Indeterminism in *Kalām* and Quantum Mechanics

Mohammad Faizal bin Abu Zarim*
feislabouzer@hotmail.com

DOI: https://doi.org/10.56389/tafhim.vol18no1.5

Abstract

Over the past 30 years, there has been a growing interest in *kalām*, accompanied by an increasing cross-disciplinary engagement with Western philosophy and science. This includes the comparative study of *kalām* and quantum mechanics, where Karen Harding and Muhammad Basil Altaie have emerged as two of the field's most prominent pioneers. Harding has demonstrated striking similarities between al-Ghazālī's views and the Copenhagen interpretation, particularly in their conceptualisation of causality and reality. Altaie's argument for indeterminacy in *kalām* further reinforces this claim. However, the Muslim experience in drawing parallels between Islam and science should caution against over-eagerness and hasty conclusions in such endeavours. This article adopts a more measured approach by highlighting the fundamental differences that persist between the two disciplines. To achieve this, additional concepts from the *kalām* tradition are introduced to broaden the existing discourse.

Keywords:
kalām, quantum mechanics, Copenhagen interpretation, indeterminism, causality

Article history:
Submission date: 20/6/2024
Received in revised form: 19/2/2025
Acceptance date: 7/4/2025
Available online: 22/5/2025

Funding:
This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Conflict of interest:
The author has declared that no competing interest exists.

Cite as:
Mohammad Faizal bin Abu Zarim, "Indeterminism in *Kalām* and Quantum Mechanics," *TAFHIM: IKIM Journal of Islam and the Contemporary World* 18, No. 1 (June 2025): 91–110.

* Currently a PhD candidate at ISTAC-IIUM under the supervision of Prof. Datuk Dr. Osman Bakar. His doctoral research, titled "*Kalām* Philosophy of Nature and Quantum Physics: A Comparative Study," explores the intersection of classical *kalām* thought and contemporary scientific paradigms. His broader academic interests focus on reintegrating *kalām* into mainstream intellectual discourse, particularly through its engagement with other philosophical traditions, especially in the realm of natural philosophy. He expresses his sincere gratitude to Assoc. Prof. Dr. Amran bin Muhammad for his encouragement in writing this piece and to Ustaz Fahmi ibn Zahari for initiating this topic in a WhatsApp group discussion, which ultimately evolved into a fully developed article.

Introduction

Over the past two or three decades, there has been a considerable surge of interest in the deeper study of *ʿilm al-kalām*. No longer burdened by the unfavourable portrayal once perpetuated by Western academia—particularly by Orientalists—recent scholarship in *kalām* has seen the emergence of both Muslim and non-Muslim scholars untainted by the monolithic and bleak perspective inherited from Orientalist narratives. A concurrent trend has emerged in which the philosophical positions of *kalām* are increasingly analysed through the lens of Western philosophical concepts and terminologies. These comparative studies have also extended into the philosophy of science, with particular attention given to the relationship between *kalām* and quantum mechanics—a field that has captivated both Muslim academics and lay audiences alike. One possible explanation for this growing interest is the recognition that a classical Islamic discipline, often dismissed as outdated and irrelevant, shares surprising conceptual similarities with a modern scientific theory widely regarded as one of the most successful in history. Osman Bakar[1] and Karen Harding,[2] for instance, have highlighted such parallels. Additionally, the desire to restore *kalām* to contemporary intellectual relevance and bridge the gap between *kalām* and modern science has been a significant factor in this renewed enthusiasm, as exemplified in the pioneering works of Muhammad Basil Altaie.[3]

However, amid the eagerness to establish connections between *kalām* and quantum mechanics, it is necessary to take a step back and critically reflect on past attempts to draw parallels between scientific and Islamic concepts—many of which have been less than successful.[4] Some scholars have even abandoned such endeavours altogether, disillusioned by the repeated failures of *Bucaillism*[5]-driven attempts at Islamising science. The tendency to uncritically adopt scientific concepts in an effort to justify Islamic ideas must give way to a more nuanced engagement—one that is both well-informed by the *turāth* and attuned to contemporary intellectual developments. While the works of Harding and Altaie, for instance, may offer grounds for optimism, progress in this field must be pursued with greater methodological rigour and scholarly caution. Harding made

1. Osman Bakar, *Tawhid and Science: Islamic Perspective on Religion and Science* (Kuala Lumpur: Arah Publication, 2008).
2. Karen Harding, "Causality Then and Now: Al Ghazali and Quantum Theory" in *The American Journal of Islamic Social Sciences* 10, no. 2 (1993).
3. Muhammad Basil Altaie, *God, Nature and the Cause: Essays on Islam and Science* (Toronto: Kalam Research and Media, 2016). See also Muhammad Basil Altaie, "Daqiq al-Kalam: A Basis for an Islamic Philosophy of Science," CMC Papers No. 4 (2015).
4. There is also the unfortunate tendency of many, Muslims included, to hastily associate quantum mechanical concepts with mystical ideas.
5. A derisive term coined up by Ziauddin Sardar, who was an early pioneer of Islamisation of knowledge but later became thoroughly disillusioned by the project.

a pioneering contribution to the transdisciplinary study of *kalām* and quantum mechanics by highlighting the similarities between the ideas of al-Ghazālī and the Copenhagen interpretation. Basil Altaie's argument for indeterminacy in *kalām* further reinforces Harding's case for these similarities. While Harding's article focuses on the parallels in their understanding of causality, I will expand her discourse by examining the differences that emerge in relation to these similarities, incorporating additional concepts from the *kalām* tradition.

Classical Mechanics and the Mechanical Philosophy

The concept of indeterminism became a central feature of physics following the probabilistic interpretation of the wave function introduced by Max Born (1882–1970) and the Uncertainty Principle formulated by Werner Heisenberg (1901–1976). These new concepts, along with the advent of quantum mechanics, disrupted the established order within the physics community, which included luminaries such as Max Planck, Albert Einstein, and Erwin Schrödinger. To fully appreciate the profound disturbance caused by this new paradigm, it is useful to first examine the preceding framework—namely, classical physics.

Classical mechanics was rooted in and built upon the ideas and works of Isaac Newton (1643–1721). However, Newton's theories themselves were the product of his synthesis and refinement of the philosophical developments of his time. The decades preceding Newton were marked by an intellectual effort to eliminate Aristotelianism, Hermeticism, occultism, and animism—remnants of the Scholastic era and the Renaissance. This shift gave rise to the dominance of mechanical philosophy, which conceived of the world as nothing more than a machine, devoid of souls or life forces. According to this view, natural phenomena were merely the result of motion and the mechanical interactions of particles.

Furthermore, as Galileo Galilei (1564–1642) asserted, mathematical and quantifiable properties—such as size, shape, motion, place, and number—were primary and intrinsic to an object or substance.[6] In contrast, non-mathematical and non-mechanical qualities—such as heat, colour, and taste—were regarded as secondary, merely derivative of the primary ones. René Descartes (1596–1650), a younger contemporary of Galileo, also accepted this distinction between primary and secondary qualities. As a rationalist, Descartes maintained that mathematics was the key to certainty, believing that the very nature and essence of the world were fundamentally mathematical. To acquire the science of pure mathematics, he argued, was to attain knowledge of the world itself. [7]

6. Cemil Akdogan, *Science in Islam and the West* (Kuala Lumpur: ISTAC-IIUM, 2008), 84.
7. Ivor Leclerc, *The Nature of Physical Existence*, ed. H.D. Lewis (London: George Allen & Unwin Ltd, 1972), 195 & 197.

Johannes Kepler (1571–1630) was the first mechanical philosopher to successfully impose a mathematical framework onto the universe through his laws of planetary motion. He was also the first to introduce causal considerations into astronomy, thereby merging it with physics.[8] If Kepler was the first to impose mathematical order upon the heavens, Galileo was the first to do so upon the Earth with his law of falling bodies. From the 17th century onwards, physics followed Galileo's conception of the discipline as the science of the motion of bodies—primarily mechanics.[9] Newton then unified these celestial and terrestrial laws by formulating a single, universal law of gravitational force. Together with his three laws of motion, in which force plays a central role, Newton's mechanical framework encompassed everything from the smallest particles to the largest celestial bodies.

Underlying these groundbreaking laws was Newton's concept of space as absolute and definite, which facilitated the permeation of mathematical order and precision throughout the universe. These laws of mechanics enabled the precise determination of an object's motion and position at any given moment. If one were provided with an object's position and velocity at a particular time, its future position and velocity could be accurately predicted. Even more significantly, its past positions and motions could also be traced, allowing for retroactive calculations (*retrodiction*).[10] With Newtonian mechanics, the entire history of an object's motion could be reconstructed solely through knowledge of its position and velocity (or momentum). This is why, in physics, knowing these two variables at a particular moment is considered sufficient for a complete description of the system.[11] As Paul Davies noted, determinism was inherently built into these laws.[12] The predictive power of classical physics led Pierre-Simon de Laplace (1749–1827) to declare that "the present is the product of the past and the cause of the future."[13]

Laplace subsequently sought to extend determinism to its fullest extent. As Marij van Strien explains, Laplace's deterministic programme, which also included figures such as Boscovich and Du Bois-Reymond, assumed that all natural phenomena could be reduced to the motions of atoms, which were regarded as mass points. To achieve full determinism, physics itself needed to be entirely reducible to mechanics. Ultimately, Laplace's programme failed, as too

8. See Marcelo Gleiser, *The Island of Knowledge: The Limits of Science and the Search for Meaning* (New York: Basic Books, 2014), 44.
9. Leclerc, *The Nature of Physical Existence*, 233.
10. Paul Davies, *The Mind of God: The Scientific Basis for a Rational World* (New York: Simon & Schuster, 1992), 29.
11. See Leonard Susskind and Art Friedman, *Quantum Mechanics: The Theoretical Minimum* (London: Penguin Books, 2014), 250–251.
12. Davies, *The Mind of God*, 29
13. Alistair Rae, *Quantum Physics: Illusion or Reality?*, 2nd ed. (Cambridge: Cambridge University Press, 2004), 2.

many critical variables and considerations had to be overlooked. Nevertheless, this failure did not eliminate the expectation or perception of classical physics as inherently deterministic—a view that continued to shape the work of physicists until the 1930s, serving as the dominant paradigm for scientific research.[14]

Quantum Indeterminism

In 1900, Max Planck (1858–1947) postulated that blackbody radiation, a type of electromagnetic field, must exist in discrete units. Planck's quantum revolution marked the beginning of a departure from the principles of classical physics. Atoms and discreteness became empirically verifiable entities and qualities rather than purely metaphysical concepts. In 1905, Albert Einstein (1879–1955) revived Newton's corpuscular theory by applying quantisation to light, leading to the establishment of light's dual nature. In 1911, Niels Bohr (1885–1962) proposed that electrons within an atom occupy discrete orbits and transition between them by "leaping" (hence the term *quantum jump*).[15] Louis de Broglie (1892–1987) subsequently postulated that if electromagnetic fields possess particulate properties, then matter itself must exhibit wave-like characteristics. The precise identity (*quiddity*) of an electron oscillated between being a particle and a wave, creating significant conceptual challenges for physicists.

These developments culminated in an even greater revolution in 1925, initiated by Werner Heisenberg's (1901–1976) formulation of a new mechanics based on a distinct set of epistemological and mathematical principles. For Heisenberg, only *observables*—quantities that can be experimentally measured—should be considered. Atoms and their orbitals, being unobservable, were to be relegated to the realm of *noumena*. Heisenberg argued that classical concepts of waves and particles should be replaced by a new mathematical framework grounded in observables. These radical principles inevitably unsettled the physics establishment.

Erwin Schrödinger (1887–1961), adhering to the classical tradition, responded in 1926 by developing his own formulation of quantum mechanics. He found the earlier matrix mechanics of Heisenberg, Max Born (1882–1970), and Pascual Jordan (1902–1980) deeply unappealing. Seeking to restore intuitiveness, visualisability, and realism to the new mechanics, Schrödinger introduced an equation featuring a quantity known as the wave function (Ψ), which he believed represented the fundamental nature of the electron. In Schrödinger's model, any particle, including an electron, was conceived as nothing more than a wave packet or a globule bound together. However, this

14. Marij van Strien, "Was Physics Ever Deterministic? The Historical Basis of Determinism and the Image of Classical Physics," *The European Physical Journal H* 46 (2021): 8.
15. A millennium earlier, the Muʿtazilite al-Naẓẓām (c. 160–231 AH/c. 775–845 CE) proposed a similar concept called *ṭafrah*.

interpretation proved incorrect, as wave packets would inevitably disperse over time.[16] As Heisenberg pointed out, Schrödinger's interpretation of the wave function failed to account for Planck's formula for heat radiation and other quantisation phenomena.[17] Consequently, Max Born proposed a radical reinterpretation of the wave function, marking a significant departure from the classical paradigm.

In his interpretation, Max Born argued that the wave function in Schrödinger's equation does not represent physical reality but rather a probability amplitude—an abstract mathematical entity. The implication of this is that we can obtain answers only to, as Born put it, "how probable is a given effect of the collision," rather than to the question, "what is the state after the collision."[18] No quantity in any individual case can be attributed as the cause of a collision or any quantum interaction. Born further stated that forces had been "freed from their classical duties of determining directly the motion of particles" and were instead reduced to determining the probability of states.[19] The inability to predict or ascertain the precise outcome of a quantum event—combined with the removal of force from its role in fully determining that outcome—clearly undermines causality. This marks a fundamental departure from the paradigm of classical physics.

Heisenberg was not yet finished in his challenge to causality. In 1927, he introduced his Uncertainty Principle, which states that the product of the uncertainty in position and the uncertainty in momentum must be at least equal to or greater than Planck's constant. This principle imposes a fundamental limit on the accuracy of measurements of observable quantities that are necessary for obtaining complete knowledge of a system. It also prohibits the simultaneous precise measurement of these quantities, as increasing accuracy in one inevitably results in greater inaccuracy in the other.[20] While Born's interpretation of the wave function introduced indeterminism specifically in relation to the effect or outcome of a quantum event, Heisenberg's Uncertainty Principle asserted that even the causes or initial conditions could not be determined with absolute accuracy. Causality was thus disrupted at both ends.

Heisenberg attempted to explain the origin of this uncertainty through the workings of a microscope. A microscope typically uses gamma rays to probe a particle. Gamma rays are simply high-energy photons. Higher resolution in the

---

16. See Abraham Pais, *Niels Bohr's Times: In Physics, Philosophy and Polity* (Oxford University Press, 1991), 285
17. Werner Heisenberg, *Physics and Philosophy: The Revolution in Modern Science* (London: George Allen & Unwin Ltd., 1958), 43
18. Pais, *Niels Bohr's Times*, 286; also Jim Baggott, *The Quantum Story: A History in 40 Moments* (Oxford University Press, 2011), 75.
19. Pais, *Niels Bohr's Times*, 287.
20. Rae, *Quantum Physics*, 13.

microscope requires higher-frequency gamma rays, which correspond to higher-energy photons. However, higher-energy photons impart greater momentum to the electrons they interact with, leading to significant changes in the electron's momentum upon collision. As a result, the electron's precise momentum cannot be determined. Conversely, using a lower-energy gamma ray preserves a more accurate measurement of momentum but results in a lower-resolution image and a less precise determination of position. According to Heisenberg, this uncertainty arises from the inherent limitations of measurement techniques, or "clumsiness."[21] However, Niels Bohr rejected this explanation, arguing that the uncertainty was not due to the limitations of measurement techniques but rather to the fundamental constraints imposed by the finite dimensions of the microscope's lens aperture. Bohr effectively replaced Heisenberg's particle-based explanation of uncertainty with a wave-based one.

In his later years, Heisenberg expanded upon Born's interpretation of the wave function. He divided the probability wave function into two components: one subjective and the other objective. The subjective component represents our knowledge of atomic events, taking into account both the Uncertainty Principle and the inherent inaccuracy of the measuring apparatus. The objective component, on the other hand, represents the tendency of certain events to occur—their potentiality. Removed by Galileo in the 17th century, the old Aristotelian concept of *potentia* was reintroduced in this mathematical form.[22] At a time when logical positivism remained pervasive (and Heisenberg himself was often regarded as a positivist), he had the audacity to introduce a Greek metaphysical concept into modern scientific discourse. He argued that it is meaningless to speak about what happens before measurement, during observation, or between observations. It is only after an observation that the wave function "collapses," marking the transition from potentiality—an abundance of possible outcomes—to actuality.[23] Only at this point can one meaningfully discuss the reality or occurrence of an electron. In other words, reality is manifested and actualised through interaction with the observer.[24] Thanks to Heisenberg, quantum indeterminism, which initially emerged as an epistemological concern, soon extended into the ontological realm as well.

Let us revisit the concept of indeterminism itself. Caner Taslaman, quoting Ian Barbour, identifies three types of indeterminism. The first type arises from the ignorance of the observer, making it an epistemic rather than an ontological form of indeterminism. Proponents of this view—including Planck, Einstein, Schrödinger, and David Bohm (1917–1992)—maintain that reality

21. Baggott, *The Quantum Stories*, 98.
22. Heisenberg, *Physics and Philosophy*, 42.
23. Ibid., 48, 52, and 54.
24. Ibid., 46–57.

is fundamentally deterministic. According to this perspective, indeterminism results from our ignorance of "hidden variables" and the incompleteness of existing theories.

The second type, which can be described as Kantian, attributes indeterminism to experimental and conceptual limitations. The *things-in-themselves* (*Dinge an sich*) lie beyond the scope of human knowledge; what can be known are merely the conceptual categories we impose upon the subatomic world, such as waves and particles or position and momentum. Even the question of whether indeterminism truly exists cannot be definitively answered. Furthermore, the interaction between the observer and the observed inevitably alters the latter, rendering its original state unknowable.

Finally, the third type is not epistemic but rather objective and ontological. In this view, uncertainty about a particle's state arises because the particle itself exists indeterministically. The reasoning follows that nature exhibits indeterminism not because we lack the ability to discern a deterministic order but because indeterminism is an inherent feature of reality. Our cognitive limitations are projected onto the world, leading to the assumption that reality mirrors our epistemic constraints rather than the other way around. As John Polkinghorne (1930–2021) aptly described it, this approach holds that "epistemology models ontology."[25]

Indeterminism in *Kalām*

In the third of his five principles of *daqīq al-kalām*, Basil Altaie states that since God is the Absolutely Able Creator and the Total Sustainer of the world—continuously creating and re-creating accidents at every moment—the world is inherently indeterminate. Furthermore, in the fourth principle, God's absolute free will and sovereignty over His creation result in probabilistic laws of nature and, consequently, the indeterminacy of the world.[26] From these two principles, which form the foundation of *kalām* indeterminism, it is evident that they, in turn, rest upon the *kalām* theories of atomism and occasionalism, which will be explained below.

Kālām cosmological theory is founded on the principle that the world is distinct and separate from its Creator. While the Creator is necessary, transcendent, omnipotent, eternal, and uncreated, the world is contingent, temporal, created, and absolutely dependent on its Creator. Consequently, every metaphysical and physical theory in *kalām* must reflect this fundamental distinction and the God-world relationship. No physical theory in *kalām* better exemplifies this than the theory of atomism. Despite its origins as a materialistic

25. Caner Taslaman, "Determinism, Indeterminism, Quantum Theory, and Divine Action," *M.Ü. ilahiyat Fakültesi Dergisi* 32, no. 1 (2007): 157–182.
26. Altaie, "Daqiq al-Kalam," 5–6.

theory—whether in its Democritean or Epicurean form—atomism was adopted by the *mutakallimūn* to argue for the contingency of the world and its absolute dependence on the Necessary Being, in accordance with the principle of *iftiqār wa istighnāʾ*. The *mutakallimūn* maintain that contingent existences are composed of *jawhar*, *jism*, and *aʿrāḍ*. *Jawhar* (substance) is a non-dimensional, space-occupying, and self-subsisting essence (*qāʾim bi-nafsihī*).[27]

A combination of two or more *jawhar* constitutes a *jism* (body). *Aʿrāḍ* (accidents), on the other hand, are not self-subsisting and must be superadded to *jawhar* for subsistence. While *jawhar* depends on *aʿrāḍ* for its attributes and properties, it possesses no intrinsic primary qualities apart from occupying space and being indivisible.[28] Accidents cannot persist for two consecutive moments and must rely on continuous recreation by God. Since substance cannot exist without accidents, it too is dependent on God for continuous sustenance.[29] As such, there is no concept of innate or inherent properties in Sunnī *kalām*;[30] everything is directly created by God at every instant. Understood in this sense, the world is inherently indeterminate.[31]

The other component of *kalām* indeterminism is occasionalism. The fundamental idea is that everything—including human actions, natural phenomena, and causative power—is continuously created by God. God is the true and ultimate cause of all existence. *Kalām* rejects the notion that things possess innate properties (in the sense that they originate from the things themselves) that enable them to cause events. What we perceive as conjunction (*al-iqtirān*) between what we consider to be cause and effect is, in reality, created by God; it does not arise from the intrinsic capacity of things and is therefore not necessary.[32]

Like *kalām* atomism, occasionalism is primarily motivated by the desire to reaffirm God's absolute sovereignty over all things. Nothing has independent power or efficacy in and of itself. To believe that God requires intermediaries or secondary causation is tantamount to believing that He has associates in managing the world, thereby compromising the doctrine of *tawḥīd*. The same theological motivation led the Sunnī *mutakallimūn* to reject both the necessitarian causality of the *falāsifah*, inherited from Aristotle, and the concept of *iʿtimād* upheld by the Muʿtazilah.

---

27. Hamid Fahmi Zarkasyi, *Al-Ghazali's Concept of Causality: With Reference to his Interpretations of Reality and Knowledge* (Kuala Lumpur: IIUM Press, 2010), 118.
28. Ibid., 120–121.
29. Ibid.
30. Harding, "Causality Then and Now", 173–174.
31. Altaie, "Daqiq al-Kalam," 5–6.
32. Mustafa Abu-Sway, *Al-Ghazzaliyy: A Study in Islamic Epistemology* (Kuala Lumpur: Dewan Bahasa dan Pustaka, 1996), 85.

According to the *falāsifah*, causation is a necessary process, implying that God is compelled to act in specific ways, thereby restricting His will and power. However, for God to exercise His will and power fully, He must not be constrained or necessitated by anything. Furthermore, occasionalism is often thought to have been conceived to allow for the possibility of miracles. On the contrary, the occurrence of miracles—perhaps the most famous being that of Prophet Ibrāhīm (*ʿalayhi al-salām*)—serves as proof that causal links are not necessary.[33]

To appreciate the logical argument employed by the *mutakallimūn* in refuting necessitarian causality and establishing occasionalism, let us examine the reasoning put forth by *Ḥujjat al-Islām* Abū Ḥāmid al-Ghazālī (450–505 AH/1058–1111 CE). He argued that the causal link between what we perceive as a cause and what we consider to be its effect is neither necessary nor, in fact, existent. Observation can only demonstrate that burning occurs when fire is present, not that burning occurs *because* of fire.[34]

The existence of a causal link cannot be empirically proven; only correlation, simultaneity, and coexistence can be observed.[35] In other words, empirical data can only reveal the antecedent and the consequent—the prior and the posterior—rather than an ontological cause-and-effect relationship.[36] Furthermore, objects and material entities cannot themselves be causes or agents of causation. A true agent of causation must possess will, free choice, and knowledge—qualities absent in inert and lifeless entities such as fire.[37] Fire, therefore, cannot be the agent or cause of burning.[38]

In reality, the concept of necessity in the context of causality was not entirely rejected by al-Ghazālī; rather, it was reinterpreted and applied in a different manner. Necessity applies only to the consistency of the connection (*wajh al-iqtirān*) between the perceived cause and effect, not to the nature of the connection itself (*nafs al-iqtirān*). This consistency is necessary because it is imposed by the will and power of the Creator and is therefore irreplaceable and unchangeable.[39] This principle is known as *ḥukm al-ʿādah* and *sunnat Allāh*. From an epistemic perspective, necessity is only relative to the observer, arising from repeated observation of the same pattern and imposed upon the mind, rather than being an inherent property of the things observed.[40]

33. Zarkasyi, *Al-Ghazali's Concept of Causality*, 209.
34. Abu Sway, *Al-Ghazzaliyy*, 86.
35. Zarkasyi, *Al-Ghazali's Concept of Causality*, 209.
36. Ibid.; Abu Sway, *Al-Ghazzaliyy*, 85.
37. Zarkasyi, *Al-Ghazali's Concept of Causality*, 200–201.
38. Abu Sway, *Al-Ghazzaliyy*, 86; Zarkasyi, *Al-Ghazali's Concept of Causality*, 211.
39. Zarkasyi, *Al-Ghazali's Concept of Causality*, 192.
40. Ibid., 245.

Recalling his fourth principle of *daqīq al-kalām*, when Basil Altaie stated, "…He is at liberty to take any action He wishes in respect to the state of the world or its control…,"[41] it does not imply that God is whimsical or capricious in creating and determining the world. Occasionalism does not suggest that the world is created in chaos; rather, everything occurs according to God's Decree (*qaḍāʾ*), Determination (*qadar*), Judgment (*ḥukm*), Knowledge (*ʿilm*), and Will (*mashīʾah*). God establishes fixed causes in an orderly manner to reflect His wisdom, without rupture or interruption. Exceptions occur only in extraordinary cases, such as *muʿjizah* (miracles) and *karāmah* (divinely granted wonders to the righteous). The world exhibits recognisable patterns and arrangements fashioned by God, as seen in the relationships between antecedents and consequents. These patterns are acknowledged by the *mutakallimūn* as *ʿādah* or *sunnat Allāh*, which must be studied and adhered to. The key distinction in their assertion is that these created entities possess no intrinsic agency or innate causal power; nothing causes anything independently. God alone is the Efficient Cause and the intermediary factor between what is perceived as cause and effect.[42] To reiterate, what we perceive as cause and effect is merely a mental association imposed upon our minds through repeated observation of regularities in nature.

An exposition of occasionalism is incomplete without a discussion of the integral concept of *takhṣīṣ*, a corollary to the understanding of God's will. If an object possesses a particular quality—despite the possibility of possessing numerous others, including equally viable alternatives—there must be a factor or mechanism that determines the selection of that specific quality. This determining factor is known as *takhṣīṣ*, or particularisation, which is how God's will manifests. It is *takhṣīṣ* that determines the nature of things, shaping the structured and patterned order of the world. It is also through *takhṣīṣ* that God occasionally chooses to deviate from established patterns, as seen in exceptional cases such as *muʿjizah* (miracles). Thus, while the world is largely intelligible and the regularities of *ʿādah* that we observe are predictable—at least within the limits of normal human perception—God Himself is not bound by these patterns.[43]

Did al-Ghazālī and the *mutakallimūn* deny knowledge, the nature of things, and the existence of patterns, as Ibn Rushd claimed? As previously mentioned, what they rejected was the notion of a necessary causal nexus, whose existence cannot be empirically proven. *Kalām* acknowledges the existence of intelligible regular patterns in the world—referred to as *ʿādah*—and recognises the necessity of conjunction in terms of its consistency. These patterns and consistencies can be expressed in logical propositions. Denying the efficacy of one thing to produce another does not necessarily equate to denying the discernible pattern of

41. Altaie, "Daqiq al-Kalam," 5–6.
42. Zarkasyi, *Al-Ghazali's Concept of Causality*, 202, 204, and 216.
43. Ibid., 206–208.

that thing. In other words, *kalām* does not entirely reject the notion of causality; rather, it distinguishes between its epistemic, mind-dependent, and logical aspects— which it accepts—and its natural and ontological aspects, which it denies. The causal link is thus merely a construct of the mind, or *amrun iʿtibārī*. Accepting one aspect of causality while rejecting another is not contradictory; rather, conflating the two is a fundamental mistake.[44]

Kalām vs Quantum Indeterminism

In her article, Karen Harding demonstrated that there are several similarities between al-Ghazālī and the Copenhagen interpretation regarding their understanding of reality and causality. Both perspectives agree that objects have no independent existence or inherent properties.[45] For al-Ghazālī and the *mutakallimūn* in general, the existence and endurance of objects depend exclusively on God, who creates them at every instant—including their properties. In the Copenhagen interpretation, objects have no reality in the absence of an observer. An electron, for instance, does not possess a definite size or position—nor inherent properties—prior to observation and measurement.[46] Furthermore, the *mutakallimūn* assert that since everything relies entirely on God, causal links are also denied. Things have no causal agency or intrinsic efficacy, as they are inert and lifeless. Similarly, in the Copenhagen interpretation, since electrons exist only as potentials and lack inherent properties, they cannot function as causal factors in producing effects.[47] Since both schools of thought significantly undermine the concept of causality, miracles, unpredictability, and unexpected occurrences naturally find a place in each. That being said, regularities still exist. In *kalām*, God consistently acts according to His custom, while in the Copenhagen interpretation, despite inherent uncertainty, electrons exhibit high probabilities of having specific positions and occupying certain locations.[48]

Let us now turn our attention to the differences, beginning with the issue of independent existence. Harding has already highlighted the existential dependence of objects on God in *kalām* and on an observer in the Copenhagen interpretation. In *kalām*, this dependence occurs at every unit of time, as God continuously creates and re-creates accidents in atoms or substrates. In contrast, according to the Copenhagen interpretation, once a particle has been observed or measured in a particular state, it no longer requires further measurement to sustain its existence and actualisation—although subsequent measurements may alter its properties. A *mutakallim* might argue that observation grants the attribute of *baqāʾ* (persistence) to the observed particle.

44. Ibid., 216, and 236–246.
45. Harding, "Causality Then and Now," 174.
46. Ibid., 173–174.
47. Ibid., 175.
48. Ibid., 176.

The absence of inherent properties is closely related to the absence of independent existence. While *kalām* and the Copenhagen interpretation agree on these points, they also diverge in significant ways. In *kalām*, as previously mentioned, *jawhar* is entirely inert and devoid of any primary qualities. Properties and qualities arise through *aʿrāḍ*, which require constant re-creation by God. This includes potentialities that could induce any form of influence or cause a *jawhar* to be in a particular state or disposition. For Heisenberg, however, potentiality is an objective aspect of a particle prior to its actualisation. From the perspective of *kalām*, this would imply that a particle possesses an innate tendency toward a certain state. However, anything that has a non-induced tendency toward something must have a *murajjih* (preponderant factor or determinant), which would render what is originally a contingent being into a necessary one. This analysis of preponderance between existence and non-existence may not, however, be applicable in this case, as statistical considerations do not factor into necessity/contingency reasoning. In quantum mechanics, there are multiple possibilities regarding where a particle may be, rather than a simple binary choice between existence and non-existence. Furthermore, probability in quantum mechanics pertains to the likelihood of certain properties and *aʿrāḍ* (accidents) emerging, rather than to the existence of the particle itself. This distinction requires further analysis. Additionally, a particle can retain its properties with or without subsequent measurements. In turn, these measurements—depending on their configurations—can determine whether an already observed particle retains its properties or undergoes random alteration.[49]

The critique of causality in *kalām* and the Copenhagen interpretation must be examined from multiple perspectives. To begin with, both schools of thought have vastly different motivations. The *mutakallimūn*, in their effort to affirm God's absolute supremacy and omnipotence in all things—while simultaneously rejecting necessitarian physics that precludes miracles—introduced an unprecedented line of thought in the intellectual and philosophical history of the world. This rejection is ontological rather than epistemological, contrary to Ibn Rushd's misattribution, and it does not undermine certitude or the production of knowledge. This stands in contrast to the development of quantum mechanics, where the failure to achieve precision and predictability served as the initial catalyst for the breakdown of classical causality. Here, the issue is primarily epistemic, as it pertains to the inability to ascertain the precise outcome of a quantum transition. Ibn Rushd would likely be astonished to learn that, despite this indeterminacy, quantum mechanics has evolved into a highly developed discipline with its own rigorous set of rules, principles, and laws.

---

49. For a detailed explanation, see Susskind and Friedman, *Quantum Mechanics*, 4–13. Also see Rae, *Quantum Physics*, 23–31.

Furthermore, the ontological aspects of lacking inherent properties and independent existence—both of which directly contributed to *kalām*'s rejection of causality—only later became significant considerations in quantum mechanics. This shift occurred through Heisenberg's interpretation of the wave function, as well as experimental evidence demonstrating the randomness of quantum outcomes. One might say that the *mutakallimūn* attacked causality out of humility before God, whereas physicists arrived at a similar position only after being humbled by their own limitations and the frustration of failing to achieve what had once seemed possible. When examining the aspect of agency and efficacy, *kalām*'s position is unequivocal: things are entirely devoid of both. In *kalām* atomism, everything is completely inert and incapable of exerting any influence or efficacy in causation. In the Copenhagen interpretation, however, force—the central factor that would typically determine the state of a particle—is instead reduced to determining the probability of states in quantum mechanics. Moreover, *potentia* within a wave function plays a role in influencing the outcome of a quantum event. These aspects suggest that some form of efficacy remains within this framework.

This divergence in position is partly due to the differing ontological views held by these two schools of thought. According to the Ashʿarites, there are only two categories of knowables or objects of knowledge: the existent (*mawjūd*) and the non-existent (*maʿdūm*). The only true existents are those that exist outside the mind (*wujūd fī al-khārij*). Possibilities, or *mumkināt*, are classified as non-existents (*maʿdūm*) and, as such, cannot be considered to possess any external reality.[50] They are merely mental constructs (*amrun iʿtibārī*). In contrast, Heisenberg explicitly incorporated the Aristotelian concept of *potentia* into the wave function, asserting that it constitutes an objective element, independent of the observer. This implies that *potentia* possesses a certain degree of reality, though not fully realised. While Heisenberg would likely refute this claim by insisting that reality—at least as he understood it—manifests only upon observation, it remains undeniable that entities that objectively possess characteristics or properties do, in some sense, have reality, whether within a *kalām* or Aristotelian framework. The tendency represented in the probability function can be framed as a type of characteristic or property, with the wave function itself as its substrate. Therefore, the tendency within the probability function must have some degree of reality and cannot merely occupy an intermediate state between possibility and reality, as Heisenberg claimed.[51] Furthermore, it is important to note that potentiality and contingency are considered real accidents in the Aristotelian framework, with prime matter serving as their substrate. Within

50. Mohd. Zaidi Ismail, *Existence and Quiddity in the Later Ashʿarite* Kalām*: A Study on al-Ījī's* al-Mawāqif *and al-Jurjānī's* Sharḥ al-Mawāqif (Putrajaya: Islamic & Strategic Studies Institute (ISSI), Kalam Research & Media (KRM), and Ta'dib International, 2017), 65 & 75.
51. Heisenberg, *Physics and Philosophy*, 42.

the Islamic intellectual tradition, Heisenberg's acceptance of *potentia* aligns more closely with the Muʿtazilite concept of *maʿdūm*, which, although non-existent, still possesses external reality because it can be intellectually conceived, distinguished, and affirmed.[52]

The issue of causation and causal links is another aspect worth examining. In *kalām*, causation is denied by rejecting agency, power, and efficacy in things, while the rejection of causal links was articulated by al-Ghazālī, who adopted a somewhat positivistic stance, arguing that the existence of causal links cannot be empirically proven. The Copenhagen interpretation, however, does not appear to distinguish explicitly between cause and causal link. Instead, it deconstructs the concepts of cause and effect separately. As previously mentioned, Born's interpretation of the probability function primarily addresses the indeterminacy of the effect. This is evident in his claim that the only obtainable answer to a quantum interaction is *how probable* a given effect is, even when all individual causes are present. Meanwhile, the impact of the Uncertainty Principle extends to the causes themselves. Since the position-momentum pair—which must be precisely known together to achieve complete knowledge of a particle's system or mechanics—can no longer be determined simultaneously, it becomes impossible to predict or retrodict the exact state or trajectory of a particle.

In contrast, the *mutakallimūn*'s rejection of causation is primarily ontological. Objects do not possess agency or inherent power in and of themselves; causation is ultimately attributed to God. However, on the epistemic (and practical) level, causality remains functionally intact. One can still assert with confidence that fire is needed to burn wood. Regarding the issue of effect, *kalām* holds that phenomena and occurrences are fixed, uniform, and regular—except for the very rare occurrence of miracles. Consequently, effects are considered knowable with certainty. In one sense, *kalām*'s form of indeterminism can be regarded as a very mild version of Born's probability law. In another sense, since God is the True Cause, and the True Cause is not bound to follow a fixed pattern, *kalām* is also ontologically indeterministic. The fact that God creates regularities and *ʿādah* in this world makes it highly intelligible and thus renders epistemic and logical causality possible.[53] Adjectives such as "strange," "bizarre," and "weird"—commonly used in popular science to describe quantum mechanics—do not apply to *kalām*. While it is fair to say that *kalām*'s version of causality is epistemically deterministic, the same cannot be said for the Copenhagen interpretation, where indeterminism applies both ontologically and epistemically.

Nonetheless, from a certain perspective—particularly through the lens of *kalām*—it can be argued that aspects of the Copenhagen interpretation remain deterministic. Consider Heisenberg's perspective on the role of observation.

52. Mohd. Zaidi, *Existence and Quiddity*, 67.

53. A term used by Hamid Fahmi Zarkasyi. See Zarkasyi, *Al-Ghazali's Concept of Causality*, 216.

Observation necessarily collapses the probability function, thereby actualising and realising the electron. The absence of any probabilistic factor in observation's role as an actualiser and collapser suggests that this is a fixed and certain regular occurrence—an instance of *ʿādah*. From this standpoint, the process of observation can be considered epistemically deterministic. In fact, from Heisenberg's understanding of the observer effect, one could even derive (or force) an argument for ontological determinism. Observation is necessary for a quantum object to actualise; there cannot be a "miracle" in which an electron suddenly appears without an observer. As Pascual Jordan (1902–1980) admitted, "Observations not only disturb what has to be measured, they produce it… We ourselves produce the results of the measurement."[54] The implication of this is that the observer, rather than God, is the creator of reality. For this reason, the Copenhagen interpretation has been accused of being not only epistemically but also ontologically subjective.[55]

Those familiar with the discourse on perception and reality in the Islamic tradition cannot help but recall Ibn Sīnā's (370–428 AH/980–1037 CE) theory of forms when reflecting on Heisenberg's theory of observation. According to Ibn Sīnā, when an object is perceived, the form of that object—representing its essence, universality, and reality—is abstracted and imprinted (*inṭibāʿ*) onto the mind and soul of the perceiver. This form can be said to occur (*ḥuṣūl*) and unite (*ittiḥād*) with the mind and soul.[56] The reality of that thing, therefore, exists in the mind of the perceiver as a mental form. Although this theory was initially rejected by the early *mutakallimūn*, later generations—most notably al-Sayyid al-Sharīf al-Jurjānī (740–816 AH/1339–1413 CE)—found justification for its adoption, albeit with some modifications.[57] Contrast this with Heisenberg's view. To use Avicennan terminology, perception or observation, according to Heisenberg, does not derive form and reality *from* a perceived electron; rather, it *imprints* reality *onto* that electron. In the case of the Copenhagen interpretation, reality is granted by the measuring apparatus, whereas in the interpretations of John von Neumann (1903–1957) and Eugene Wigner (1902–1995), reality is granted by the human mind itself. To put it another way, in the Islamic

---

54. Cited in "Chapter 24: Can We Know What is Real?" in Gleiser, *The Island of Knowledge*, 189.
55. Einstein was really bothered about this that he quipped "Is the Moon not there if I'm not looking?". See Gleiser, *The Island of Knowledge*, 185.
56. For more information, see Murat Kaş, "Mental Existence Debates in the Post-Classical Period of Islamic Philosophy: Problems of the Category and Essence of Knowledge." *Nazariyat* 4, no. 3 (November 2018): 49–84; see also Ibrahim Halil Üçer, "Realism Transformed: The Ontology of Universals in Avicennan Philosophy and Quṭb al-Dīn al-Rāzī's Theory of Mental Exemplars," *Nazariyat* 6, no. 2 (November 2020): 23–68.
57. See Moiz Hasan, "Foundations of Science in the Post-Classical Islamic Era: The Philosophical, Historical, and Historiographical Significance of Sayyid al-Sharīf al-Jurjānī's (d. 1413) Project," PhD thesis (Notre Dame: University of Notre Dame, 2017); see also "Chapter Five: Mental Existence" in Mohd. Zaidi, *Existence and Quiddity*, 207–231.

tradition, perception and observation serve as the causes of knowledge and the acquisition of reality, whereas in Heisenberg's and the mind-body interpretations, perception and observation are themselves the causes of reality.

Miracles and unexpected occurrences certainly have their place in both *kalām* and the Copenhagen worldview. The key difference is that miracles—or what are considered out-of-the-ordinary occurrences—happen far more frequently in the quantum realm than within the *kalām* framework of the world. Take quantum tunneling, for example. For an electron to penetrate an energy barrier high enough to be deemed insurmountable and impenetrable is quite a "miracle." Yet, this phenomenon occurs with such regularity that modern technologies, such as the Scanning Tunneling Microscope and various electronic devices, have greatly benefited from its application (a macro-scale analogy would be a tennis ball miraculously passing through a brick wall). In the Sunnī understanding, anyone who can harness miracles at will on a regular basis—save for a few exceptions, most notably Prophet Sulaymān—is most likely practicing *siḥr* (sorcery).

Conclusion: Can We Make a Case for Epistemic Indeterminism in *Kalām*?

I would argue that it is possible, as there remains some room for it. Recall that the first type of indeterminism described by Ian Barbour is epistemic and subjective in nature. This form of indeterminism arises due to the incompleteness of our theories and our ignorance of certain factors—or "hidden variables," as David Bohm described them. Now, consider the epistemological position in *kalām*. The *mutakallimūn* acknowledge that not everything can be known. There are simply too many factors at play in natural occurrences. Furthermore, the *mutakallimūn*—particularly those following Fakhr al-Dīn al-Rāzī's (544–606 AH/1150–1210 CE) line of thought—concede that the true nature or essence of things cannot be grasped through normal epistemological means.[58] They could, therefore, accept concepts such as hidden variables. However, unlike dogmatic realists who believe that either a *theory of everything* can be devised or that time will eventually unravel all the mysteries of the universe, the Ashʿarites, with their epistemological humility, would likely contend that some hidden variables will remain forever unknown in this world. This perspective could potentially represent the epistemic indeterminism of *kalām*, though the claim is weaker compared to its ontological counterpart. As with some of the other comparisons, further investigation is required.

58. See Bilal Ibrahim, "Fahr ad-Din ar-Razi, Ibn al-Haytam and Aristotelian Science: Essentialism versus Phenomenalism in Post-Classical Islamic Thought," *Oriens* 41 (2013): 417–426; Recep Erkmen, "Fakhr Al-Dīn Al-Rāzī: The Problem of Knowledge and Metaphysical Skepticism," PhD thesis (Bloomington: Indiana University, 2022).

I have demonstrated that, despite the similarities between *kalām* and quantum mechanics, there are fundamental differences that must be acknowledged—differences that inevitably stem from distinct motivations and worldviews. While *kalām* embraces indeterminism to affirm the centrality of God in His creation, even at the smallest scale, quantum indeterminism emerged as a response to perplexing discoveries that could not be satisfactorily explained within the classical framework. Moreover, I have also shown that a more extensive engagement with the *kalām* tradition—including foundational *kalām* concepts such as existence, reality, essence, necessity, and possibility—could generate even richer discussions. Ideally, greater involvement of *turāth* in engaging with scientific and philosophical ideas will lead to more meaningful and measured intellectual discourse in the future.

References

Abu-Sway, Mustafa. *Al-Ghazzaliyy: A Study in Islamic Epistemology*. Kuala Lumpur: Dewan Bahasa dan Pustaka, 1996.

Akdoğan, Cemil. *Science in Islam and the West*. Kuala Lumpur: ISTAC-IIUM, 2008.

Altaie, Muhammad Basil. *God, Nature & the Cause: Essays on Islam and Science*. US: Kalam Research & Media, 2016.

_______ "Daqiq al-Kalam: A Basis for an Islamic Philosophy of Science." *CMC Papers* no. 4 (2015).

Baggott, Jim. *The Quantum Story: A History in 40 Moments*. Oxford: Oxford University Press, 2011.

Davies, Paul. *The Mind of God: The Scientific Basis for a Rational World*. New York: Simon & Schuster, 1992.

Erkmen, Recep. "Fakhr al-Dīn al-Rāzī: The Problem of Knowledge and Metaphysical Skepticism." PhD diss., Indiana University, 2022.

Gleiser, Marcelo. *The Island of Knowledge: The Limits of Science and the Search for Meaning*. New York: Basic Books, 2014.

Hamid Fahmi Zarkasyi. *Al-Ghazali's Concept of Causality*. Kuala Lumpur: IIUM Press, 2010.

Harding, Karen. "Causality Then and Now: Al-Ghazali and Quantum Theory." *The American Journal for Islamic Social Sciences* 10, no. 3 (1993): 165–177.

Hasan, Moiz. "Foundations of Science in the Post-Classical Islamic Era: The Philosophical, Historical, and Historiographical Significance of Sayyid al-Sharīf al-Jurjānī's (d. 1413) Project." PhD thesis, Notre Dame: University of Notre Dame, 2017.

Heisenberg, Werner. *Physics and Philosophy: The Revolution in Modern Science*. London: George Allen and Unwin Ltd, 1958.

Ibrahim, Bilal. "Fahr ad-Din ar-Razi, Ibn al-Haytam and Aristotelian Science: Essentialism versus Phenomenalism in Post-Classical Islamic Thought." *Oriens* 41 (2013): 379–473.

Kaş, Murat. "Mental Existence Debates in the Post-Classical Period of Islamic Philosophy: Problems of the Category and Essence of Knowledge." *Nazariyat* 4, no. 3 (2018): 49–84.

Leclerc, Ivor. *The Nature of Physical Existence*. Edited by H.D. Lewis. London: George Allen & Unwin Ltd, 1972.

Mohd. Zaidi Ismail. *Existence and Quiddity in the Later Ash'arite* Kalām*: A Study on al-Ījī's* al-Mawāqif *and al-Jurjānī's* Sharḥ al-Mawāqif. Putrajaya: Islamic & Strategic Studies Institute (ISSI), Kalam Research & Media (KRM), and Ta'dib International, 2017.

Osman Bakar. *Tawhid and Science: Islamic Perspective on Religion and Science*. Arah Publications, 2008.

Pais, Abraham. *Niels Bohr's Times: In Physics, Philosophy and Polity.* New York: Oxford University Press Inc., 1991.

Rae, Alastair. *Quantum Physics: Illusion or Reality?* 2nd ed. Cambridge: Cambridge University Press, 2004.

Rovelli, Carlo. *Reality Is Not What It Seems: The Journey to Quantum Gravity.* Translated by Simon Cornell and Erica Segre. UK: Allen Lane, 2016.

Susskind, Leonard, and Art Friedman. *Quantum Mechanics: The Theoretical Minimum*. London: Penguin Books, 2014.

Sway, Mustafa Abu. *Al-Ghazzaliyy: A Study in Islamic Epistemology*. Kuala Lumpur: Dewan Bahasa dan Pustaka, 1996.

Al-Taftazānī, Saʿd al-Dīn. *Sharḥ al-ʿAqāʾid al-Nasafiyyah (Huraian al-Aqaid al-Nasafiyyah)*. Translated by Mohamad Hilmi Marjunit, Anwar Yusof, and Farhan Affandi. Kuala Lumpur: Inisiatif Buku Darul Ehsan (IBDE), 2017.

Taslaman, Caner. "Determinism, Indeterminism, Quantum Theory, and Divine Action." *M.Ü. Ilahiyat Fakültesi Dergisi* 32, no. 1 (2007): 157–182.

Üçer, Ibrahim H. "Realism Transformed: The Ontology of Universals in Avicennan Philosophy and Quṭb al-Dīn al-Rāzī's Theory of Mental Exemplars." *Nazariyat* 6, no. 2 (2020): 23–68.

van Strien, Marij. "Was Physics Ever Deterministic? The Historical Basis of Determinism and the Image of Classical Physics." *The European Physical Journal H* 46 (2021): 8.