
FROM QUINTESSENCE TO SPOOKINESS EVOLUTION OF SUPERNATURAL IN PHYSICIST MIND

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Abstract

In this research we try to find answers for why, how and where great physicists used supernatural concept in physical theories. We start from Aristotle and end up with Stephen Hawking. Physicists use supernatural concept in their theories to describe nature. This concept has changed considerably in physicists' minds. For instance, supernatural is a philosophical God to Aristotle, to Newton is a personal God, while to Maxwell is a demon, and according to Einstein, it fluctuates between Spinoza the philosophical God and spookiness to explain entanglement phenomena in Quantum mechanics.

Keywords: God, Newton, Einstein, Maxwell, entanglement

1. Introduction

M. Scriven [1] has mentioned in his work on the concept of supernatural "the supernatural is in terms of a frame work which distinguishes certain phenomena as supernatural because of their exceptional idiosyncrasy or generic differences from the other phenomena of nature". Physicists have come across these concepts: quintessence and unmoved mover or prime mover in Greek philosophy, the masterful creator of Newton, the Maxwell demon, the God of Einstein, spooky action at distance in entanglement, etc. These are, undoubtedly, supernatural statements that find their roots in the very foundation of Physics.

These supernatural concepts are not personal believes of physicists. They find themselves in scientific books, scientific papers and scientific conference debates. These concepts do always exist in Physics and they cover the 'unknown fields' [2, 3]. We can see a vicissitude in the name and functionality of supernatural in the history of Physics. In the Aristotle physics a philosophical

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supernatural known as unmoved mover existed, which later became God by the philosophers. This philosophical God was changed, in the first century AD, to a personal God. Physicists then believed that God can interfere in any physical phenomena. Copernicus praised the Christian God's help in his discoveries [4]. Kepler, on the other hand, believed that God has created the world with geometrical beauty [5]. Christian God, according to Newton, was necessary to the natural world and supremeness of space [6].

Early in the nineteenth century, Laplace invented scientific determinism and tried to dismiss the personal God from scientific theories but the supernatural concepts resurfaced in many important theories of Physics as Maxwell's demon and the spooky action at a distance in entanglement. These two are examples of supernatural re-entering physics [7, 8]. But in the twentieth century, we notice that supernatural is used as a philosophical God for the interpretation of theoretical results of Quantum Mechanics by both Einstein and Bohr [9].

One has to say that not only supernatural ideas existed in the beliefs of some great physicists but also they have nestled in the philosophical roots of the physical theories. In this study, we firstly discuss different types of Gods as supernatural in the minds of great philosophers, while in second part we cast some light on the roles of these supernatural in Physics. Finally we explore the evolution of supernatural in the minds of physicists from Aristotle to Hawking.

2. God in the great philosophers' minds

Philosophers throughout history regard supernatural as a philosophical problem. In the history of Greek philosophy, God is a philosophical subject. God and Universe are two intertwined subjects that coincide with pre-Socrates philosophy [10].

Sophists managed to change supernatural from heavens and universal problem to a human one. For example, Plato believed God is personal, the creator of everything, and the master of soul and wisdom. The idea of God acquired a universal meaning after Plato. Aristotle's thoughts have affected the concept of God which bore historical values. Most literature on Aristotle indicates that God must exist as an unmoved mover. To have heavens with eternal movements and rotations one must presuppose the existence of an eternal, oneness, and unchanging reality [11].

According to Aristotle's philosophy, Universe is eternal and for it to have a creator is not necessary. Aristotle emphasized that God does not deal with human lives. Based on this philosophy, there were two types of movements: an eternal movement of heavens and the movements of different bodies in which motion of one affects that of another. Therefore, this creates an infinite chain of causes and effects [12]. In Aristotle's view, God is neither materialistic nor placeless and Universe cannot move on its own but it does so according to God's will. After Christianity established itself, God becomes a person who created the

world beyond the Universe. This religion was influenced by the philosophy of both Aristotle and Plato and even science to follow suit.

With the appearance of the Renaissance, people in Europe started to think that the old thoughts and ideas were obstacles in front of advancement of any scientific theory or new ideas. One of rationalist philosopher of the period was Descartes. He stated that in order to assess the validity of our propositions there is no need to prove the existence of God [13]. Descartes believed God is an endless substance. God is independent of the world he created. According to the Descartes philosophy, humankind has limited imaginations while God is beyond our comprehension. Descartes left the dualism saga behind.

Spinoza followed his footsteps and on the basis of rationalism he opposed the idea of dualism by arguing that there is just one substance. Spinoza defined God as “Cause in itself” and this meant God’s essence is dependent on his existence. God and nature in Spinoza philosophy are inseparable and nature is indeed identical to God [14]. Spinoza interpreted his monism philosophy in a famous expression, ‘*deus sive nature*’, God or nature. This was the expression that stigmatized him as an atheist or a pantheist. Spinoza rejected categorically this branding and he attributed this to the limited perception about God. God is the immanent cause of everything and not a transeunt cause of the things. This implied that he exists in the world of his own creation.

In addition, as causality is a form of necessity and because divine nature is eternal and necessary, so everything that occurs is necessary to happen. Free will has limitations in the worlds of matter and ideas. In Spinoza world God is the cause of everything but it is an eternal cause. In this philosophy God does not interfere in the path of change of things [15]. We understand Universe via the changing process and these descriptions depend on the state of God, which are far from the essence of the divine. Those descriptions are partial perceptions of people lacking adequate imagination for God.

God is free from cause as he is a self-creator. In this thought, nature is known to be a creative principle or in scholastic terms God is the *naturea naturanse*. Nature can be seen as a creation product reflecting the work of the creator in both limited and unlimited ways of a substance.

These two views are equivalent in reaching a unique reality but they have contrasting approaches. Spinoza’s metaphysical result is that there is a self-containing unique substance which makes the Universe. This unique substance is called God or nature or creator, etc. [15].

According to Spinoza’s view, every entity in the world is made from matter and it is this that embraces all changes in the world. In modern Physics this is known as energy. Science provides a perfect description of the substance and explains events in terms of nature’s laws. Hume refused God in the empirical philosophy. But the concept of God was rekindled in the mind of the rationalist philosopher, Kant. In Kant philosophy reason cannot be started from concepts but they can start from normal experiences. If we think there is one thing then the existence of that thing should be necessary and the chain of causes must have a beginning and this beginning constitutes the necessary being [16].

3. Supernatural in the great physicists' minds

In Aristotelian physics the world was divided into two parts: celestial and terrestrial. In the terrestrial world (the Earth), all materials were made from four substances: air, water, fire and earth. The celestial objects like planets and stars were made of the fifth substance, the quintessence. Quintessence is known as aether in the history of new Physics. By the end of twentieth century, this word came back into Physics and Cosmology as a canonical scalar field to explain late-time acceleration of the Universe [17, 18]. Supernatural in Aristotle philosophy is not a personal God but a philosophical one. In fact, at Aristotle's time, the ancient Greek style of worshipping was polytheism [19]. But philosophical thoughts of Aristotle as scientific truths and principles were accepted by the Church and the scientists were not allowed to reject these principles especially the unmoved mover concept [20].

Scientists in middle ages found out that motion is relative and the unmoved mover cannot be verified as a scientific truth. Galileo and Newton challenged the concept of the unmoved mover via the introduction of inertial observer. This challenge can be noticed in the Newton's first law of motion and the Galilean principle of relativity [21]. Other Aristotle's pseudo-sciences were rejected by Tyco Brahe, Nicolas Copernicus and Galileo.

The Earth, during this period, was regarded as the centre of Universe. Its rotation together with free falling bodies were regarded as big problems in Physics. Physicists had to discard both Aristotle's opinions on nature and Ptolemy's model of the Universe. Having said this, the supernatural such as the Christian personal God remained in the mind of the most classical physicists [22].

Galileo (1564-1642) was a great physicist who was excommunicated for scientific opinions. He supported Copernicus model and rejected both Aristotle's opinion and Ptolemy's model of the Universe. Galileo was an astronomer, an inventor, a physicist, a mathematician and a philosopher. He showed that nature obeys a set of simple mathematical equations and believed that this is indeed God's language [23]. However, Galileo believed in a personal God and he thought that Bible tells the truth and his work is a mere interpretation of the Bible manuscript [24].

The great physicist and mathematician in the classical Physics' period was Newton (1642-1727). Newton introduced three important laws that laid the principles of classical Physics. In addition he discovered the universal gravitation force that governs the motion of all celestial objects. Newton, on the other hand, invented calculus which is an effective tool in calculating behaviour and future of any simple physical system. The philosophy of Aristotle still prevailed at Newton's time, but to refuse the notion of unmoved mover, Newton introduced his first law which states that absolute motion does not exist but depends on the observer [25].

In Newtonian physics God is necessary for nature and absoluteness of space. He believed that the order in solar system is the reason for the existence of an intelligent and powerful being [21, p. 501]. Supernatural, in Newton's view, has many duties, for instance, the planets will be absorbed by the Sun if not for God's intervention. Newton thought that he is an interpreter of the Bible. Therefore, God in Newton's mind should be a special personal God and his duties are similar to Descartes' description [26].

A physicist who challenged the role of personal God in Science was a French mathematician and physicist Pierre-Simon marquis de Laplace (1749-1827). He wrote a book on motion of celestial objects and contrary to Newton he did not mention anything about God's role in the motion of the planets. When the French emperor Napoleon asked him why he did not mention God in the book Laplace's reply was: I had no need of that hypothesis (*Je n'avais pas besoin de cette hypothèse-là*) [27]. This has become the dawn of scientific determinism that each system in Physics obeys specific natural laws; therefore, supernatural desire has not got any role in determining the future of any system. The root of Laplace scientific determinism goes back to Kant's philosophy and causality principle. Laplace introduced what is known as 'Laplace demon'. In terms of which, if one is able to determine the state a system at the moment then it should be possible to predict exactly the future and the past of that system [28]. Laplace believed in God and his God was the same philosophical one as Kant's description [29].

The role of personal God in Physics, due to scientific determinism, became limited as supernatural still existed in Physics and appeared in descriptions of different phenomena. Examples of this were, as mentioned earlier, the Laplace's and Maxwell's demons. In Thermodynamics and Thermal physics, Maxwell's demon is a thought experiment which is related to the second law of Thermodynamics.

Consider a box, containing molecules of a gas, is divided into two parts by an insulator wall with a door. The gas is in equilibrium state (constant temperature). Maxwell considered a demon sitting on the wall to control the door. The demon allows low velocity molecules to pass to the left partition, say, while high velocity ones are allowed to pass to the right. This means that the right partition is getting warmer while the other becomes colder. Therefore, the entropy of the system will decrease. This in effect contradicts the second law of Thermodynamics. Entropy principle states that the entropy of an isolated system should increase [30].

With the dawn of Quantum mechanics, the philosophical God reappeared in different discussions on the subject. According to the Copenhagen interpretation of Quantum mechanics, the Kantian causality fails. This is due to the Heisenberg uncertainty principle, which can only predict the future a system with certain probability [31]. One of great physicists of the twentieth century and one of the founders of Quantum mechanics is Albert Einstein. The probabilistic nature of the Quantum mechanics' predictions was not acceptable to Einstein. He vehemently believed in Laplace's scientific determinism which states that the

future of a system can be precisely determined by using a complete set of physical laws. The famous quote that Einstein used quite often in scientific meetings was “God doesn’t play dice with the world”. Consequently, he believed Quantum mechanics is not a complete theory to describe nature [32]. To Einstein, God is not religion’s personal God but is a complicated philosophical God that described by Spinoza, namely, God is nature [33].

The Einstein’s rival and the leader of both Quantum theory and Copenhagen interpretation was Niles Bohr. Bohr and his colleagues believed that Quantum mechanics is a complete theory and that nature’s behaviour in itself is probabilistic. He asserted that Physics’ duty is not to find out how nature is but what we can say about it. In answer to Einstein’s quote, he said “Don’t tell God what to do with his dice”. Bohr was agnostic, and he mentioned God in his discussions with Einstein merely because the latter used to bring it up [34].

In 1935 a formidable challenge, against the Copenhagen interpretation for Quantum mechanics, was presented by Einstein, Podolsky and Rosen, the EPR paradox [35]. This was a mental experiment that discernibly showed Quantum mechanics has reached some irrational conclusions. In terms of EPR, information between two entangled particles can transform instantaneously. Of course, this contradicted special relativity. This was enough for Einstein and his colleagues to argue that Quantum mechanics is incomplete. In the EPR paper, the authors argued that a complete theory should encompass all elements of a physical reality. For instance, a moving body has both position and momentum and the relevant theory must involve some variables to represent these quantities.

In microscopic world, Heisenberg uncertainty principle states that an observer cannot measure both position and momentum simultaneously. This renders Quantum mechanics as an incomplete theory to explain reality. Consider a particle is at rest then divides into two equal particles that move in opposite directions. We start measuring position or momentum of one of the particles, we instantly know position or momentum of the other particle located somewhere else. The question is that how these effects can instantly transfer through the space! Einstein named this as “spooky action in distance”. They believed that there should be some hidden variables.

As a result of these confrontations a question was asked on locality or non-locality of Quantum mechanics. New researches show that Quantum mechanics is a non-local theory and information between two or more entangled particles can transfer instantly and a local Quantum mechanics with hidden variable does not exist. Supernatural, such as spookiness, still lurks in the heart of Quantum mechanics.

Another physicist that discussed the role of supernatural in Physics is Stephen Hawking. In both of his popular books: ‘The Briefer History of Time’ and ‘The Grand Design’ he challenges the duties of God and any supernatural in the Universe. He believes that the Universe does not need any creator. Creation of the Universe and the mechanism of how it works follow natural laws but an assumed supernatural cannot intervene in these laws. The amounts of negative

and positive energies in the Universe are equal and the Universe can come from nothing. He believes totally in scientific determinism and goes even further to think the concept of human freewill is a mere illusion [36, 37].

4. Conclusions

We started from ancient Greek, the dawn of Science and presented the view of the great philosophers from Aristotle to Kant with regard to God as a cause of motion and events in the Universe. The concept of God has changed throughout the above period. Aristotelian God is a philosophical one which gradually changed to a personal one. A big difference between a philosophical God and a personal one is attributed to God's role in nature. The philosophical God is the creator of the natural laws, and nature obeys these laws but on the other hand, the personal God is an intervener in the nature and can change these laws to suit his followers [38]. We saw an evolution in the supernatural concept. Ancient Greek believed in polytheism, but to Aristotle a philosophical God was unmoved mover.

Centuries later a sharp vicissitude of supernatural led to a personal God. Being opponents to the idea of unmoved mover, Newton and some other scientists used personal God to avoid answering some awkward questions that they did not have answers to. A massive change occurred in the concept of supernatural physics through Laplace's scientific determinism.

In addition to personal and philosophical God, we saw the appearance of another type of supernatural as demon or spookiness in the nineteenth and twentieth centuries. Maxwell used demon to illustrate a paradox in Thermodynamics and Einstein named the unknown physical process of entanglement as spooky action in distance. On the other hand, Einstein believed in a philosophical God as defined by Spinoza. Einstein used quite often the word God to challenge Quantum mechanics. Werner Heisenberg looked for the central order in Physics and he suggested Music and Physics as two approaches to the central order. He believed in the God of the mystics (personal God) and not in the philosophers' God.

In the twenty first century, Stephen Hawking rejected the intervening God or any supernatural metaphor in the Universe and its physical laws. In fact, Hawking answered Einstein in the language of scientific determinism, i.e. the creation of the Universe and how it works obey universal scientific laws and God or any other supernatural is not needed. We do not think that this is the end of supernatural idea in Physics. The Hawking's assertion on the role of the creator is the creation of the Universe. The role of supernatural in theoretical Biology and the origin of life in theories of quantum biology have been discussed recently. The transition from non-life to life is hypothetically a quantum mechanical process. The meaning of superposition in Quantum mechanics is that a system at a specific time can take many quantum mechanical paths and as such life is one of those. Life is an unusual state of matter. Quantum mechanics actually has made a shortcut to life via superposition [39].

The well-known physicist, Paul Davies, has argued that life occurs in some special state with low probability but it is not clear as to why the system has chosen to collapse to one of these states with such probability. To put this differently, how quantum superposition can find the state of life to collapse into it. According to Paul Davies, there may be a need for Theology to intervene in the system [40].

Comparing the opinions of Hawking and Davies one may conclude that the supernatural goes out from Cosmology's door only to re-enter from that of quantum biology.

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