decreasing on it in the same proportion. The thing which weighs a tonne on the surface of the Earth will weigh on Mercury only twenty seers. (B) On the surface of the sun, the weight of a thing measures twenty times that of the Earth. If it is a tonne here, it will weigh there 28 tons. It means a maund here is equal to a tonne there. And a tonne there will be a mound here. The resistance (falsification) of it is given in Chapter II, resistance No. 14. (C) The thing which is three thousand six hundred pounds on the surface of the Earth and the distance of it from its center is half of the diameter of the Earth. If a thing is put at a distance of half a diameter from the surface of the Earth, it will weigh only nine hundred pounds, and on the full distance of the diameter of the Earth above its surface, it will weigh four hundred pounds and of the distance of one and a half the diameter it will be 225 pounds and on the distance of

> two diameters above the surface of the Earth it will weight only 144 pounds because the attraction goes on decreasing in proportion to the increase in the Square of the distance and so also the weight goes on lessening. It means at a distance equal to four and half a diameter, it will be only 36 pounds and at a distance of five and a half the diameter, it will be 25 pounds and at nine and a half, it will be 4 pounds, and at twenty-nine and a half, it will be only one pound. Thus, three thousand five hundred ninety-nine pounds of weight will vanish. And as per speculation, the weight of a thing at the Equator will be less and as much you move towards the Pole, it will go on increasing because the attraction at and near is less and that is more on and near the poles." (Raza, 2005, p. 40)

Ahmed Raza Khan called it mere speculation of modern science and suggested the variation of weight as per the proportion of gravitation if it exists. He pointed out that in calculation and logic, modern science is inconsistent with the principle of gravitation as sometimes it considers distance and sometimes it does not. To explain, he offers a mathematical description in the first chapter, as shown in Figure 4.

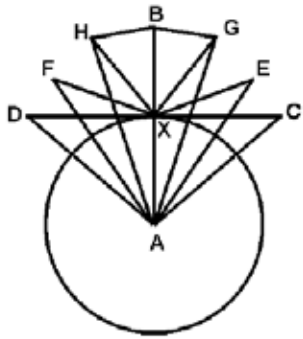

Figure 4: Describing the Earth's Motion

> "Draw Line AB from the center of the circle on point X on the circumference. Then, on both sides of the line XB, draw six equal lines in which CX, DX be the tangents, and EX, GX, HX & FX divide both the right angles equally. Then join all of them to point A. It will be clear that every line of them will be equal to its corresponding line. And AE will be greater than AC; AG is greater than AE & AB is greater

> than AG. In the same way, AH is greater than AF and AB is greater than AH because in triangles AXC, AXE AXG, Line AX is common & XC, XE, XG are equal, and the angle on X has gone increasing as every first is a part of the other. Necessarily, the bases AC, AE, AG will, also, go on increasing. (Euclid's Theorem 1, figure 24). Now consider AB join GB. You will get isosceles triangle GXB in which both the angles at points GB will be equal. And it is clear that in triangle AGB, angle G. whose diagonal is AB is greater than angle XGB. Hence, AG being the diagonal of a small angle B. is smaller than AB. (Fig. 19). Necessarily, B is at a greater distance than all others. And as much you come towards the tangent, it will be nearer to the centre. All that now, the Earth was at point X, and because of the force of the repulsion, it was inclined to go away from the center. In that condition, it must move to XB because to this side, only the fartherness is a pure fartherness. And all others are relative ones as they are in a sense, distances and in another sense, they are nearness. Why did it acquire some other than the unmixed pure distance (or direction). It is due to the preference of its own liking. In that condition, whatever line it inclines to, for the other side, there is its alternative. Why it did not go to that side is a negative preference of it. And as a matter of fact, both of them are humbugs and falsehoods. The Earth is not an animate conscious thing that may have the choice of its own intention in any condition. When it moves to XB, the turn or the rotations will be impossible. If the force of attraction overcomes it, it will move nearer to A, and if both the forces are equal, it will remain on X. It will not move in the direction of any of them. Necessarily, it will not revolve." (Raza, 2005, p. 101)

As per the argument, the Earth should not move because the proportions of attraction and repulsion have equal capacity. Earth does not move along any other axes left or right to position X, which follows that logically Earth should not go anywhere. To support his position, Ahmed Raza Khan offers the following argument:

> "The sun is the first, foremost & reliable witness to the falsehood of the theory of attraction. In its orbit, which they take for the orbit of the Earth, there is a point at an extreme distance from the centre of the Earth, and we call it the

Zenith, and there is another one at the maximum nearness, and we call it the depth. They are observed every year, the sun is at a maximum distance from the Earth i.e. at its Zenith on July 3 or so, and on January 3, it is nearest to the centre of the Earth. This difference is to the tune of 31 lakhs miles or more. In view of modern research, the average distance of the sun is nine crores twenty-nine pulled up (and merged in the sun) by the continuous attraction by the sun for the powerful, great, intensive, and extensive period of thousands of years. In view of modern astronomy, the sun is equal to the volume of 12 lakhs thirty-five thousand one hundred thirty Earth. Some are of the opinion that it is equal to 10 lakhs, and some have quoted it to be 14 lakhs. And as we calculated it on the measurements of modern astronomy on the basis of the original oval shape of the Earth, it is (i.e., the sun) equal to the volume of 13 lakhs 13 thousand two hundred sixty-five Earth. In such a condition, how can the Earth resist and stand against the sun, and how long would it revolve around it? It would have, at the very first day of its revolution, merged in it as it is in volume not even equal to one part of its 12 lakhs of parts. Can you imagine that there are 12 lakhs of people together pulling a man, and he is trying to go away from them, and he would not be pulled up by the 12 lakhs of the people? And he would be rotating around them. And it is absolutely and rationally falsehood that one thing is strong and then weak. It requires some cause or the other to defend it. When in the half of its rotation around the sun, the Earth was pulled by the sun towards it to the extent of thirty-one lakhs of miles, then in the half of the rotation of the Earth, who is that made it (i.e., the sun) so weak and the Earth ran away from it to the extent of thirty-one lakhs of miles? And as a matter of fact, the nearness of the Earth depends upon the strength of the force of the attraction of the sun (No. 101). As a matter of fact, having brought the Earth on its lowest girdles, it was a must for the force of the attraction of the sun to become more and more effective, and the Earth should have, step by step, to increase its nearness to the sun. And not that having the Earth come nearer to it, the force of attraction on the part of the sun should have weakened, and the Earth should escape from its claws, and it should go away to such a fartherness. As to joke, perhaps the sun is getting more and more ration from July to January, and consequently, its power gets on increasing And, in the months from January

> to July, it remains without food and becomes weak. If there were two bodies equal to each other, then this would have been reasonable to think that in a certain half of the turn or the period of the rotation, one of them overcomes the other, and in the other half of the turn, the other one of them overcomes the first one. This would not be an offence that it is 12 lakh times bigger than the Earth, and it pulls it to the nearness and makes it at the nearest distance of more than 31 lakhs of miles and in the time of its very youth, it should become so weak and dull, and the whole turn of the revolution be divided in the proportion of 1:12 lakhs in the two half parts of it. On this, they tender this obsolete excuse that at the point of the depth, the strength of the force of repulsion increases and it frees the Earth from the claws of the sun and moves it away." (Raza, 2005, p. 121-122)

The importance of this argument lies in the notion that the power of attraction is due to the sun. It must remain constant. It cannot be countered by merely applying the law of conservation of angular momentum because there must be something to vary the momentum. It can be asked, is attraction creating conservation of momentum or vice versa? (Jearl et al., 2013) Ahmed Raza Khan goes even deeper by criticizing both attraction and repulsion simultaneously. He also discussed the idea of the retrograde motion of Mars and why planets are taken below and above. In the arguments of Ahmed Raza Khan, the supposed hypothesis that the tide is generated due to the moon's gravitational force is an area in astronomy that has attracted critique, including Ahmed Raza Khan. He comments:

> "The seawater rises up to metres high, and sometimes it reaches 70 feet two times daily, and then afterwards it lowers down to its own former level. If we attribute this phenomenon on the part of the attraction of the moon, it is as if to say goodbye to the attraction of the Earth. If you put the moon at its nearest distance of 225719 mites and consider the attraction of the Earth from its centre the distance of its water from its centre will be 3956.5 miles. So as per the law of Newton, if the attraction of the Earth and moon were to be equal, the ratio of their attraction on the water would have been like this, the attraction of the moon the attraction of the Earth: (3956.5)2: (355719)2 Consider the first as one, then the third - the 4^{th} = the attraction of the moon. It

> means 15653892.25/50949066961 =0.0003072450, but the attraction power of the moon is 0.15^{th} of that of the Earth. So, multiply it by 0.5, the product would be 0.000046. It means if the attraction of the moon on the water is 23, that of the Earth will be five lakhs. Or if the moon pulls it with one unit of power, the Earth will do the same with 21727 units of power. Then, how would it be possible for the water to raise itself a distance of a hair's height?" (Raza, 2005, p. 133)

The argument is valid and cannot be countered by barycenter assumption or by converting the formula of tide-generating force by the cube distance between them (John D., 2010). How can one determine whether the tide is going to behave as per the formula or whether the formula has been formulated without observational proof? Ahmed Raza Khan raises many interesting arguments. However, his arguments are not easy to be understood. For that reason, no extensive study has been made on such important works. It must be noted that, while surveying the listed treatise of Ahmed Raza Khan, it was found that he knows almost all the works which George Saliba and colleagues reported in their research on Arabic literature about astronomy and what Razaullah Ansari reported for the Indian sub-continent because Ahmed Raza Khan referred to them by name. He sometimes refers to Arabic, Persian, and Urdu works, and his intimate acquaintance with these works allowed him to perform a thorough critique. In the fourth chapter of *Fauz-i-Mubin*, after refuting modern science, Ahmed Raza Khan narrated the arguments posed by ancient and medieval scholars on Earth's motion, which he intended to falsify. He says:

> "By the Praise of Allah, I have presented one hundred and five arguments, so forcible, against the motion of the Earth. There are still more such ones in the books of the predecessors like Mujasthi, Batlimous, works of Tusi and its commentary by Allamah Barjandi, Tazkirah-e-Tusi, the commentary by the learned Khizri and Shams-e-Bazigha of which Jaunpūrī boasts of Hadyah-e-Fazil Khairabadi and so on. They trusted these arguments. In our opinion, these are all false, as I will discuss." (Raza, 2005, p. 240)

On the one hand, Ahmed Raza Khan is attempting to debunk modern science and the Earth's motion, while on the other, he does not seem to agree with the philosophers and astronomers who argued for

the falsehood of the Earth's motion as well. Such a unique stand creates curiosity. He answers that curiosity by mentioning his book named *Al-Kalimah al-Mulhamah fī al-Ḥikmati al-Muḥkamah li Wihā'yi al-Falsafati al-Mash'amah*, which he wrote to refute ancient and medieval philosophy of science and astronomy.

Al-Kalimah al-Mulhamah fī al-Ḥikmati al-Muḥkamah li Wihā'yi al-Falsafati al-Mash'amah (The Revealed Words in the Strong Wisdom for the Weakness of Execrable Philosophy)

The idea for this book was introduced in *Fauz-i-Mubin*. Imam Ahmed Raza planned to compose a book refuting ancient philosophy, especially astronomy. It is possible that he wrote both books simultaneously, as he already alluded in the Preface of *Fauz-i-Mubin* that he was going to address ancient arguments. He explains:

> "This humble servant has written a detailed historical book on the refutation of modern philosophy named *Fauze Mubin* in which we have refuted the earth motion with 105 arguments… In its fourth chapter, we have discussed the argument of ancient philosophy in defence of the Earth's motion, and we have refuted them. It is evident in physics that motion will not occur until intended, and Earth, by nature, is not conscious (or without intention). Refutation of these contentions led to the refutation of ancient philosophy as well. We have written thirty places on their refutation which by the grace of Almighty, all the ancient philosophy, like the modern, does not seem to observe any value. Due to this, our discussion reached too far, and the fourth chapter too crossed the limit… Albarqat Mohiyuddin Jilani has suggested to Mustafa Raza Khan that those places (where Ahmed Raza critiqued ancient philosophy) should be transferred to a book on the refutation of ancient philosophy… so that one book belongs to the refutation of modern philosophy and one exclusively contains the refutation of ancient philosophy… It is obligatory for Muslim students to read both books thoroughly… so that they should not be misled by those philosophies." (Raza, 1920, p. 4)

This reminds us of the Preface of Imam al-Ghazali's *Taḥāfut al-Falāsifah* wherein he mentioned his intention to write a book refuting the views of the philosophers concerning the world and God (Ghazzali and Marmura, 2000). Similarly, Ahmed Raza Khan intends to refute several philosophical doctrines related to Earth's motion and astronomy. It would be an interesting journey to explore his arguments; however, that is not our concern in this article. But it should not be without flavour, so here is the starting argument. He says:

> "God is the ultimate cause whose action is not bound to selection… in his consciousness, human knows his will to select between two similar things… (I say - Ahmed Raza), It can be deduced that this preference of things does not apply to God, that, one out of two similar things, one becomes the preferred choice… And indeed, the motion of the planets proves the exclusive action of God without making preferences." (Raza, 1920, p. 6)

In this simple argument, Ahmed Raza is trying to counter the notion that the power to select between two things depends on the will. It is the power of the will from which human beings prefer one choice over another. Ahmed Raza says such natural consequences of selection based on preferences are not unique to God. God is not bound to the process of preferring options before concluding (Popper and Bartley, 1993). God decides without preference as he is unlike others and has ultimate knowledge of what is best. As the motion of planets is without a will and they cannot thus decide their motion, then the matter is left to God, who decides on a celestial motion without preference. It answers the question of why the world is the way it is.

In this book, Ahmed Raza Khan raises one of the important issues related to the existence of real depth and the problem of distance. He believed that there must exist a real depth from where distances can be actualized. It seems that this point led Ahmed Raza Khan to write his rebuttal about the concept of the indivisibility of the atom, which was an issue. It was called the problem of '*Juz' alladhī lā yatajazza*', that the bodies are composed of indivisible parts, but these parts are dimensionless. While discussing the issue of aboveness and belowness, where Islamic theologians stop at the *al-jawhar al-fard* (single atom), Ahmed Raza Khan asserts in *Al-Kalimah al-Mulhamah*:

> "*Juz La Yatajazza* is not impossible. This issue of Kalam has been understood in an inferior sense; moreover, its impossibility is taken for granted…however near us, the idea of *Juz La Yatajazza* is not wrong, but the combination (the issue of contiguity) of the two parts is impossible…we will provide the proof of it from the Quran `and scattered them completely.
>
> Aqul: 'and scattered them completely with adversity.' *Tamjiq* means total disintegration. We did not save any 'scattering' and disintegrated them all. Here, scattering is not expected for the existence, and hence the meaning is possible scattering that the extreme possibility has been disintegrated." (Raza, 1920, p. 156, 159)

The scattering of something in its entirety means its existence is no more in reality. It follows that even the parts do not remain from such scattering. Thence, the problem of contiguity does not arise. For Ahmed Raza Khan, the issue of contiguity of *juz* is an imaginary and philosophical assertion without real existence. Through the Quranic verse, he argues that it is always possible to have the existence of a *jawhar* or *juz*, which cannot be imaginarily divided infinitely. It has to stop at some point; otherwise, it can be further divided, and this issue will lead to the eternity of distance, and that will follow the motion and then space and time. Such an attitude is against the eternity of the Islamic concept of God. Thence, Ahmed Raza Khan argues for a real object; the possibility of its imaginary division cannot be argued. However, does Ahmed Raza Khan means that the atom cannot be split? No, certainly not, because in *Al-Kalimah al-Mulhamah*, he discussed in detail, and the only criteria which he supports are the splitting of the atom through power. It is the same thing he argues by the Quranic verse. Following these premises, Ahmed Raza Khan argues for a fixed and solid depth, which can be justified as being a real reference of bodies. The single real depth is the necessary attribute. Ahmed Raza Khan says its existence should become a reference point as an incidental phenomenon because it has been achieved apart from any outside considerations.

These three books summarise Ahmed Raza Khan's critique of modern and ancient science on the topic of the Earth's motion. He disagreed with the most influential philosophers and astronomers

in history, be they Muslim or otherwise. Ahmed Raza Khan made observations, "but my observation, undoubtedly, I have learned that between it and the real morning, there is a difference of more than 15 degrees" (Raza, 2006). He was passionate about the debate over the Earth's motion and employed all the tools available to him to arrive at his version of astronomy. There is a need to study his books on this topic to uncover the details of his version of astronomy. In this book, Ahmed Raza Khan discussed 31 topics which include the concept of space and time, atoms, distances, planetary motion, and vacuum, to name a few. It is a more interesting book than the *Fauz-i-Mubin*.

Nuzūl-i-Āyāt-i-Furqān Basukūn-i-Zamīn-o-Āsman **(The Verses of the Quran on the Static Earth and Heavens)**

On January 23 1921, a fatwa (religious decree) was asked by Moulwi Haqim Ali to prove the Earth's motion from the Quran and Hadith based on the verse:

> "Undoubtedly, Allah upholds the heavens and the earth lest they deviate. If they deviate, there will be none to hold them except Allah. Indeed, he is Allah, the clement, All-forgiving." (Surah Fāṭir, 35: 41)

The questioner narrates other verses accompanied by Hadiths to persuade Ahmed Raza to accept his point of view. Unfortunately, Ahmed Raza very pragmatically and emphatically presented his interpretation of the same verse and supported it with ḥadīth that both the Earth and heavens are stationary. The above verse contains the words '*yumsik*' (uphold) and '*an tazūla*' (lest they deviate), which are discussed from a linguistic point of view.

It is related in al-Nihayah Ibn al-Athīr under the ḥadīth of Jundab Jahni he said, "By God! my arrow went inside, if it has the power to move (*zayīla*) then it does move." '*Zayīla*' is the name of an animal that does not leave its place. '*Zawal*' has been used as movement, and the Qur'ān has negated the movement of the heavens and Earth. Then *zawal* means to go and to change, so both diurnal and yearly motions will be null and void. Imam Jalāl al-Dīn Suyūṭī states in *Nihāyah va Dernasīr*, "The meaning of '*Zawīl*' is movement (flow) and not to

rest anywhere." *Tāj al-'Urūs* states that '*Qalqenshey qalqen*' refers to something that does not shift. *Al-Mufradāt Imām Raghīb* states '*Qarfi makana yaqra qararan*' refers to something that is in rest. So *zawal* is *qalq*, and the opposite of *qalq* is *qarar*, and *qarar* is *suqūn* (rest). The opposite of *qarar* is *zawal*, and the opposite of *suqūn* is vibration/ shaking/quaking/fluctuating or movement. It is related in *Tāj al-'Urūs* as – Allah Almighty has solved the problem of movement means Allah finished movement and its movement had gone (Raza, 1921, p. 7-8).

He further presents the commentary of Imam al-Rāzī on verse 22 of Chapter 2 of the Quran:

> "Know that the mention of bed is related to static Earth. So, neither the Earth is rotating around its axis nor around the sun. It is only in the power of Allah to make Earth static as he says: Undoubtedly, Allah upholds the heavens and the Earth lest they deviate." (Raza, 1921, p. 8)

Imam Ahmed Reza refers to the ḥadīth narrated by Sa'īd bin Manṣūr, 'Abd bi' Ḥamīd, Ibn Jarīr and Ibn Mājah through Hazrat Shaqīq ibn Salma and mentioned by Ibn Jarīr with authentic chains in his *Tafsīr-e-Jarīr* under this verse CH-35, V-41:

> "We have been told a tradition by Ibne-bishar that they were told on the authority of Abu Va'eil. Abu Va'eil said one person came in the presence of hazrat Abdullah ibne Mas'ood (radiallahuanhu) then ibne ibne Mas'ood (radiallahuanhu) asked him, 'To whom did you meet there?' He said, 'To Kaab.' He asked: 'What has Kaab explained to you?' The person said, 'Kaab said that heavens move on the shoulders of an angel.' Hazrat ibne Mas'ood asked him, 'Did you affirm or deny the Kaab?' The person said, 'Nothing (because it is an order for a Muslim to neither affirm nor deny any information of the people of the book, until you have proof from Quran).' Hazrat Abdullah ibn Mas'ood (radiallahuanhu) said, 'It was better for you to give your camel & Quzada' and abstain from that journey; Kaab lied. Because Allah All mighty says: 'Undoubtedly, Allah upholds the heavens and the Earth lest they deviate. If they deviate, there will be none to hold them except Allah.'" (Raza, 1921, p. 21)

Along with the descriptions of Earth's motion from the Quran and Hadith, Ahmed Raza Khan discussed the motion of other planets, like the sun and moon, which are explicitly mentioned in the Quran. By accumulating the proofs, he rejected the Earth's motion based on revealed doctrines.

Through the four treatises about Earth's motion, Ahmed Raza Khan debated Copernican astronomy using mathematics, logic, philosophy and modern physics to support his arguments. Even though he is not the first to critique Copernican astronomy, as Tycho Brahe had already introduced a planetary theory after Copernicus, which was observationally true (Blair, 1990), the uniqueness of Imam Ahmed Raza is that he not only argued based on observation of modern astronomy but also with the accepted axioms of physics like gravitational law and tide generation etc. Given that he also does not seem to agree with ancient philosophers on static Earth, he offered new arguments based on his vision of astronomy. By disagreeing with modern and ancient scholars, he developed a version of astronomy that would make for exciting research.

Conclusion

This research paper examines the prevailing notion that Muslim scholars, particularly in the field of astronomy, had lost their spirit of critical analysis. The literature suggests that since the 16th century, Muslim scholars made no significant contributions to the field and attempted to reconcile Copernican astronomy with Islamic teachings without thoroughly analyzing it. However, this perspective is incomplete. Ahmed Raza Khan, an Indian Muslim polymath with vast knowledge, engaged in a critical examination of Copernican astronomy. His analysis was prompted by an American professor's prediction of a catastrophic event on December 17 due to the conjunction of six planets. This prediction motivated Ahmed Raza Khan to refute the Copernican model through mathematical, logical, and philosophical arguments, challenging various assumptions of modern science and revisiting the arguments of ancient philosophers regarding the Earth's static nature. In the process, it appears that he developed his own version of the planetary theory, drawing inspiration from the Quran. Further research is needed to delve into his works. This historical context calls for a fresh perspective

on the transfer of knowledge from the West to the East, providing a solid basis for recognizing the undiscovered contributions of Muslims and challenging the notion of "Western science" as the sole authority, emphasizing that science is a universal pursuit.

References

Abbud, Fuad. "The planetary theory of Ibn al-Shāṭir: Reduction of the geometric models to numerical tables." *Isis 53*, no. 4 (December 1962): 492-99. doi:10.1086/349635.

Ansari, S. M. Razaullah. "European astronomy in Indo-Persian writings," 133-44. Springer, Dordrecht, 2002. doi:10.1007/978-94-015-9862-0_11.

———. "Ghulām Ḥusain Jaunpūrī." In *Encyclopaedia of the history of science, technology, and medicine in non-Western cultures*, 1-4. Dordrecht: Springer Netherlands, 2014. doi:10.1007/978-94-007-3934-5_10124-1.

———. "Modern astronomy in Indo-Persian sources." In *Highlights of Astronomy*, 730-31. Dordrecht: Springer Netherlands, 1998. doi:10.1007/978-94-011-4778-1_39.

Bareilvy, Imam Ahmed Raza. *Husam al-harmain 'ala munhir kufr wal myvan*. Edited by Alhaaj Bashir Hussain Nazim. Aala Hazrat Network, 1906.

Blair, Ann. "Tycho Brahe's critique of Copernicus and the Copernican System." *Journal of the History of Ideas* 51, no. 3 (July 1990): 355. doi:10.2307/2709620.

Campion, Nicholas, François Charette, Hamid-Reza Giahi Yazdi, Thomas A. Dobbins, Mònica Rius, Gregg DeYoung, Katherine Haramundanis, et al. "Nīsābūrī: Al-Ḥasan Ibn Muḥammad Ibn Al-Ḥusayn Niẓām Al-Dīn Al-Açraj Al-Nīsābūrī." In *The Biographical Encyclopedia of Astronomers*, 837–837. New York, NY: Springer New York, 2007. doi:10.1007/978-0-387-30400-7_1016.

Ghazzali, and Michael E. (trans) Marmura. *The incoherence of the philosophers*. Edited by Daniel C. Peterson. Islamic Translation Series. USA, 2000. http://library.perdana.org.my/Bk_scan/297.261-GHA.pdf.

Hallaq, Wael B. "Was the gate of ijtihad closed?" *International Journal of Middle East Studies* 16, no. 1 (1984): 3–41. doi:10.1017/S0020743800027598.

http://www.alahazrat.net/islam/writing-work-of-imam-ahmad-raza.php http://imamahmadraza.net/wfproducts.aspx?md=4

http://www.columbia.edu/~gas1/project/visions/case1/sci.4.html#t32

Jearl, Walker, Resnick Robert, and Halliday David. *Fundamentals of physics*. 10th ed. John Wiley, 2013. https://www.google.com/search?ei=hNdiWpjFJsaDvQTlzZvwBg&q=The+Fundamentals+of+physics+extended+&oq=The+Fundamentals+of+physics+extended+&gs_l=psy-ab.3..0i22i30k1l10.1337313.1337313.0.1337791.1.1.0.0.0.0.362.362.3-1.1.0....0...1c.1.64.psy-ab..0.1.361....0.

John D, Fix. *Astronomy journey to the cosmic frontier*. New York: McGraw-Hill Education, 2010.

Kennedy, E. S. "A survey of Islamic astronomical tables." *Transactions of the American Philosophical Society* 46, no. 2 (1956): 123. doi:10.2307/1005726.

Kennedy, E. S., and Victor Roberts. "The planetary theory of Ibn Al-Shāṭir." *Isis* 50, no. 3 (September 21, 1959): 227-35. doi:10.1086/348774.

Kennedy, Edward Stewart. *Studies in the Islamic exact sciences*. Beirut: American University of Beirut, 1983.

Kochhar, R.K. "The growth of modern Astronomy in India, 1651-1960." *Vistas in Astronomy 34* (January 1, 1991): 69–105. doi:10.1016/0083-6656(91)90021-J.

Marlborough Express, December 3, 1919.

Muḥammad ibn Aḥmad Bīrūnī. *Alberuni's India (v.1)*. London: Trübner & Co., 1910. http://www.columbia.edu/cu/lweb/digital/collections/cul/texts/ldpd_5949073_001/pages.

New York Times, December 14, 1919.

Popper, Karl R. (Karl Raimund), and William Warren Bartley. *Realism and the aim of science*. Routledge, 1993.

Ragep, F.J. "Tusi and Copernicus: The earth's motion in context." *Science in Context* 14, no. 1-2 (2001): 145–53.

Raza, Imam Ahmed. *A fair success refuting motion of earth*. Edited by Abdul Hamid Maiskar. Karachi: Idara-e-tahqiqat-e-Imam-Ahmad Reza, 2005.

———. *Al-Kalimah al-Mulhamah fī al-Ḥikmati al-Muḥkamah li Wihā'yi al-Falsafati al-Mash'amah*. Bareily: Aala Hazrat Network, 1920.

———. *Fauz-i-mubin dar radd-i-harkat-i-zamīn*. Bareily: Aala Hazrat Network, 1920.

———. *Kanz ul iman : The treasure of faith*. Edited by Muhammad Aqib Farid Qadri. UK: Ahlus Sunnah Publications, 2010.

———. *Mu'īn-i-mubin bahar daur-i- shamas-o-sukūn-i-zamīn*. Bareily: Aala Hazrat Network, 1919.

———. *Nuzūl-i-āyāt-i-furqān besukūn-i-zamīn-o-āsman*. Aala Hazrat Network, 1921.

———. *Warding off the foulness in understanding the time*. Edited by Abdul Hamid Maiskar. Bareily: Idara-e- Farogh Islamic Art & Science, 2006.

Roberts, Victor. "The planetary theory of Ibn al-Shāṭir: Latitudes of the planets." *Isis* 57, no. 2 (July 1966): 208-19. doi:10.1086/350114.

———. "The solar and lunar theory of Ibn Al-Shāṭir: A pre-Copernican Copernican Model." *Isis* 48, no. 4 (December 21, 1957): 428–32. doi:10.1086/348609.

Sahab, Muhammad Ahmed. *Savaneh āla hazrat Imam Ahmed Raza*. I. Bareily: Aala Hazrat Darul Qutub, 1997.

Saliba, George. "A sixteenth-century Arabic critique of Ptolemaic astronomy: The Work of Shams Al-Din Al-Khafri." *Journal for the History of Astronomy 25*, no. 1 (February 22, 1994): 15-38. doi:10.1177/002182869402500102.

———. "An observational notebook of a thirteenth-century astronomer." *Isis* 74 (1983): 388-401. The University of Chicago Press The History of Science Society. Accessed March 29, 2018. doi:10.2307/232597.

———. "Arabic science in sixteenth-century Europe: Guillaume Postel (1510-1581) and Arabic astronomy." *Suhayl. International Journal for the History of the Exact and Natural Sciences in Islamic Civilisation* 7 (2007): 115-64.

———. "Copernican astronomy in the Arab East: Theories of the earth's motion in the ninteenth centuries." In *Transfer of the Modern Science and Technology to the Muslim World*, edited by Ekmeleddin Ihsanoglu, 442. Kuala Lumpur: International Institute of Advanced Islamic Studies Malaysia, 1987.

———. "Islamic science and the making of the European Renaissance." *Transformations*, 2007. doi:10.1017/CBO9781107415324.004.

———. "Theory and observation in Islamic astronomy: The work of Ibn Al-Shāṭir of Damascus." *Journal for the History of Astronomy* 18, no. 1 (February 23, 1987): 35-43. doi:10.1177/002182868701800102.

Samsó, Julio. "Robert G. Morrison, Islam and science: The intellectual career of Nizam Al-Din Al-Nisaburi: Culture and civilization in the Middle East. (London/New York: Routledge, 2007). Pp. 312. $160.00 Cloth." *International Journal of Middle East Studies* 42, no. 02 (May 13, 2010): 344. doi:10.1017/S002074381000019X.

Sanyal, Usha. *Ahmad Riza Khan: In the path of the Prophet*. Oxford: Onworld Publication, 2005.

———. *Devotional Islam and politics in British India: Ahmad Riza Khan Barelwi and His Movement, 1870-1920*. Third. Delhi: Yoda Press, 2010.

Swerdlow, Noel M. "The derivation and first draft of Copernicus's Planetary Theory. A Translation of the Commentariolus with Commentary." *Proceedings of the American Philosophical Society*, Vol. 117, No. 6, Symposium on Copernicus, 1973.

`Te Puke Times, December 5, 1919.

The Pittsburgh Press, November 29, 1919.

Zafar ud-Din, Bihari. *Hayat-e a'la hazrat*. I. Karachi: Maktaba Rizwiyya, 1938.