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Quantum Divine Action in Quantum-Time Perspective

Kuantum-Zaman Perspektifinden Kuantum İlahi Eylem

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Abstract

This article is intended to present my response to an article by Hakan Turan recently translated to English and published in Kader (Kader 22/2, 435-464). The discussion is centered on my proposal for Divine action. Here I try to answer some good questions raised by Turan and provide a wider scope of my theory on re-creation of quantum state upon which the model for divine action is based. The elaborations include perspectives of the quantum-time measurement which is very essential for clarifying the views and resting the foundation of the model. This presentation will resolve several questions related to the original proposal which utilizes the re-creation mechanism. Here I introduce quantum time measured by a quantum clock in concise description. This is a recent development taking place during the last ten years by physicists who are seeking merging relativity theory and quantum mechanics. Quantum time measure is an important complement for the re-creation hypothesis serving the construction of a model for quantum divine action. Time in this measure is discrete and is represented by a dynamical operator acting on the temporal states of the clock, which are entangled with the quantum states of the system. Beside this quantum time measurement aligns perfectly with the concept of discrete time devised by the Mutakallimūn which comes under the principles of Daqīq al-Kalām.

Keywords: Kalam, Divine Action, Quantum, Quantum-Time, Daqiq al-Kalam.

Öz

Bu makale, Hakan Turan'ın yakın zamanda İngilizceye çevrilen ve Kader'de (Kader 22/2, 435-464) yayınlanan makalesine cevabımı sunmayı amaçlamaktadır. Tartışma benim İlahi eylem ile ilgili teklifim üzerine odaklanmaktadır. Burada Turan tarafından ortaya atılan bazı iyi soruları yanıtlamaya ve ilahi eylem modelinin dayandığı kuantum durumunun yeniden yaratılmasına ilişkin teorimi daha geniş bir kapsamda sunmaya çalışıyorum. Açıklamalar, görüşleri netleştirmek ve modelin temelini sağlamlaştırmak için çok önemli olan kuantum-zaman ölçümü perspektiflerini içermektedir. Bu sunum, yeniden yaratma mekanizmasını kullanan orijinal öneriyle ilgili çeşitli sorunları çözüme kavuşturacaktır. Burada bir kuantum saati tarafından ölçülen kuantum zamanını kısa ve öz bir şekilde tanıtıyorum. Bu, görelilik kuramı ile kuantum mekaniğini birleştirmeye çalışan fizikçiler tarafından son on yılda elde edilmiş yeni bir gelişmedir. Kuantum zaman ölçüsü, kuantum ilahi eylem için bir modelin inşasına hizmet eden yeniden yaratma hipotezi için önemli bir tamamlayıcıdır. Bu ölçümde zaman süreksizdir ve sistemin kuantum durumlarıyla dolaşık olan saatin zamansal durumları üzerinde etkili dinamik bir operatör tarafından temsil edilir. Bunun yanı sıra, bu kuantum zaman ölçümü Mütekellimler tarafından tasarlanan ve Dakîku'l-Kelâm ilkeleri arasında yer alan süreksiz zaman kavramıyla mükemmel bir uyum içindedir.

Anahtar Kelimeler: Kelam, İlahi Eylem, Kuantum, Kuantum-Zaman, Dakiku'l-kelam.

Introduction

Several models are available for divine action in the world.[1] The model I propose here is a further development of an earlier one which utilizes the principle of re-creation. This principle was originally proposed by early Muslim theologians (the Mutakallimūn) and has been presented in several publications[2] The early mutakallimūn did not specify details of the re-creation process

[1] For detailed study of the Christian view see: C. Lameter, *Divine action in the framework of scientific knowledge: From quantum theory to divine action* (Fuller Theological Seminary, School of Theology, 2004).

[2] M. B. Altaie, "The Scientific Value of Dakik al-Kalam", *Islamic Thought and Scientific Creativity* 5/2 (1994), 7-18; Basil Altaie, "Re-Creation: A Possible Interpretation of Quantum Indeterminism", *Matter and Meaning*, edited by Michael Fuller (Newcastle upon Tyne: Cambridge Scholar Publishing, 2010), 21–37; Basil Altaie, "God, Nature and the Cause", *Essays on Islam and Science* (Abu Dhabi: Kalam Research and Media, 2016); Basil Altaie, *Islam & Natural Philosophy* (Oldham: Beacon Books, 2023).

other than saying that the transients (accidents) are under continuous change and that no transient stays two instants of time. I found that this principle resonates conceptually with the foundation of quantum mechanics. Therefore, I tried to utilize it on two levels: theological level where I propose a model for quantum divine action, explaining how the divine may interact with the world, and on a scientific physical level where I suggest that this principle has the potential of solving the fundamental problem of measurement in quantum mechanics. In my presentation of the hypothesis of re-creation I postulate that physical observables of the quantum state are under continued re-creation at a rate proportional to the total energy of that state. Such a postulate is based on Max Planck's relationship for the quantization of thermal radiation. Since the re-creation rate is extremely high for macroscopic systems, many features of macroscopic (classical) systems are regained including objectivity while maintaining the quantum features of the microscopic systems.

Hakan Turan thoroughly analyzed and discussed my proposal in his excellent work[3]. Assessing my proposal, Turan raised several important questions which need to be answered. In this article I present my response to those questions using this opportunity to present some unpublished material extending my model for divine action to include other recent discoveries of theoretical physics, reinforcing the model and enhancing it to become a full-fledged theory of the temporal development in nature. In this respect some mathematical symbols and physics concepts were unavoidable, as it is necessary to clarify the ideas behind those new ingredients incorporated with the basic re-creation hypothesis to construct the full picture of divine action in a self-consistent theory. In what follows I will present those discoveries, as much as I can, in a simplified mathematical and physical context, to move later to the second part of this article in which I respond to some important questions raised by Hakan Turan.

1. The problem of Time

The concept of time has long been the focus of both philosophical reflection and physical evaluation. According to Aristotle, time is a counter of changes and thus a measure of motion[4]. Time does not exist if there is no change; in other words, time exists whenever events happen. According to Aristotle, psychological time is a type of change that occurs within us even in absence of external change. Thus, the realm in which time is realized through our consciousness, is made up of space, motion, and matter. According to this perspective, time was believed to exist forever since the universe was believed to be eternal and without origin.

An alternative view of time was put out by the Algerian Christian philosopher and theologian St. Augustine of Hippo (356-430 C.E.), who assumed that the universe had a beginning. He acknowledged that time did not exist prior to the birth of the universe, even though he considered

[3] Hakan Turan, "The Kalām-based Continuous Re-creation Approach of Basil Altaie Compared to Quantum Divine Action Models from Christian Contexts", trans. Hakan Turan. *Kader* 22/2 (Aralık 2024), 435-464.

[4] Aristotle, *Physics*, trans. Robin Waterfield with an introduction and notes by David Bostock (Oxford: Oxford University Press, 1999), 105.

time in relation to events as it was in the Aristotelean notion. He provides a beautiful and profound explanation of eternity in his work "Confessions"[5].

The Muslim philosopher and theologian Abu Hamid Al-Ghazali (1058–1111 C.E.) expanded on the idea that time is connected to the occurrence of events. He shared Augustine's belief that time marked the beginning of the universe. Al-Ghazali also urged that space and time be treated equally, acknowledging that the "time extension," as he dubbed it, ought to be handled similarly to the space extension. According to him: "In a similar vein, it will be stated that temporal extension is a concomitant of motion, just as spatial extension is a concomitant of body."[6] According to Al-Ghazali, there is no *before* or *after* other than in relation to another reference; time can only be identified in relation to other events[7].

Traditionally physicists invented a scale indicating the chronological order of events. Such a scale, which was taken in reference to the astronomical ephemeris, was adopted by Issac Newton in developing his mechanics and the theory of gravity and is called *coordinate time*. This reference of time is external and independent of the dynamics of the physical systems. It is the time which is measured by conventional clocks. However, this linear scale-time is conceptually incompatible with the theory of relativity in which time measurement depends on the frame of reference of the observer. This Newtonian time is adopted in standard quantum mechanics and, besides this, despite that all dynamical observables in quantum mechanics have corresponding operators, time in quantum mechanics is usually taken as a parameter. Physicists found that there is a need to develop the theory of gravity as presented by Albert Einstein in his theory of general relativity in which time is not linear and depends on the frame of reference of the observer. Having the coordinate-time being a continuous parameter, it is hard to see how it can be associated with the long-sought quantization of gravity. Time and gravity are intimately associated with each other. In the general relativistic description, gravity is described by the curved time[8].

A complete theory of physics requires merging relativity and quantum mechanics to enable considering microscopic systems with gravity acting at very short distances properly. This means that a theory of quantum gravity requires that the measurement of time follows a profoundly different scheme. Several attempts have been made during the last forty years to quantize gravity and most were unsuccessful. Yet recently, some physicists succeeded in spotting the essential point which makes the merging of relativity theory and quantum mechanics and possibly formulating an approach to quantum gravity. This is a time which needs to be treated as a quantum-mechanical observable.

An observable in quantum mechanics is the result of a mathematical *operator* acting on the *wavefunction*, say $\psi(x, y, z, t)$ which is a mathematical symbol representing the physical system and containing all the physical information about the system. The result of an operator acting on

5 Augustine, *Confessions*, trans. R. S. Pine-Coffin (Harmondsworth Middlesex: Penguin Books, Book XI, 1961), 398.

6 Al-Ghazālī, *The Incoherence of the Philosophers*, trans. Michael Marmura, (Utah: Brigham Young University Press, 2000), 33.

7 More details about al-Ghazālī's views on time and the universe can be found in my recently published book Basil Altaie, *Natural Philosophy of Imam al-Ghazālī*, (Penang Malaysia: Baytul Hikma, 2025).

8 Kip S. Thorne - Charles W. Misner and John Archibald Wheeler, *Gravitation* (San Francisco: Freeman, 2000).

a wave function is in effecting a transition. For example, transition in space is effected by the operator of linear-momentum and the angular momentum operator effects rotation. The energy operator (called the Hamiltonian) effects translation in time, so that if you make transitions in time would produce energy. Energy and momentum are called *dynamical observables*, that emerge as a result of the act of an operator on the wavefunction. Formulating time as an operator is one of the most fundamental outstanding problems in standard quantum mechanics.

From a theological perspective a fundamental problem with most of the proposed models for the divine action is rooted in understanding time. Several problems emerging in such models might be solved once we deal properly with *natural time* which is part of the dynamics of physical systems. For example, according to the basic Islamic creed the world is deterministic in the knowledge of God, He knows the past, the present and the future, while quantum mechanics shows that it is indeterministic. Furthermore, events in the world are unfolding for us sequentially the future is unknown to us and we get knowledge about it as events unfolds.

It is important to remark here that my approach in correlating science and theology stems from the basic Islamic belief that God has formed this world to obey certain decreed laws that we call Laws of Nature which get to be discovered, at least in approximate forms, and are expressed according to our mental comprehension and them Laws of physics[9].

The intrinsic measure of time can solve such many problems and resolve contradictions both in the theological belief and in physics. Such a measure of time makes it an emergent observable that is intimately correlated with the energy states of the system. This correlation is required since we know that the Hamiltonian is the drivers of the time-development of quantum systems according to the Schrödinger equation. Effectively, this equation tells us that the rate of change of a wavefunction is proportional to the Hamiltonian acting on the wave function. It is the most basic equation in quantum mechanics.

2. Quantum Time

According to quantum mechanics, the energy of a system is the sole driver of its temporal development. Primarily this aligns perfectly with the basic assumption that the state of the physical system is under continued re-creation at a rate proportional to its energy. For this reason, some physicists realized that two steps are necessary for qualifying time to become a full quantum-relativistic observable. First, they must construct an operator of time associated with time-states and, second it would be necessary to have time as an emergent observable associated with the dynamics of the physical system, with relativistic features compatible with both quantum mechanics and relativity theory. For this goal physicists based their works on a formulation which was suggested by Don Page and William Wootters[10] in 1982. This formulation was not clear enough when proposed but was further developed and qualified during the last ten

[9] This point is explained in details in the second edition of my book Basil Altaie, *God, Nature and the Cause*, (U.K.: Beacon Books, 2025).

[10] Don N. Page - W.K. Wootters, "Evolution without evolution: Dynamics described by stationary observables" *Physical Review* 27/12 2885 (1983).

years through the extensive works of Giovanetti et. al.[11], Leon and Maccone[12], Smith and Ahmadi[13], Marletto and Vedral[14], Maccone and Sacha[15] with further development by Favalli and Smerzi[16]. The basic idea is to refer the measurement of time to a *quantum clock* that is made to be part of a global system (called the universe) which includes the quantum system and the clock. The global system is represented by a Global wavefunction $|\Psi>$ composed of the direct product of the states of the clock and the states of the physical system under consideration. Changes in the energy states of the system are correlated (entangled) with the temporal transitions of the clock. Accordingly, time is no longer get measured with reference to an external and independent clock, but becomes an intrinsic dynamic observable part of the *universe*. By this reformulation of the reference of time physicists were able to formulate it as an operator acting on the states of the quantum clock. Several other physicists tried to elaborate on the relativistic features of the quantum time showing how time get dilated in quantum relativistic systems.[17] Favali and Smerzi[18] went further to expose how quantum time formulated according to the prescription suggested by Pegg[19] get dilated by gravity and tried to build a quantum spacetime based on that formulation. A full review of this topic is available.[20]

2.1. Quantum Time in physical context

In all the above formulations time is measured by a quantum clock with its states being entangled with the states of the physical system. In mathematical language we say that the Hamiltonian of the universe is the sum of the clock Hamiltonian and the Hamiltonian of the physical system.

To merge relativity with quantum mechanics John Wheeler and Bryce Dewitt modified Schrödinger's equation and applied it to the whole universe. It is known that the main feature of the universe in general relativity is being closed, has no outside, and is called *block-universe*. In such a universe the past, present and future all exist, but different observers live different times. In such a universe the dynamics is driven internally by energy and time development of the states, in addition to having time measured intrinsically with the relativistic features (measurements becoming observer-dependent).

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11 V. Giovannetti - S. Lloyd, and L. Maccone, "Quantum time", *Physical Review* 92/4 (2015).

12 J. Leon - L. Maccone, "The Pauli Objection", *Foundations of Physics* 47/1597-1608 (2017).

13 A. Smith - M. Ahmadi, "Quantizing time: interacting clocks and systems", *Quantum* 3/160 (2019).

14 C. Marletto - V. Vlatko, "Evolution without evolution and without ambiguities", *Physical Review* 95/4 (2017).

15 L. Maccone - K. Sacha "Quantum measurements of time", *Physical Review Letters* 124/11 (2020).

16 T. Favalli - A. Smerzi, "Time observables in a timeless universe", *Quantum* 4/354 (2020).

17 Alexander RH Smith - Mehdi Ahmadi, "Quantum clocks observe classical and quantum time dilation", *Nature Communications* 11/1 5360 (2020).

18 T. Favalli - A. Smerzi, "Time dilation of quantum clocks in a Newtonian gravitational field" (2023).

19 D. T. Pegg, Phys. Rev. A 58, 4307, (1998).

20 M. Basil Altaie - Daniel Hodgson and Almut Beige, "Time and quantum clocks: A review of recent developments", *Frontiers in Physics* 10/897305 (2022).

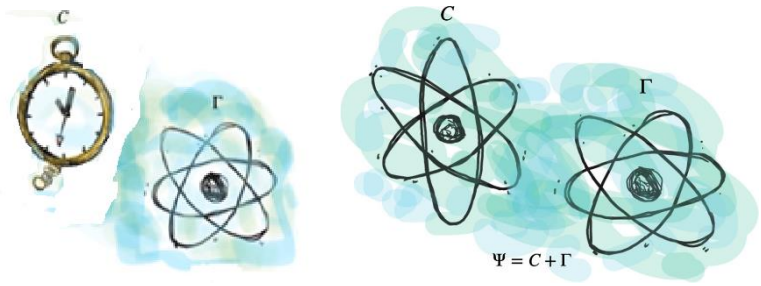

Figure (1) Left: shows a classical clock C measuring time-development of a quantum system Γ. Right depicts a quantum clock entangled with the quantum system forming a "universe" described by the global wavefunction Ψ=C+Γ. The figure is a slight modification of the original presented in Ref. (25).

If the universe is composed from the physical systems and the clock, then the total Hamiltonian is the sum of the system's Hamiltonians and the clock Hamiltonian. This global Hamiltonian acting on the global wavefunction of the universe must be zero ($H|\Psi^{>}=0$). This is called the Wheeler-DeWitt equation. When applied to the whole universe, it implies that the mass-energy of all constituents of the universe equals the gravitational energy between those constituents. This is one argument for claiming that the universe was created from nothing[21].

Employing this equation in the formulation of time based on the Page-Wootters formulation the quantum states of the universe will be a sequence of stationary states (states stationed in their positions in space and or in time) engulfed by the global wavefunction $|\Psi^{>}$ which is a solution of the Wheeler-DeWitt equation. Foti et. al., presented a nice discussion of the concepts involved in the Page-Wootters proposal trying to show that there is not a "quantum time", possibly opposed to a "classical" one; there is only one time, and it is a manifestation of entanglement .[22] Such a conjecture might be feasible, but here we present the basic arrangement as proposed by Page and Wootters, not to confuse the reader with technical matters.

For the block-universe we have two different observers. One who is inside the universe, who experiences the time-development of the states of physical systems and consequently recognizes the causal sequence of change when states make transitions. Having the states of the physical system and the clock within the universe subjected quantum uncertainty according to Heisenberg's relations, the states will have indeterministic status when viewed by this internal observer since.

The other observer is a *hypothetical* one and is considered hypothetical since no physical observer is allowed outside a block universe. Yet, in the quantum time formulation it is allowed to assess the status of the states engulfed by eternity. For this hypothetical observer, all the states are stationary appearing as 3d-holograms and existing at once; past, present and future. Time has no distinct meaning for him but may recognize the difference between the states and consequently,

21 Lawrence M. A Krauss, *Universe from Nothing: Why there is something rather than nothing* (Simon and Schuster, 2012).

22 Caterina Foti - Coppo Alessandro Coppo - Barni Giulio - Alessandro Cuccoli and Paola Verrucchi, "Time and classical equations of motion from quantum entanglement via the Page and Wootters mechanism with generalized coherent states" *Nature communications* 12/1 1787 (2021).

may reckon that time sequence exists (see Fig. 2). The available literature does not provide much detail in this respect.

Having the states of the universe being stationary, the global state $|\Psi>$ is composed of a sum of all the states of the system which are the direct product of the states of the clock and the states of the physical system. Obviously, the time dependence is accounted for by the states of the clock, while the states of the system are stationary having allocated by their *conditional probabilities* which allocates the states entangled (correlated) with time marked the quantum clock. The time development of the states of the physical system happens as the system goes through the available states. At any moment t_0 the internal observer sees any event because of the projection of the global wavefunction $|\Psi>$ onto the time state at of the clock t_0. Symbolically, this is represented as $< t_0 \ |\Psi>$.

In such a block-universe all the time, the past, present and the future are all there. The observer inside the universe sees the time development of the states inside the universe as he observes it happening as it is a three-dimensional holographic movie (see Fig. 2 depicting a 2-d projection). For him the *present* is what hesees and feels, the *past* is what has passed out, for which he may keep a memory, and the *future* is what is expected to happen ahead. On the other hand, a hypothetical observer outside the universe sees all states (events) at once in one pot. For this hypothetical observer, all states are deterministic, and all events occur deterministically.

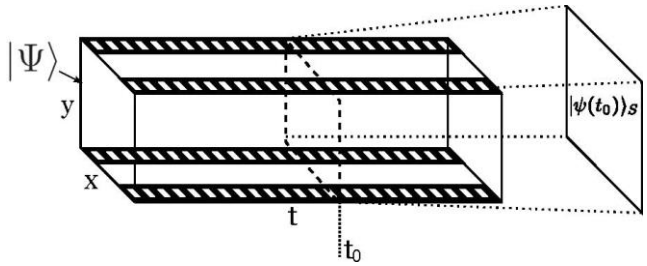

Fig. (2) stationary states of the clock engulfed in eternity (modified from ref. 5)

The theory currently is incomplete, but discoveries are going ahead, and the theoretical composition is progressing while experimental tests are also being proposed. We know that once this observer knows the dynamic of the system, he can predict the happenstance of the next event with some associated probability. However, it is not clear what determines the occurrence of events. Yes, it is logical to expect that the state with the highest probability to occur most, nevertheless we may have some low probability event occurring too. This indeterminism experienced by the internal observer can be explained by standard quantum mechanics.

In view of the classical and the quantum realms limits it means that the hypothetical external observer is finding events inside the universe behaving classically, whereas the observer inside the universe find the events indeterministic and follow quantum rules. Here the problem of the border between the classical and the quantum world arises. Smith and Ahmadi[23] (2020) presented the evolution of the system entangled with the states of the clock and extended the conditional

[23] Alexander RH Smith - Mehdi Ahmadi. "Quantizing time: interacting clocks and systems", *Quantum* 3/160 (2019).

probability to allow for the clock and the system to interact. Figure (3) depicts such tracking of the evolution of the system. Now, since states coming out from the superposition state represented by the global wavefunction $|\Psi^{>}$ are not equally probable, they need a determinant. Standard quantum mechanics does not tell us what that determinant is. However, such a determinant could be assumed to be some form of superselection.

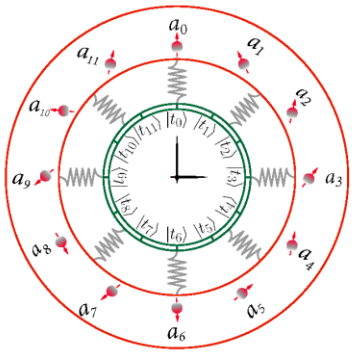

Fig (3) The quantum clock states entangled with system's states and are correlated with occurrence of events. (Ref. 25)

2.2. Quantum time in the theological context

Einstein's theory of general relativity suggested a Block Universe which has no outside. Such a universe contains all the space and time that is available. The physical description of time in a block universe at present might not provide us with the full story of the relationship between divine action and time. However, some features of this proposal are intriguing indeed, and mind provoking.

If we look at fig. (2) and fig. (3) above, we find that events are occurring according to their destined probabilities or conditional probabilities as described in mathematical terms. However, since there are many possible solutions for the state of a physical system we need to consider them in a process of re-creation. Each frame shown along the timeline represents a possible solution which is contingency for the event. These frames are packed up and get unfolded during the development of time.

An observer inside the universe sees events happening in a causal sequence, only past and present are determined while the future, although predictable, but nowhere is determined. Such an internal observer certainly thinks that he enjoys free-will and the indeterminacy of his world may make him think that nature has free will too. The internal observer finds that the events are indeterministic but can be predicted probabilistically. Yet, the case is different on the global level.

A hypothetical external observer sees all events occurring deterministically without reference to time, but according to their configurational status. For this observer, past present and future are all in front of his eye. As such one is strongly tempted to suggest that this external hypothetical observer itself determines the occurrence of all events inside the universe someway or another through his consciousness.

Here I can visualize an analogy by suggesting a thought experiment. Let us imagine large number of pianos located in a grand hall. All the pianos are playing the same symphony but with a lag in between. An observer outside the hall sees what keys are played in each specific piano and he also knows which keys the other pianos will play the next moment. For him all the events take place deterministically. But wouldn't it be reasonable to conclude that such an external observer himself is determining the play of all the pianos in the grand hall?

Pierre Laplace imagined a super-intelligence that can see the world deterministic, he says:

> *An intelligence knowing all the forces acting in nature at a given instant, as well as the momentary positions of all things in the universe, would be able to comprehend in one single formula the motions of the largest bodies as well as the lightest atoms in the world, provided that its intellect were sufficiently powerful to subject all data to analysis; to it nothing would be uncertain, the future as well as the past would be present to its eyes.*[24]

This paragraph is perhaps the best description in physics for the deterministic structure of classical mechanics. As one can easily notice, determinism requires knowing all the forces acting in nature and the momentary positions of all things in the universe, something that cannot be granted in quantum mechanics. However, taking the possibility of such knowledge as an assumption, one can see that Laplace is pointing to a *superbeing* that is "sufficiently powerful to subject all data to analysis; to it nothing would be uncertain, the future as well as the past would be present to its eyes". This affirmation underlays a kind of metaphysical speculation over the presence of such an omniscient entity. Yet, admittedly, divine action was not in Laplace's belief as we know.

2.3. Superdeterminism or Superselection

Superdeterminism is a concept aiming at resolving the problem of measurement in quantum mechanics where there is a conflict between the measurement process which is non-linear and the original equation of motion (Schrödinger's equation) which is linear.[25]

It suggests that there is no Statistical Independence between the measurer and the systems being measured. By positing that all systems are correlated with the choices of measurements, superdeterminism provides a potential loophole in the arguments against hidden variables in quantum mechanics suggesting that everything in the universe may be predetermined. This raises the question of free will.

The proposal of superdeterminism faced several objections from physicists, the most important of which is the argument that superdeterminism cannot faithfully reproduce the predictions quantum mechanics in all circumstances. Landsman argued that to reproduce quantum mechanics requires true randomness and this means that the theory cannot be deterministic.[26]

Physicists Sabine Hossenfelder made a good effort to explain and discuss the confusion and problems associated with superdeterminism and in collaboration with Tim Palmer argued that

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[24] Rouse Ball - Walter W., "Pierre Simon Laplace (1749–1827)", *A Short Account of the History of Mathematics* 4th ed. (New York: Dover Publications, 2003).

[25] S. Hossenfelder, Superdeterminism: A guide for the perplexed, (2020).

[26] K. Landsman, "Randomness? What Randomness?", *Foundations of physics* 50 (2020), 61-104.

superdeterminism "is a promising approach not only to solve the measurement problem, but also to understand the apparent non-locality of quantum physics".[27]

The conditional probability adopted by quantum time-measurement formulation limits the probability of having an observable with a given value occurring at a specific moment of time. By such an assumption we are saying that the measured value of the observable is correlated with the time of measurement. This implies a superselection which brings up physics to be effectively ruled through a kind of transcendental agency. This assumption is imposed in the theory as we don't clearly understand the motive behand choosing certain value for the physical observable at a specific moment of time under measurement rather than another. Incidentally, the Copenhagen school lead by Niels Bohr and Werner Heisenberg assumes the concept of wavefunction collapse, by which the state of the system falls on one of the possible states and consequently an observable takes the assigned value. Physicists call the assumption of the collapse of states metaphysical without assigning a source for it, yet some authors believe that the collapse of the wave function has a metaphysical connection of some sort. For instance, David Chalmers and Kelvin McQueen[28] have explored the relationship between consciousness and the collapse of the wavefunction, suggesting that the notion of "measurement" in quantum mechanics is vague and anthropocentric. This view implies that collapse is not purely a physical process but involves metaphysical considerations. Other works present a similar stand on physical basis[29].

Recently, Bass and Le Behan have criticized superdeterminism arguing that that the view requires a neo-Humean account of at least some laws, and creates a significant problem for the use of statistical independence in other parts of physics and science more generally.[30]

A better realization of determinism/indeterminism can be achieved by adopting a block universe with quantum time measurement inside which physical systems are under continued re-creation. In this case we have two perspectives: one which is experienced by an external hypothetical observer in which all events, past, present and future are available in no time (as stationary states), the external observer lives in no time. The other perspective is what the internal observer in a block universe sees, where only events that have passed and those at present are known to him. As time passes events in the future unfold. Such events can be predicted with some probability but never determined; the world as seen by the internal observer is indeterministic. This is the picture we get from the quantum time formulation. Superselection comes in this context upon the occurrence of an event out of different possibilities with different probabilities. Such selection which implies superdeterminism too but in a different perspective. This is the reason why I choose the term *superselection* when expressing the status from the perspective of the internal observer while not objecting to using the term *superdeterminism* when looking from

27 Sabine Hossenfelder - Tim Palmer, "Rethinking Superdeterminism", *Frontiers in Physics* 8/139 (2020).

28 David J. Chalmers - Kelvin J. McQueen, "Consciousness and the collapse of the wave function" (2021).

29 Ney - Alyssa and David Z Albert (eds), *The Wave Function: Essays on the Metaphysics of Quantum Mechanics* (Oxford Academic, 23 May 2013).

30 A. Baas - B. Le Bihan, "What does the world look like according to superdeterminism?", The *British Journal for the Philosophy of Science* 74/3 (2023), 555-572.

the perspective of the hypothetical external observer. I hope the reader will be able to appreciate the theological implications of such a picture.

3. The Re-creation Proposal

About fifteen years[31] ago I proposed that the problem of measurement in quantum mechanics besides the question of free will and resolving the dilemma of determinism and indeterminism could be solved by proposing that physical systems are under continued re-creation at a rate proportional to their total energy.[32] As such macroscopic systems will behave almost classically because of their very high rate of re-creation while microscopic systems like atomic and subatomic particles behave quantum mechanically. This proposal can resolve several fundamental problems in quantum mechanics and predict others. Furthermore, the re-creation process can explain the wave-particle duality, which is fundamental for nonlocality and can explain quantum entanglement and other quantum phenomena. In this article I will not go any further in presenting the detailed formulations of the re-creation process, as such formulation gets involved in many technical and mathematical details which are out of the scope of this article. However, if we associate the quantum time measurement with re-creation it would be easy then to see that the two perspectives presented in the previous section get realized.

4. Response to Turan's Questions

Now I turn to comment on some of the fundamental questions raised by Turan in his article cited above.

4.1. On Special Divine Action

Historic Salvation, Miracles, Fulfilment of prayers. All four are allowed in a general framework of the Divine providence. However, in my approach an outline of a theistic evolution is possible through the mechanism of superselection. An overview of this scheme is presented in my article cited below[33]. As for the miracles there are two types to be considered in this respect (a) events that are allowed to happen by the solutions of the equations of motion (laws of physics) irrespective of their probability provided that it is not zero, and (b) events which cannot be justified through natural processes (e.g., staff becoming a snake), such type of miracles are subject religious doctrines, rather than having an interpretation in natural sciences, and therefore might be subjected to some lingual or semantic interpretations. Incidentally, the Qur'ān has already alluded to some sort of psychological effects that produce illusion in the people and make them imagine the objects inanimate objects behaving like live characters (see for example verse 20:65-66) where Moses himself was deluded by the magicians. Metaphoric explanations for some miracles of this type are alluded to in the Qur'ān where in the case when Moses challenges the magicians of the Phero he thaws his stick, and it turns into a snake.

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31 See reference (3) above.

32 M. Basil. Altaie, "Re-Creation: A possible interpretation of quantum indeterminism", 2009.

33 M. Basil. Altaie, "The Quran and Evolution: on the creation and development of Humans", ResearchGate (2024).

Fulfilment of prayers take place in special cases when God accepts the prayer of a person. This has some conditions to be fulfilled. Within the same context falls the action of historical salvations. There, in the acceptance of prayers and salvation, can one see the divine *hand* more clearly.

Events that have the highest probability are the most expected to happen and these are the classical limit of the quantum system. At this point it is important to remind that in Islamic kalam laws of nature are called the *established habits* (mustaqar al-ʻāda), and since these established habits are indeterministic, therefore we may say that the miracles are breaching laws of nature in the classical sense. However, in the quantum model we need not say that miracles are breaking laws of nature, since they are basically described by contingent states of an extremely low probability. Such events therefore may happen naturally subject to conditional probability or superselection.

The way macroscopic effects resulting from microscopic quantum re-creation process is subject to the superselection taking place within the process of re-creation which usually has a very high rate. For example, this high rate of re-creation, 10^{22} Hz, allows a single electron to be thought of as passing through the two adjacent slits at the same time. Here I have an explanation for the confusing situation of a particle having to pass through two adjacent slits to build the interference patten seen on the screen.

4.2. On Scientific Realism

Events in the world on the microscopic level are indeterministic. This is what standard quantum physics tells us, and this is what the experiments have directly verified. So, there is no question that a modification of the theory will reinstall determinism without confirming some principles that have been verified experimentally, e.g., Bell's inequalities. Theories like Hidden variables or else have no future on this issue. However, if it is said that there are some indications that quantum mechanics is incomplete, then this is possible since there are unsolved paradoxes like the problem of Schrödinger's cat and EPR. Indeed, as we have seen above, introducing quantum time-measurement elucidates the possibility of merging relativity with quantum mechanics through having time-measurement correlated with changes of the physical system and be described by an intrinsic reference showed that several features of relativity theory merge with quantum features.

It is true after all that God does not play dice, but it is the world which is playing dice with us. Complementing quantum mechanics with quantum-time measurement resolves several paradoxes including the Schrödinger cat problem, the EPR and other problems once we bring in the picture the re-creation process and the superselection which is represented by the conditional probability. For example, quantum entanglement in EPR is a consequence of conservation of the phase of re-creation and need not imply a superluminal speed.

My model for divine action, which is based on the re-creation principle, utilizes quantum-time measurement and assumes the presence of superselection to be performed when choosing the events according to the respective conditional probability associated with quantum time formulation.

Somehow the external "hypothetical observer" proposed by quantum time formulation which, is assumed to be outside the block universe, is a hint for the divine presence in a scientific perspective. Accordingly, it is acceptable to say that my model is not concerned with theological or eschatological implications, therefore it does not necessarily subscribe to any religious faith, yet it can be understood as based on the principles of Islamic kalam in natural philosophy.

4.3. The Ontological Randomness

As for the question of the ontological randomness in quantum mechanics, the model suggests that re-creating observables at extremely high rate would exhibit a classical behavior of the system. For macroscopic systems the rate of re-creation (their total energy divided by Planck's constant) is extremely high and, therefore, shows deterministic classical behavior. Since our model suggests that the value obtained upon measuring an observable is always the temporal statistical average of that observable taken over the duration of the measurement, accordingly randomness is ontic since the process of re-creating states produces wide spectrum of values for the observable, but in each case a *superselection* intervenes randomly, as it appears to us, to produce the measured result. This is what al-Ghazālī may have meant by the concept of "preponderance".[34] This superselection is expressed as the conditional probability when quantum time is adopted. So, the calculated probability for each possible state indicates the recurrence of that value of the observable within the spectrum of all the possible values for that observable. This can be better understood by adopting the Heisenberg picture in which operators are time dependent. Applying a quantum operator on a wave function results in producing an *eigenvalue* which is the physical observable. If we imagine a set of *creation operators* constructed according to the methodologies of quantum field theory acting on the wavefunction in discrete time counted with units of re-creation time t_r we get a spectrum of values for that observable within the duration of the measurement. The longer the duration is, the thinner the spectrum is and the nearer the average to the "*expectation value*".

The question is who is effecting the collapse of the wave function? In physics there is no precise answer, however we may say it is the measurement process, or the observer according to the Copenhagen naive interpretation. Yet, we need a determinant choosing at which value of the observable to embark upon by the collapse, otherwise the universe will be in chaos which is not the case. Therefore, we may say that actual randomness may exist in the microscopic world in one view or another, as we don't know what the intentions are of the preponderant (or the superselection), not necessarily in a teleological sense, yet we know that this randomness get smoothed out in the macroscopic world due to the extremely high re-creation rate.

4.4. The Objective Reality

As already remarked by Hakan Turan, the interpretation of quantum mechanics through re-creation reintroduces the concept of objective reality into the quantum world both before and during the measurement process. Further technical details can be found in ref. (2) cited above. The Heisenberg uncertainty principle emerges naturally from the process of re-creation because

[34] Al-Ghazālī, *Incoherence*, 23. Also see: Basil Altaie, *Islam & Natural Philosophy*, 89-93; Basil Altaie, *Natural Philosophy of Imam Al-Ghazālī*, 44-46 also Box 2 p.60-64.

of the entanglement between transitions into position space and momentum space. Once a position is re-created a momentum is generated and as the momentum gets re-created in the next moment a position is generated and so on. If unitarity is to be preserved, then this can be expressed as a commutation relation between the position and the momentum. Requiring that the unitarity is to be preserved under such a commutation leads to uncertainty relationship similar to that of Werner Heisenberg. Yet this conjecture needs to be justified through technical details possibly involving the Aharonov multiple-time measurements cited above.

4.5. On Human Free Will

This might be one of the most important questions to tackle. However, within the scope of the two perspectives produced by quantum-time measurement presented above, it would be straightforward to say while freewill exist from the perspective of the internal observers, such a fee will does not exist in the perspective of the external observer who sees the global status with all events are pre-determined. The internal observer sees the world as indeterministic and therefore free will is there. This aligns perfectly with standard quantum mechanics.

4.6. On Occasionalism

The stand on occasionalism in my model for the divine action has been mentioned in Turan's article several times, most important of which is the point where he recognizes my distinct position on occasionalism, and quotes what I have said during a webinar shared by Mehmet Bulgen and Nazif Muhtaroğlu. There I said "In occasionalism there is no clear role of the law. In my understanding of occasionalism, I say there is a law which is devised by the creator. The law is a set of causal relationships which occur regularly under specific conditions to expose a phenomenon. This stand I take it from the Qur'an where in several verses the creation of the heavens and the Earth is said to have been achieved with justice, for example: 'khalaqa assamāwāti wa l-arḍa bi-l-ḥaqq. Bi-l-ḥaqq', which that there must be a law." Indeed, here again I find that it is necessary to affirm this position which stems from the basis of daqīq al-kalām deriving its principles from the Qur'ān. On that occasion, Mukhtaroglu commented on my position saying, "It's a new modern form of occasionalism."

However, apart from the common understanding of Islamic occasionalism a more precise description of the act of the omnipotent God in a world of contingencies without sacrificing his sovereignty or break laws of nature, can be presented as quantum theory has demonstrated that the world is indeterministic, yet causal relationships remain valid. The argument which could be put forward for negating deterministic causality is that being indeterministic means that there is a choice to be made between contingent results. The question is: who is making such a choice? More precisely what is activating the given outcome among several possible outcomes? We certainly cannot assume that the one who is making the choice is a natural agency. Certainly not, since in such a case the outcome of that law will be indeterministic too. Consequently, the argument becomes circular. Therefore, the activator can only be a transcendent agent acting beyond space and time.

One may say that, as such, the role of the divine has been limited to the specific action of choosing between contingent (allowed) results. Yes, indeed but this role is very important as it would rule

all the events in the universe. Since the allowed possibilities for a given event are defined by the laws of physics, therefore, a superselection is taking place on choosing between the epistemic contingencies. Traditionally this is accounted for by divine will. the absolute will of the divine in this scope is confined within the allowed possibilities. This would make the concept more specific and get better definition. For example, the spin state of an electron could be either up or down. These are the two contingent states which he has created and out of which God may choose. One more limitation is that for each contingent state we have a well-defined probability, in most cases the event happens with the highest probability. Accordingly, one may say that God is forced to follow certain pattern of actions by which he mostly chooses the result with the highest probability. This means that the ability of God is limited and that he is confined to act within certain algorithms within natural systems. This limits the omnipotence of God, consequently, it might then be against the religious belief that God is free to do whatever he may will.

The resolution of the above dilemma is to say that God has created all the universe to work according to laws that he respects. These are the laws of nature decreed to play over the contingent possibilities or chances. The indeterministic nature of these laws requires a determinant or preponderant. So, while the divine has the full power to choose from the contingencies, he abides himself with the laws generating those contingencies. Here comes the play between the divine transcendence and the providence.

The concept "Occasionalism" as presented in the traditional literature may have become a classical monumental term that is used to describe divine action in a theistic context. The implication of this term is no longer valid in light the new developments in understanding divine action in the light of modern physics. Quantum mechanics has abolished classical determinism and locality. Relativity theory has integrated space and time and presented a picture of a block-universe in which past, present and future are all existing; it is only the observer's perspective which allocates events in space and time. Furthermore, describing the divine action using the hypothesis of re-creation takes the divine action away from being occasional, unless we mean by it that the divine is making the choice according to what he requires for the "occasion". In this sense occasionalism has a new dimension. This hypothesis furnishes a fundamental physical basis for changes taking place in nature while providing robust explanations to many quantum features and phenomena including wave-particle duality. In this context, modern views about divine action do not seem to be occasional anymore. Yet, there are useful details which expresses a different view in articles presented in the monograph Occasionalism Revisited".[35]

5. Laws of Nature and Divine Action

The Qur'ān presents the fundamental belief that God is the creator and sustainer of every part in the world. However, we look at the detailed description of the relationship between divine and the laws of nature, which might look to be acting autonomously, where we find that God has described these laws as his way of ruling (sunnatullah) confirming that it is generally immutable, though indeterministic. Such a ruling has been expressed in verse (41:11) where we read

[35] Nazif Muhtaroglu (ed.), *Occasionalism revisited: new essays from the Islamic and Western traditions* (Columbus: Lockwood Press, 2025)

> *"Then HE turned to the heaven, while it was something like smoke, and said to it and to the earth; `Come ye both of you in obedience, willingly or unwillingly.' They said, `We come willingly.'"*

From this verse we understand that the inanimate matter has accepted the way prescribed by God to become laws of nature according to which the development of the universe is performed. Accordingly, laws of nature are acting under the auspices of the Divine. This expressed clearly in (41:12) which say

> *"So, he ordained them seven heavens in two periods and revealed in every heaven its order; and We adorned the lower heaven with brilliant stars and provided it with protection; that is the decree of the Mighty, the Knowing."*

This verse clearly shows that God is ruling the world according to laws that he has prescribed and that the constituents of the universe has accepted these laws which we now call Laws of Nature, yet the Qur'ān tells us that these laws works under the auspices of God and for this reason for attributing the action to the divine despite that there is a law at work. This confirms that God is ruling and sustaining the universe through Laws of Nature, such laws through which the mechanism of empowering events takes place, a fundamental doctrine which is part of Daqīq al-Kalām. Divine action does not break the laws of nature because these laws are created and sustained by the divine, consequently the sustainment of these laws is understood as showing a divine respect for these laws.

It is sometimes asked how does the action of God is found in determining the event? In my model the action of God is there beside the process of creation and re-creation by which the universe is sustained. Laws of nature are the invention of God to show how such effect is maintained, it provides the apparent, or secondary causes, for events that happens within the world. The need for God arises, in part, out of the indeterminism which is manifested in the microscopic world. Having the macroscopic world looking as being deterministic does not rule out the fact that indeterminism is a built-in intrinsic feature of the world. Understanding the world as such by an Intelligent being like human necessitates the existence of a creator, a coordinator and a sustainer of the world who is beyond the laws of nature yet using them. From a scientific perspective the assumption of wavefunction collapse is usually considered to be metaphysical. However, the wave function collapse is not rich enough concept, it is a formal assumption lacking requirements like the will and intention. God who creates and chooses which event is to be effected is a richer concept that involves a consciousness and will.

As for the question is the act of God to be considered an intervention or not? In our model the action of the laws of nature are operated and sustained through regularity by the divine. All events are subject to divine will, and the laws of nature are means by which the universe is ruled, just like the laws and legislations by which individuals and society is ruled.

5.1. The Speed of Re-creation

The re-creation of individual particles goes at a rate proportional to the total energy of the particle. However, once we consider the whole universe to be under re-creation then using the adopted formula that the re-creation rate equals the total energy divided by Planck's constant it is easy to see that the rate of re-creation of the whole universe will be take about 10^{-44} second. It

is reasonable then to speculate this figure for the rate of the re-creation of the quantum spacetime units. This coincides with another constant derived from the universal constants of physics, which is called Planck time.

6. Toward a Definitive Physical Theory

One of the main problems with quantum field theory (QFT) as we know is the presence of divergences which appear on calculating physical quantities. According to some physicists, these divergences are thought to be associated with a chronic disorder on the adopted basis of the theory.[36] My published works on the quantum divine action model might not be proposing explicitly a definitive physical theory, yet the proposal is approaching that goal primarily through the basic hypothesis of re-creation. First, the continued re-creation process implicitly involves quantization of time expressed in terms of the re-creation period. The repetition of the re-creations forms an ensemble of states, which is equivalent to the state experiencing re-creation many times. Therefore, incorporating the quantum time approach mentioned above and the assumption of superselection in my model would certainly lead us to construct a definitive physical theory that covers wide range of applications. I have already presented some important implications of the model, including explaining the emergence of wave particle duality, in Ref. (2).

Turan correctly recognized that the "statistical character of quantum physics comes as a result of the extremely rapidly alternating values (e.g. the position coordinate) of a single particle, which exist even without interaction, are sufficient due to the rapidly repeating re-creation." This then would match in a nice way and conform in a more elegant presentation with Pollard understanding of the wave function presented in Pollard's transcendence and providence.

7. Safeguarding the Divine Action Model

Turan questioned: "if, instead of God, another cause could be given for the transition from pure possibilities to a concrete reality of particles, then the model would lack a *safeguard* for the actually decisive theological component at this point."

It was recognized earlier by Turan that indeterminism, in our physical world, is an essential pillar of my model of quantum divine action. Viewed in a physical and philosophical context, the indeterminism of the world as uncovered by quantum mechanics is not an artifact of the theory that may get replaced by deterministic alternative. This is supported by several conclusions. Bell's theorem and the experimental verification of the violation of Bell's inequalities (e.g. Aspect's experiments[37]) is one important evidence in support for having indeterminism as a deep and intrinsic feature of nature.

Despite those other theories, which imply restoring determinism are available (David Bohm theory and the hidden variable theories for example), nevertheless none of these, at least until now, could provide robust conclusive evidence on their predictions.

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[36] J.D. Bjorken, and S.D. Drell, *Relativistic quantum Fields*, (in the introduction) (McGraw Hill, 1965).

[37] Aspect - Alain - Jean Dalibard and Gérard Roger "Experimental test of Bell's inequalities using time-varying analyzers." *Physical review letters* 49/25 1804 (1982).

Contrary to the expectation of Einstein claiming that a spooky action at a distance is involved in quantum mechanics, quantum entanglement has been confirmed experimentally. Quantum indeterminism is like spacetime affinity which cannot be disposed with even if alternative theories appear. Even if new theories are discovered, the correspondence principle safeguards to preserve all fundamental features of the old theory at least in the limits. In our physical world indeterminism is the result of the fundamental wave-mechanical feature in nature which exhibits non-locality. The incompleteness of quantum theory is possible in the interpretations of some of its fundamental features and these could be complemented by the re-creation hypothesis and the adoption of quantum time measurement.

Certainly, in some respects one might be tempted to leave a door open for the role of determinism for the ruling of the world. Such a temptation is motivated by our comprehension of the classical world and the need to see a ruler who does not "play dice". Indeed, such a wish can be realized when we incorporate quantum time in our formulations, where we discover that a hypothetical observer outside a block universe figuring all events inside the universe happening deterministically while the real observer inside the block universe see events happening in a time sequence like a movie, yet are indeterministic. Accordingly, we discover there is a deterministic ruling in our universe played this time by God. This means that Einstein was correct, God do not play dice, but it is the universe which is playing dice with us.

Conclusion

Perhaps the most important pivotal point in my model for divine action is the reference it makes to Superselection that allude to the intervention of the hypothetical external observer in a block universe configuration. This is a concept that science is approaching from different sides of knowledge. In quantum mechanics we have now the concept of Superdeterminism on the table and it seems to be plausible to accept such a concept which could contribute to solve the fundamental *problem of measurement* in quantum mechanics. However, I find that the formulation of this concept and the available arguments supporting it need a fundamental revision. Hossenfelder and Palmer[38] gave a touch on rethinking the arguments, yet we need to consider the topic on a more fundamental level. The proposal of having two observers chasing the universe with two different perspectives is quite promising since it solves many problems in the philosophy of religion and marks a border line between physics and metaphysics. No longer it is acceptable to follow the age old original Aristotelian approach on this matter. Metaphysics cannot be projected on physics and our understanding of the causes and reasons cannot be complete from one perspective only. We must consider both the hypothetical external observer who sees the whole on the stationary states of the block-universe observing the past, present and the future in one glance and the perspective of the observer inside the block universe, who sees all states as time-developing according to the basic equations of physics. Both perspectives are complementary to each other and can explain the problems related to the divine actions and quantum mechanics as well, possibly, providing us with an explanation on the realization

[38] See Ref. (29).

causality from two perspectives in which it is deterministic and uncaused (in the eyes of the external observer), indeterministic and occasional (in the eyes of the internal observer).

In conclusion I say: Albert Einstein was right in saying "God does not play dice", here I complement the phrase by saying: being a resident inside the universe I find that "the world is playing dice with us not God."

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