DETERMINISM, INDETERMINISM, QUANTUM THEORY AND DIVINE ACTION

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ABSTRACT

While the theory of relativity is the most important theory of modern physics at the macro level, quantum theory is the most important theory at the micro level (subatomic). In this article, we shall attempt to analyze how quantum theory was the first to shake the foundations of the deterministic interpretation of the universe that had previously dominated the natural sciences, and how its "ontological indeterministic" interpretation enabled new points of view related to the questions about divine action, miracles and free will. In this article, we do not claim that quantum theory proves the existence of divine intervention, miracles and free will; in other words we are not engaging in natural theology. What we are trying to do is to demonstrate the error of the assertion according to which, from the point of view of positivism, divine intervention and miracles are impossible, since they would be violations of natural laws. In other words we are claiming that the formulation of a theology of nature is 'possible' within the framework of the laws of modern science (but not claiming that this view is scientifically correct). We would like to stress in particular that as we do this, our attempt to show what the 'possible' is does not include a claim related to what the 'actuality' is.

Key Words: Philosophy of religion, philosophy of science, physics, determinism, indeterminism, quantum, chaos, divine action, miracles, free will.

LAPLACE'S DEMON, WHO CAN FORESEE THE KNOWN FUTURE

Thanks to the process made up of the discoveries of Copernicus, Kepler, Galileo and Newton, humanity was able for the first time to get hold of a detailed, systematic and scientific cosmology. With these discoveries, the universe was being described by means of mathematical laws, and these laws were applicable to the entire universe. Aristotle's system, which had been considered valid for more than a thousand years, and which subdivided the universe into a sub-lunar and a supra-lunar sphere, with different laws for the two spheres, fell into utter disrepute after Newton. A determinist view of the universe was adopted. This conception of physics also greatly influenced philosophy, theology and all other sciences; philosophers and theologians shaped their views on the basis of developments in physics, while other scientific fields tried to reorder their knowledge, following the example of Newtonian physics.

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Laplace, who was influenced by the success of Newtonian laws in describing the universe, was one of the first to express scientific determinism in a systematic way.[1] According to Laplace, a superior intelligence (Laplace's demon), who knows all the details concerning the position and speed of all the particles of the universe in a given moment, will know everything concerning the past and the future of the universe. If naturalism, which views the universe as a sphere that does not receive intervention from the outside, and materialist philosophy, which claims that there is no substance, but matter, are merged with Laplace's determinism, a materialist fatalist view, which reaches the conclusion that the future tends towards a result established in the first second of the Big Bang, will become inevitable. By claiming that nothing can intervene in nature from the outside, naturalism will protect universal determinism from God; materialism on the other hand, will claim that the soul cannot be a separate substance, and thus it will protect determinism also from beings within the universe. Descartes claimed that animals were nothing more than automata, even though they might be much superior from man made machines;[2] in other words he claimed that they were beings with no substance but matter and bound by deterministic laws. As for philosophers who were influenced by Descartes,[3] like La Mettrie, who developed his own philosophy in contraposition to Descartes's matter-spirit dualism, they classified the human soul among automata. The existence of a substance other than matter (God or the soul of a living creature), might invalidate the prediction of Laplace's demon, by influencing the beings and the process (determinism) in the material universe.[4]

The point that is really interesting is that an atheist-materialist Laplacian ontology may not find any place for free will within a materialist conception of predetermination, which claims that all future events have been preordained since the very beginning. Within the naturalist-determinist conception of the universe, the ontological status of the realization of an alternative within the process being undergone by the universe, is equal to an impossibility; as this conception of the universe sees it, even the exact position of your fingers as you are holding this article and the sentence that you are reading in this precise moment could not have been different: if Laplace's demon had made its calculation a billion years ago, he could have both drawn the way you are holding this page and let you know the precise second in which you would have been reading this page. Claims by philosophers, like Sartre, concerning the fact that, "existence precedes existence,"[5] are an illusion as far as determinist-materialist and naturalist philosophy is concerned. The fact that in such a universe, Laplace's demon can foresee the whole future, shows that this is an illusion. There have also been views believing in fatalism within theism, like the *Cebriye* sect within Islam, and Lutheranism within Christianity. However, theism's ontology has also recognised the existence of a vast scope of possibilities; for example, it has been stated that since God is free, He could create creatures free like himself, and that the soul, which is not a material substance, has a scope for free will (independent from determinism). In addition to this, it could also be said that even if the soul is not a separate substance, the moment that matter is organised in the shape of a

[1] Stephen Hawking, *Ceviz Kabugundaki Evren (The Universe in a Nutshell),* translated by: Kemal Comlekci, Bursa, Alfa Yayinlari, 2002, p. 104; Stephen Hawking, *A Brief History of Time*, New York, Bantam Books, 1990, p. 53.

[2] Rene Descartes, *Discourse on Method and the Meditations*, translated by: F. E. Sutcliffe, London, Penguin Books, 1968, p. 65.

[3] Ernst Mayr, *The Growth of Biological Thought,* Cambridge, The Belknap Press of Harvard University Press, 1982, p. 97-98.

[4] In general, those who claim that Laplace's determinism does not permit the existence of free will in humans do so without underlining the fact that this view should take naturalism and materialism as a given assumption.

[5] Jean Paul Sartre, *Being and Nothingness*, translated by: Hazel E. Barnes, New York, Washington Square Press, 1993.

human brain, may have the emergent characteristic of the existence of free will.[6] The fact that the *Mutezile* sect of Islamic thought and Christianity's Catholicism claim that humankind has free will, is based on the vast scope of possibilities provided by the ontology of theism, since everything is possible for God.[7] Since theism's claims concerning free will can neither be proved, nor disproved, they are not scientific. However, since the opposite cannot be proved (the structure and functioning of the human mind is still a mystery; and this makes the study of the exact nature of humans and of their free will impossible), this claim cannot be reduced to absurdity (*reductio ad absurdum*) either. On the other hand, since in a universe that according to claims is determinist and where the only substance is matter (a universe where a materialist ontology is adopted), certain causes will always give rise to the same results, claims related to the existence of a free cause (the existence of free will implies the existence of free causes) can very easily be reduced to absurdity, from a logical point of view.

THE PROBLEMS CREATED BY A DETERMINISTIC CONCEPTION OF THE UNIVERSE FROM KANT TO SPINOZA

Even before Laplace, Kant had seen the problem that the deterministic conception of the universe, which reached its apex with Newton, would have presented as far as human free will was concerned. True enough, in the third of his *antinomies*, Kant analyses the way that determinism would not leave any space for freedom.[8] Kant was of the opinion that pure reason could not prove the free will, but that practical reason needed free will for the "categorical imperatives" that were supposed to make up the basis of his theory of morals.[9] At the end, he solves the *antinomy* by stating that free will is part of the world of *numen*, while determinism is part of the world of phenomena. When we take into consideration the fact that in Kant's system the world of *numen* cannot be understood in a rational way, we see that in his system there is no rational solution for the problem of free will. However, Kant states that the practical reason is superior to the pure reason, and for the sake of morality, he accepts the existence of human free will together with the existence of God and of Hereafter,

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[6] We are of the opinion that the literature that has taken shape in opposition to reductive approaches during the last twenty years, within the general title of "emergence", is very important from the point of view of the philosophy of religion. The main point to be solved as far as this subject is concerned, can be expressed with this question: Does the fact that once elements are united to form a complex structure, the resulting and completely new characteristics (as in the case when cells unite and make up the brain) cannot be explained by its constituent elements any more, mean that our knowledge is insufficient to formulate such a constituent element based explanation, and thus that this situation is an "epistemological emergence"; or that a whole can really not be explained by its constituent elements and thus that this situation is an "ontological emergence"?

[7] Many theist sects and philosophers have made a distinction between God's knowing the future and God's determining the future or obliging it to take shape in a certain way. According to this view that in Islamic thought is expressed as, "Knowledge is subject to what is already known," the fact that God's knowledge about what is going to happen and the concept of free will are not in contradiction. For more detailed information see: Hanifi Ozcan, *Bilgi-Obje İliskisi Acisindan Insan Hurriyeti* (Human Freedom from the Point of View of the Relation between Knowledge and Object), *Dokuz Eylul Universitesi Ilahiyat Fakultesi Dergisi 5,* 1989; For more information about free will in Islam see: Kasım Turhan, *Kelam ve Felsefe Acisindan Insan Fiilleri* (Human Acts from the Point of View of the Theology and Philosophy), Istanbul, Marmara Universitesi Ilahiyat Fakultesi Vakfi Yayinlari, 2003, p. 29-133.

[8] Immanuel Kant, *The Critique of Pure Reason,* translated by: J.M.D. Meiklejohn, Chicago, William Benton, 1971, p. 140-141.

[9] Immanuel Kant, *Fundamental Principles of the Metaphysics of Morals,* translated by: Thomas Kingsmill Abbott, Chicago, William Benton, 1971, p. 279-280.

as a *postulate*.[10] In this way, Kant constructs his own metaphysics in place of the metaphysics he has demolished. The important point to be observed in this matter, is the important role played by Newtonian determinism in the way Kant constructs his whole system. He thought that pure reason required an acceptance of determinism and of all of its results. He was aware that according to the conception of a universe functioning on the basis of deterministic laws, the future would be known in advance, but at the same time he needed the concept of free will to be able to formulate a theory of morality; may be it is just for this reason that the concept of "Kant's demon" does not exist among philosophical terms. But, if nature, as we shall see in a while in the most widespread interpretation of quantum theory, has an "objective indeterministic" structure, then isn't Kant's effort to attack the authority of pure reason to be able to create a basis for free will, and at the same time to express a superiority of the practical reason over pure reason in opposition to philosophical tradition, futile?

Debates resulting from scientific determinism were not limited to free will. In a deterministic universe there will be no gap, "A" will always determine "B", "B" will always determine "C", and when "B" happens, what follows will always be known in advance; the opposite is not possible. In such a universe, there will be the question of how divine intervention is. It is this problem that makes up the basis of the accusation of being contrary to science that is leveled against the three monotheistic religions. Since even many theist philosophers and theologians state that the existence of the universe, the coherence of its laws and divine interventions like God's use of the laws of the universe instrumentally, are possible even without violation of determinist laws, the biggest problem especially arises when the three monotheistic religions claim that some of the divine interventions take the shape of "miracles". Theist thinkers have generally viewed "miracles" as violations of natural laws. According to this view, even though "B" should cause "C", it is not "C" that is caused, but "M". The fact that even though scientifically speaking "C" should be the result of "B", the above-mentioned theologians have stated that "M" has resulted; this has led some materialist-atheist thinkers to claim that religion is contrary to science. This objection against theist religions has originated not just from atheism, but also at times from certain theologically based approaches. Spinoza for example stated that the laws of nature were a result of the Nature of God, and that those who claimed that God acted in ways contrary to these laws, were guilty of stating the nonsense that God could act against his own Nature.[11] By stating that natural laws originated from the Nature of God, Spinoza was being influenced by Descartes. However, according to Descartes, God and the universe were separate substances, and the point he underlined aimed to formulate a mechanistic conception of science; he did not use this approach to deny the existence of miracles. Spinoza on the other hand was a monist; he identified the essence of God with nature; this is why according to him the transition between divine Nature and the laws of nature was direct, and in the same way that he considered miracles as violation of nature's laws, he also considered them as contrary to divine Nature. Also Schleiermacher claimed that for theological reasons the conception of miracles as violation of nature's laws should be eliminated from Christian theology. He considered causality as a logical must, and even though he viewed every event within the universe as God's work, he thought that these phenomena were to be taken within the framework of natural laws, and that they happened without violation of natural laws.[12]

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[10] Immanuel Kant, *The Critique of Practical Reason*, translated by: Thomas Kingsmill Abbott, Chicago, William Benton, 1971, p. 343-348.
[11] Benedictus de Spinoza, *Tractatus Theologico-Politicus*, translated by: Samuel Shirley, Leiden, Brill Academic Publishers, 1997.
[12] Friedrich Schleiermacher, *The Christian Faith*, Edinburgh, T. and T. Clark Publishers, 1999.

As it can be seen, many questions that are very important from a philosophical point of view, like Kant's philosophy, Laplace's demon and the problem of free will, or objections to the view that divine intervention is violation of nature's laws, based on a view of science deriving from a naturalism, or based on theology as in the case of Spinoza and Schleiermacher, have been shaped within the framework of an approach deriving from a belief that in the universe there are laws of an "objective determinist" nature. This belief reached its apex with Newtonian physics, and was strengthened with Einstein. However, the unexpected challenge was based on quantum theory concerning the subatomic world.

QUANTUM THEORY AND INDETERMINISM

Einstein, changing Newton's absolute space and absolute time concepts, explained the force of gravity in a more sophisticated way and used the speed of light as an absolute value in his physics; however, his physics also were deterministic and realistic, just like Newtonian physics (presuming that a universe expressed with mathematical formulae existed in an external world, independently from observers and actually, in harmony with these mathematical formulae). Quantum theory that describes the subatomic world was formulated during the same period that Einstein developed his theory of relativity; actually Einstein was also among those contributing to a better understanding of the subatomic world. The model of the atom, presented by Ernest Rutherford in 1911, was more or less similar to the solar system; the model of the atom as perceived by the majority is still like that: in the middle there is a nucleus similar to the sun, and electrons rotate around it like satellites. On the other hand, on the basis of quantum theory's model of the atom, it would be more correct to refer to the electrons as probability waves rather than as rotating satellites; it is impossible to draw a model of the atom on the basis of this theory. Quantum theory in the shape with which it is known nowadays began with Werner Heisenberg's "matrix mechanics" in 1925 and with Erwin Schrödinger's "wave mechanics" in 1926; these were initially separate theories, but later Paul Adrien Maurice Dirac merged these two and formulated a single theory with a wider scope.[13] According to quantum mechanics, what we describe as subatomic particles, are also at the same time waves. There are also data deriving from experiments that support this contradictory status.[14]

According to Heisenberg's Uncertainty Principle that explains the quantum situation, it is impossible to calculate the position and speed of atomic level particles, at the same time and exactly.[15] According to this principle, the more exactly we calculate the position of a particle, the less exact will our calculation of its speed be; if we calculate with the maximum exactness the speed of a particle, its position will become completely unknown. Schrödinger, who is one of those to have established quantum theory, described the atom not as a system formed of a nucleus and electrons, but as a system made up of waves of matter. As for Bohr, he interpreted the particle and wave aspect of matter as two separate aspects of reality that completed each other (the Complementarity Principle). Heisenberg claimed that Schrödinger and Bohr's interpretations were applied only up to a certain point, and could not rid themselves of their contradictions, and that the contradictions would disappear only by

[13] Roger Penrose, *Kralin Yeni Usu 2: Fizigin Gizemi (The Emperor's New Mind: Concerning Computers, Minds,* and The Laws of Physics), translated by: Tekin Dereli, Ankara, Tubitak Populer Bilim Kitaplari, 2000, p. 103.
[14] Roger Penrose, *The Road To Reality,* London, Jonathan Cape, 2004, p. 505-511.
[15] Werner Heisenberg, *Einstein'la Yuzlesmek (Encounters with Einstein)*, translated by: Kemal Budak, Istanbul, Gelenek Yayincilik, 2003, p. 33-36.

passing the borders established by determinism.[16] Heisenberg's approach is unacceptable from the point of view of classical physics. In classical physics, once we know the position and momentum of a particle, we can easily calculate where it will be later; as a matter of fact, Laplace's demon's capability of seeing the future rests on this kind of a possibility of being calculated. According to Bohr, when we are not observing it, the atom is nothing more than a ghost; it is only as a result of observation that the atom becomes actual. There is also the fact that we decide what we are going to observe, if we look at its position the atom is in its place, if we observe its speed we can calculate its speed; however we cannot observe both its position and its speed. To those who were completed confused as a result of this situation expressed by the most famous names of modern physics, and who deemed it to be too paradoxical to be accepted, Paul Davies replied by saying that they should not worry, because even Einstein agreed with them.[17]

In quantum theory there are only probabilities. The first introduction of probabilities to physics happened with the entropy law (end of 19th century); however the reason why there are probabilities in the entropy law is that when quadrillions of particles move in accordance with Newtonian mechanics, it would be impossible to calculate them. In other words, our epistemological insufficiency is the reason why the entropy law is probabilistic. In quantum theory on the other hand, the claim put forward through Heisenberg's Indetermination Principle is not that we are in a "subjective indeterministic" (an indeterministic situation caused by our epistemological insufficiency) universe; "objective indeterminism" is accepted as a reality of the universe. According to this assumption the universe moves on the basis of probabilities. No matter how skillful Laplace's demon is, in such a situation he will not be able to see the future, because the future is not predetermined; if we went back to the beginning of the universe and repeated the Big Bang in exactly the same way, the universe would very probably not be like today and we would not be here.[18] Such a universe is not the deterministic universe of Newton and Einstein; if such a description of this universe is correct, than many problems shaped by the influence of a deterministic conception of the universe and related to philosophy and theology, like Kant's approaches, Spinoza's objections, the God-universe relationship, miracles and free will, should be studied anew.

GOD'S ACTION IN THE WORLD

When studying the God-universe relation, God's action in the world is subdivided into two: 1- General divine action, 2- Special divine action. General divine action is used to express God's preservation of the universe together with its laws. Special divine action on the other hand is used to express God's action in a certain place and time; miracles, as this concept is traditionally understood, and religious experiences are included in this.[19] We are of

[16] Werner Heisenberg, *Fizik ve Felsefe (Physics and Philosophy),* translated by: M. Yilmaz Oner, Belge Yayinlari, 2000, p. 20-21.
[17] Paul Davies, *God and The New Physics,* New York, Simon and Schuster, 1984, p. 103.
[18] Data concerning the Anthropic Principle, have shown that the existence of humans in the universe requires very critical and delicate settings as far as the laws and phenomena of the universe are concerned. These critical settings correspond to a very small probability within the scope of probable parametres. Even with the same Big Bang based beginning and the same laws of the universe, the slightest change in the phenomena of the universe would have made it impossible for life to appear on earth. For more information on this subject, see: John D. Barrow, Frank J. Tipler, *The Anthropic Cosmological Principle,* Oxford, Oxford University Press, 1996; Caner Taslaman, *The Big Bang, Philosophy and God,* Istanbul, Istanbul Yayınevi, 2007, 10th Chapter.
[19] Nicholas Saunders, *Divine Action and Modern Science,* Cambridge, Cambridge University Press, 2002, p. 18-23.

the opinion that subdividing divine actions into four categories would be more useful. We shall try to explain what we mean, by providing examples of these four categories in the case of rain:

1- **The Creation by God**: With this, we refer to God's creation of the universe and of its laws. According to this, God created from nothingness the matter and energy that would make up the atoms that would in their turn make up the rain, but also laws like the law of gravity that play an important role in the rain phenomenon.

2- **The Preservation by God**: By this we mean the continuation over time of the existence of the matter and laws created by God. According to this, since God ensures the continuation of universal matter and laws, it is possible for rain to happen after 15 billion years of the beginning of the universe.

3- **The Realization of Phenomena by God**: By this we mean the phenomena realized by God, within the framework of the universe and laws preserved by Him. At first glance we might be led to think that the divine action expressed in this point and God's preservation in the second point are the same thing; however, there is a clear distinction between the two. What we refer to in the second point is what many people call "necessity". What we refer to in this point is on the other hand what many people call "chance"; or in other words, the fact that God carries out one of the many probabilities that are possible within the framework of the laws established by him. God might very well have created the universe and laws in this way exactly, but the earth at this exact distance from the sun, and water with this kind of properties and atmosphere might not have existed. What is referred to in the second point is that rain is possible 15 billion years after the beginning of universe thanks to the preservation of the related natural laws, but what is referred to in this point is that 15 billion years later this probability has happened in a certain place and time.

4- **The Realization of Miracles by God**: By this we might mean God violating natural laws for certain special situations, and realizing extraordinary events in a certain place and time; but also his realizing, within the framework of natural laws, and in a certain place and time, events the probability of happening of which is very low. According to this, God might make rain happen in a place where there are never clouds or rain, to fulfill the prayers of a beloved subject of his.

We are of the opinion that this four-element distinction is more useful than the two-element distinction, from the point of view of the classification concerning the claims about God's action in the universe. There have been efforts to merge the general divine action, and special divine action of the two element distinction.[20] It is also possible to merge certain points of the four-element distinction, according to the way of divine action is described. For example, someone who claims that God makes miracles by realizing very low probabilities within the universe, but never violates natural laws, might merge points three and four. However, we are of the opinion that no approach will make it necessary to add a new point to the above-listed four points; this is why we recommend the four point classification.

[20] Nicholas Saunders, ibid., p. 23-32.

In this article, we shall not focus on theistic claims concerning the creation of the universe from nothingness, mentioned in the first point, or on those concerning the preservation of the universe, mentioned in the second point. Many theists have stated that God, who is the primary cause, caused the universal phenomena that we indicated in the third point, by using natural laws as secondary causes, and in this way they formulated a conception of divine intervention that did not violate natural laws. Theistic claims concerning the violation of natural laws are mostly expressed with regard to the making of miracles; as we have already mentioned, objections to this have been stated both in the name of naturalism and of the some theological approaches. However, the general tendency has been of explaining miracles as a violation of natural laws.

David Hume made his famous objections against miracles on the basis of a definition of miracles that stated that miracles were violations of nature's laws.[21] The appearance of miracles in a deterministic universe can be explained by stating that divine laws (in Islamic terms we could call these laws *Sunnatullah*), are much more all-encompassing than natural laws; and we can thus say that the violation of natural laws on special occasions like the coming of a prophet, is not in contradiction with the laws God himself established (or with his own Nature), as Spinoza and Schleiermacher thought it was. This situation is similar to the way that machinery operating in a factory within the framework of mechanical laws, will, once every few years, be stopped for maintenance and thus presents a situation different from the usual situation, without this being a violation of the deterministic laws, to which the machinery is subject.

In addition to this, in a Leibnizian way, miracles can also be explained without being a violation of pre-established harmony and the natural laws of a deterministic universe. There have been those who have confused this kind of a Leibnizian approach with deism; we are of the opinion that this is completely wrong. God, as seen generally by deism, creates the universe, but later will be uninterested towards what is happening in the universe. According to this approach on the other hand, God is the creator of every moment of time; he has designed each of these moments in advance. Since there is not a single moment in which God does not intervene, it would be wrong to confuse this conception of God with deism. For God, who knows everything with an advance of 15 billion years (at the moment of Big Bang), there is no difference between intervening with an advance of 15 billion years or of a few seconds. Especially after Einstein proved with the theory of relativity that time is relative[22] there is not a significant difference between 15 billion years and a few seconds. For those who believe that God intervenes in every point of the space, even though he is transcendent to space, there should be no problem in believing that God can intervene in every moment of time, even though he is transcendent to universal-time. If we take as an example the separation of the waters by Moses, which is "a miracle" accepted by all three theist religions, we can state on the basis of this approach that God separated the waters just in time for Moses' passage, by planning it at the beginning of the universe, by using physical laws like those regulating the tides, and without violating any deterministic law. However, the purpose of all these approaches is to explain miracles, which after the creation of the universe from nothingness, are the most extraordinary kind of divine intervention in a deterministic universe. Nevertheless, as we shall see in the next pages, an indeterministic universe provides us with new possibilities concerning the explanation of divine interventions like miracles.

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[21] David Hume, *An Enquiry Concerning Human Understanding,* Oxford, Oxford University Press, 1999, 10th Chapter.

[22] Albert Einstein, *Izafiyet Teorisi (Reality,The Special and The General Theory)*, translated by: Gulen Aktas, Istanbul, Say Yayinlari, 2001.

DIFFERENT APPROACHES TO THE UNCERTAINTY PRINCIPLE OF THE QUANTUM THEORY

We could say that there is a general agreement concerning the approaches to physics of the entropy law and of the theory of relativity. Philosophers and theologians have expressed different contradictory interpretations of these theories, notwithstanding common assumptions from the point of view of physics. As for quantum theory, there is no agreement as far as physics are concerned; the philosophical and theological interpretations of those who accept one or the other of the approaches concerning the physical interpretation of this theory will also be different among themselves. Not only can the philosophical and theological interpretations of those that think that this theory points to an objective indeterministic universe be different, but also those who do not agree with this will have philosophical and theological opinions that will differ among themselves.

In its present state, this theory provides the basis only for probabilistic interpretations. We can judge when a radioactive element made up of many atoms will decay, but we cannot state with certainty when a certain atom will decay. According to Heisenberg's Indetermination Principle, the more exactly we determine the position of a sub-atomic particle, the more its speed will become undetermined; the better we calculate its speed, the more undetermined will its position become. Even the most famous scientists in the field of physics have been in conflict among themselves over whether this indetermination derived from an ontological indeterminacy existing actually, or from an indetermination deriving from our epistemological situation. We can classify these different views in three groups, on the basis of Barbour's classification:[23]

1- <u>Indeterminacy Deriving from Our Ignorance</u>: Especially those who follow the deterministic model of the Newtonian approach are of the opinion that the indeterminacy of the subatomic world does not reflect ontological reality. Planck, Penrose and Einstein are the most important representatives of this view. Einstein's famous statement, "*God does not play dice,*"[24] was said to express the impossibility of being ontological indeterminacy in the quantum world. Einstein, Podolsky and Rosen stated that our theories concerning the subatomic world were incomplete and that there must be "hidden variables" not known by us.[25] According to this view, it is our ignorance that is the cause of indetermination; the fact that quantum theory is expressed in terms of probabilities, does not derive from the fact that in the real world probabilistic laws are dominant, since in the real world, events happen within the framework of deterministic laws.

2- <u>Indeterminacy Due to Experimental and Conceptual Limitations</u>: This view can mean that indeterminacy does not actually exist, but also that the subatomic world is unattainable for us and thus that we cannot know whether objective determinism or indeterminism exist. This view is considered the projection in modern physics of

[23] Ian Barbour, *Religion in an Age of Science,* New York, Harper and Row Publishers, 1991, p. 101-104.
[24] Albrecht Fölsing, *Albert Einstein,* translated by: Ewald Osers, New York, Penguin Books, 1997, p. 585.
[25] Albert Einstein, B. Podolsky, N. Rosen, Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?, *Physical Review* 4, 1935, p. 778-779.

Kant's statement that "thing in itself" cannot be attained.[26] This is also at the same time an expression of the fact that with quantum theory, the epistemological approach of classical physics, in which the role of the person observing is not considered important, changed. Those of this opinion state that the interaction between the observer and the observed at the phase of experimentation results in uncertainty. Assume that an electron is being observed; if nothing else, for it to be seen by us, at least light quanta should reflect from it to our eyes. Also for us to see the moon, light must reflect from it and reach our eye, but at a macro level this effect will be too irrelevant to be able to influence either the position or speed of the moon. However, at a micro level the particle of light that reflects from the electron will affect both the position and speed of the electron, and thus the result of our observations. Consequently, in the case of observations concerning the subatomic world, we should develop an epistemology that also takes into consideration the influence of the observer. However, the indeterminate aspects of quantum theory are not related only to this type of observations; there are indeterminate situations like the time when radioactive elements decay that cannot be explained with the influence of the observer.[27]

The claim that indeterminacy exists because of the limited nature of our concepts is nothing much more than a repetition of Kant's view, according to which the human mind imposes its own categories to the external world. We choose the experimental situation and the conceptual framework (wave or particle; position or speed) within which we shall evaluate the situation of the electron. According to Barbour, this approach is agnostic, meaning that we cannot understand whether or not the subatomic world is dominated by determinism, or indeterminism.[28]

3- <u>Indeterminacy as Objective Indeterminism</u>: According to this approach, the indeterminate nature of the subatomic world has no relation with our not knowing the "hidden variables", or epistemological deficiencies and problems like our weaknesses concerning experiences and concepts known; indeterminacy exists as a reality of nature, and this is not a false indeterminism that we might describe as epistemological or subjective indeterminism, but actual ontological indeterminism. Heisenberg, who was the most famous follower of this view, states that the mathematical scheme of quantum theory should be interpreted as the expansion or change of classical logic. According to him, this theory makes changing "the principle of the excluded middle," which is one of the most basic principles of logic.[29] As for Prigogine, whose name is identified with chaos theory, he expressed the fact that indeterminism imposes itself in physics, independently from any metaphysical or philosophical preference.[30] However, we think that Prigogine is wrong when he states that indeterminism imposes itself independently from any metaphysical preference. In his books, Prigogine states repeatedly his annoyance of "Laplace's demon". For example, he says the following in the book he wrote jointly with Isabelle Stengers: *"Nevertheless, for nearly two centuries Laplace's demon has plagued our imagination, bringing a nightmare in which all things are insignificant. If it were really true that the world is such that a demon - a being that is, after all, like us, possessing the same science, but endowed*

[26] Immanuel Kant, *The Critique of Pure Reason,* p. 129-159.
[27] Ian Barbour, *Issues in Science and Religion,*New York, Harper and Row Publishers, 1971, p. 301-302.
[28] Ian Barbour, *Religion in an Age of Science,* p. 102-103.
[29]Werner Heisenberg, *ibid*., p. 171.
[30] Ilya Prigogine, *The End of Certainty*, New York, The Free Press, 1997.

with sharper senses and greater powers of calculation - could, starting from the observation of an instantaneous state, calculate its future and past, if nothing qualitatively differentiates the simple systems we can describe from the more complex ones for which a demon is needed, then the world is nothing but an immense tautology. This is the challenge of the science we have inherited from our predecessors, the spell we have to exorcise today."[31] In conclusion, the answer for the question of why Prigogine preferred Heisenberg's approach, rather than Einstein's, cannot be just the view presented to him by modern physics; in the same way that Einstein looked at this scene and made a choice coherent with his own metaphysical choice, Prigogine, also in coherence with his own metaphysical choice, chose the interpretation that would have rid him of Laplace's demon, about which he had always been complaining. As we see it, the one with an interesting situation is Popper. Even though he opposed Heisenberg's Indetermination Principle that provided indeterminism with its greatest support in the field of physics,[32] he claimed the superiority of indeterminism against Laplace's determinism, which he saw as a threat towards human free will, independently of quantum theory.[33]

When Heisenberg and his followers described what we could know epistemologically, they referred to the fact that this was a description of ontological reality, and stated that indeterminacy did not derive from ignorance or from our own limitations concerning experience and concepts, but that it was the true status of nature. This situation is the result of thinking, as Polkinghorne expressed it by saying, "*Epistemology models ontology,*" that what we can or cannot know is taken to be a reliable guide to what is the case.[34] This strategy was also adopted by Newton, with the difference from Heisenberg being: Newton created a model of the universe that was determinist on the basis of what he knew, while Heisenberg predicted an ontological indeterministic universe on the basis of what he did not know (uncertainties). While in a determinist universe the ontological status of alternatives is equal to impossibility, in an indeterministic universe the ontological status of alternative events happening is possibility. In the same way that from the point of view of the God-universe relation, the ontological determinist model of the universe has been the cause of the appearance of many philosophical and theological approaches, the ontological indeterministic model of the universe has been the starting point of many new philosophical and theological approaches.

GOD AS THE DETERMINATOR OF INDETERMINACIES

Some atheists interpreted quantum indeterminacies as the scientific basis for the existence in the universe of "ontological chance" far from any kind of determination; this "chance" is supposed to protect them from the materialist fatalism. According to this view, even starting from the same beginning of the universe, its the present day state might very well have been different; even the most acute intelligence (Laplace's demon) cannot foresee the future, even if he was able to calculate the position and speed of all material particles, because the future is not predetermined. This approach has given many people an optimistic

[31] Ilya Prigogine, Isabelle Stengers, *Order out of Chaos*, New York, Bantam Books, 1988, p. 77.
[32] Karl R. Popper, *Bilimsel Arastirmanın Mantigi(The Logic of Scientific Discovery),* translated by: İlknur Aka, Ibrahim Turan, Istanbul, Yapı Kredi Kultur Sanat Yayincilik, 1998, p. 248-284.
[33] Karl R. Popper, *Open Universe: An Argument for Indeterminism,* New Jersey, Rowman and Littlefield, 1985.
[34] John Polkinghorne, *Science and Theology,* London, Fortress Press, 2003, p. 31.

outlook concerning the fact that they are not living through a predetermined future and that they really have a free will. According to this view of the universe, "A" does not necessarily lead to "B"; it determines one of many probable outcomes, and consequently "C" or "D" may be as probable as "B". Indeterminacies that look like chance to atheists, are considered by some theist thinkers as gaps through which God influences the universe. According to this view, God determines what is indeterminate and causes according, to his own wishes, all sorts of phenomena and miracles.

According to how Polkinghorne expresses it, divine influence inserts information into the system, but does this without inserting energy; and because of this, this effect cannot be observed like a physical cause.[35] Such a definition of divine intervention asserts that divine influence can happen without violating "the law of conservation of energy," which is the first law of thermodynamics. Those that interpret quantum indeterminacies as something within the scope of God's influence, are not following some new kind of natural theology, because they are not trying to base the truthfulness of the theist approach on scientific results. Yet, they are following a theology of nature, as Barbour expressed it.[36] This point of view shows us how divine action might have happened without violating natural laws, but it does not claim that modern science proves divine action. This approach's importance lies in the fact that it shows, against the objection concerning the fact that the scientific approach excludes divine action, how a conception of divine intervention in accordance to the data of modern science (a theology of nature) could be. What is more, this approach is based on quantum theory,[37] which brought about the invention of the electron microscope, the laser, the transistor, and the super conductors, and which explained many important phenomena like the structure of the atom, the conduction of electricity, and chemical bonds.

Even though he was influenced by the work of some philosophers like Karl Heim,[38] who preceded him, physics professor and priest William Pollard is considered the first to have put forward claims concerning the fact that divine action happens by determining quantum indeterminacies. According to him, God acts on the universe by determining all quantum indeterminacies. The laws of the universe are not deterministic, but probabilistic; by determining quantum indeterminacies, God chooses among probabilities and directs the universe.[39] According to this view, there is indeterminism in the universe, but the moment that we include God into the ontology, we obtain a deterministic structure once more. This shows that Einstein's statement, "*God does not play dice,*" said to express the fact that God does not leave anything to chance, should not be used against the objective indeterministic interpretation of the quantum theory. A conception of God that determines quantum indeterminacies shows us that there is no chance that God does not influence; quantum theory does not mean that indeterminacies are such also for God – even though there are those that think it is so.

Pollard is aware of the problem that might arise between God's determination and free will; and he tries to solve this problem by means of an analogy formulated through quantum theory. We have already said that Niels Bohr's Complementarity Principle presents particles and waves, which look like opposites, as two different versions of the same reality that

[35] John Polkinghorne, *ibid*., p. 89.
[36] Ian G. Barbour, *When Science Meets Religion,* New York, Harper San Francisco, 2000, p. 170.
[37] Paul Davies, *ibid*., p. 101.
[38] Karl Heim, *The Transformation of the Scientific World View*, London, SCM , 1953.
[39] William Pollard, *Chance and Providence: God's Action in a World Governed by Scientific Law,* London, Faber and Faber, 1958.

complete each other. From the observations that support Complementarity Principle which in the physical world look as if were opposites could very well coexist, Pollard passes on to the observation that God's determination (or foresee) and free will might coexist even if this looks paradoxical.[40] According to this interpretation, in the same way that the particle and wave duality is a contradiction only in appearance, but not in actuality, also the duality between divine determination and free will is a contradiction only in appearance, but not in actuality.

Pollard was the most important leader in the theological interpretation of the quantum theory, but not everybody shared his theological interpretation of this theory. For example, Arthur Peacocke thinks that quantum indeterminacies are also indeterminate for God; because of this God cannot know the future; God took some risks at creation and limited himself.[41] At this point, it would be useful to remember that Peacocke was a panentheist.[42] According to Peacocke there is a relation between divine nature and the laws of the universe; also Spinoza had determined the same relation, but, due to the characteristics of science in his time, he had established a relation between the determinism in the universe and divine Nature. Peacocke on the other hand established a relation between indeterminism and divine Nature, with the support of quantum theory. According to this view, God does not create universal phenomena by determining indeterminacies or by violating natural laws, because Peacocke thinks that this would create a distinction between nature and God, and would take us to unacceptable conclusions concerning the problem of evil.[43]

There is a significant difference between saying that there is ontological indeterminism in the universe, to which God is not subject; and saying that there is an indeterministic structure, to which also God is subject. Those who share the views of Pollard think that ontological indeterminism exists only within the universe. According to him, since God determines the gaps within indeterminism, there actually are no gaps; in other words there is no indeterminism from the point of view of the ontology that includes God. For those who share Peacocke's views on the other hand, ontological indeterminism is vast enough to exist even when God is included in ontology. (Peacocke tried to reconcile the view of a God that is so active as to create continuously, and the view of a God that does not know the future.) Others like Thomas Tracy[44] and Robert Russell[45] said that God determined only some quantum gaps, and claimed that there was ontological indeterminism in the universe.

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[40] William Pollard, *ibid*., p. 138-148.

[41] Arthur R. Peacocke, *Theology for a Scientific Age* ,London, SCM, 1993.

[42] According to panentheism God is immanent to the universe and as such he is all of the universe, but at the same time he is more than the universe.

[43] Arthur R. Peacocke, *ibid*., p. 141-145. Whitehead's views according to which the future is indeterminate even for God - even if God knows all possible probabilities, there is no determinism in the universe, and ontological chance exists - he influenced the way the problem of evil was taken up by philosophers, who came after him.

[44] Thomas F. Tracy, Particular Providence and the God of the Gaps, in *Chaos and Complexity*, edited by Robert John Russell, Nancey Murphy, Arthur R. Peacocke, Indiana,Vatican Observatory Publications and The Center for Theology and the Natural Sciences, 2000, p. 289-324.

[45] Robert John Russell, Does "The God Who Acts" Really Act? New Approaches To Divine Action, in *Theology Today 54*, 1997, p. 43-65.

CAN QUANTUM INDETERMINACIES SOLVE THE PROBLEM OF FREE WILL?

Those, who would like to present a view of God in accordance with theism, or in other words of an all-knowing and all-powerful God, accept the conception of a God that determines all quantum indeterminacies. In the meantime they do not neglect the related problems of free will and evil, and defend their theses by establishing an analogy with the Complementarity Principle in quantum theory, as Pollard did, and by claiming that apparently contradictory elements can co-exist, and also, as Nancey Murphy[46] did, that God can determine all indeterminacies without violating free will of humans (by acting at quantum level in the case of the lifeless world, or upon the mind level). We can compare Pollard's position to Malebranch's occasionalism, since while trying to solve certain problems he faced problems similar to occasionalism. On the other hand, those, who thought that this approach was not sufficient to solve the problems of free will and evil, expanded universal indeterminism in a way to encompass also God, and claimed that God did not determine all indeterminacies. According to us, it will be more correct to choose the first of these two approaches. We think that the assumption that God might have created indeterminacies that even he cannot know, is unacceptable from the point of view of theism, even if it is said that it had happened as a result of his own choice. On the other hand, we are also of the opinion that we cannot solve the problem of free will by assuming that God cannot foresee the future or by proposing models that limit God's action. We have already seen that the problem of free will exists for atheists, at least as much as it exists for theists, since the fact that Laplace's demon could foresee the future was an existential nightmare for atheists. We are of the opinion that even if we accepted the facts that universal indeterminism does not derive solely from an epistemological situation, and that ontological indeterminism is the universe's actual structure, we would still have to be skeptical about Prigogineian optimism concerning the fact that the free will problem can be solved.

Certain philosophers have established a relation between quantum theory and processes within the human mind. Penrose for example, is one of those who think that the mysteries of quantum theory may be useful in solving the mysteries of the human mind.[47] Among those, who developed detailed approaches to unite the subjects of quantum theory, of the human mind and of divine action, George Ellis is one of the most important. Ellis tried to show that the revelation and inspiration of God might have happened by means of God determining the quantum indeterminacies in the human mind, without violating natural laws.[48] According to this, quantum gaps make possible a physical explanation concerning the way the relation between God and humans may have been established; since the brain is also made of atoms and subatomic particles like all matter; interventions at a quantum level may create thoughts and sentiments. Contrary to the general approach that shows the bottom-up effect of quantum theory, Ellis mentions the top-down changes that can be brought by means of acting upon the human mind and of using the human body. Ellis considers his own approach important from the points of view of the free will problem, and of the matter of ethics that is

[46] Nancey Murphy, Divine Action in the Natural Order: Buridan's Ass and Schrödinger's Cat, in *Chaos and Complexity* edited by: Robert John Russell, Nancey Murphy, Arthur R. Peacocke, Indiana, Vatican Observatory Publications and The Center for Theology and the Natural Sciences, 2000, p. 325-357.

[47] Roger Penrose, *Buyuk, Kucuk ve Insan Zihni (The Large,The Small and Human Mind),* translated by: Cenk Turkman, Istanbul, Izdusum Yayinlari, 2003, p. 67-109.

[48] George F.R. Ellis, The Theology of the Anthropic Principle, in *Quantum Cosmology and the Laws of Nature* edited by: Robert John Russell, Nancey Murphy, C. J. Isham, Indiana, Vatican Observatory Publications and The Center for Theology and the Natural Sciences, 1993, p. 196-198.

related to it.[49] He is of the opinion that determinist chaos and the determinist approaches of classical physics that do not leave any gap in nature, cannot explain the way special divine action happens within the framework of natural laws, and that it is only quantum theory that has the potential to explain this.[50] Ellis tried to reconcile divine action at a mental level with the existence of free will in humans. As a result of this, Ellis's approach is important since it is an effort to provide a model of how divine action can happen at the level of the human mind without violation of natural laws. However, just like all other theistic and atheistic approaches, his approach also cannot solve the paradoxes related to free will.

It is necessary to very carefully analyze how coherent we can be when stating that a person can have free will, even in an indeterministic universe, where people have been determined by the physical circumstances that precede them. Pollard, Murphy and those who were of their opinion, did not show how the problem of free will could be solved; however, by saying that the existence of free will could be in accordance with God's determination of the universe's indeterminacies, they voiced a view more in line with theism's classic conception of God. On the other hand, not only are the efforts of those that limit divine action, so as to be able to solve the problem of free will and of the consequent problem of evil, not enough to solve the above-mentioned problems, but they are also not in accordance to theism's classic conception of God. The problem of the free will of people, is not related only to whether or not the universe has a deterministic structure; it is related to the 'essence' of the human mind (or soul), and to whether or not there is determinism at this level. Science as it is nowadays, has not yet been able to solve the 'essence' of humans, and it is still possible to claim that in humans there is a substance (soul) other than its material substance; if this view is correct, it means that because of an impermeable non-material substance, the problem of the "humans' essence" will never be solved. On the other hand, even those who claim that humans are made only of material substance accept that the brain has kept its mystery – and even if according to this approach it might seem that there is hope in the future concerning the solution of the mystery of the brain – this means that the 'essence' of humans has not yet been solved. In addition to this, it should be kept in mind that notwithstanding the existence of physical circumstances pre-determining what humans will be, there is no agreement concerning a single definition of free will (even if these circumstances are of an indeterministic nature), which is the basis of the solution of the problem concerning whether or not free will is possible. Not only have those who have designed a model that limits divine action and knowledge to find a basis for free will and consequently to solve the problem of evil, not been able to solve the problems that they were trying to solve, but they have also drifted apart from theism's conception of an all-knowing and all-powerful God, for the sake of the solution to a problem that they could not solve. The problem of free will has not been solved by either theism or atheism. We are of the opinion that this problem cannot be solved, for in the case of theism this does not depend only on an insolvability deriving exclusively from natural sciences, but on the difficulty of determining a border between divine will and human will, while at the same time taking into consideration human responsibility; in the case of atheism on the other hand, insolvability derives from a paradox that looks impossible to solve, consisting of the problem of how to speak about the freedom of a material being determined by external physical circumstances, independent from him, notwithstanding this physical determination. According to us, no explanation, be it of a theistic or atheistic nature, formulated with the aim of solving the problem of free will and the related problem of ethics,

[49] George F.R. Ellis, Ordinary and Extraordinary Divine Action, in *Chaos and Complexity* edited by: Robert John Russell, Nancey Murphy, Arthur R. Peacocke, Vatikan Observatory Publications and The Center for Theology and the Natural Sciences, 2000, p. 376-377.
[50] George F. R. Ellis, *ibid*., p. 361.

has been able to solve all paradoxes and to reply to all objections, nor can it ever hope to. We think that it is not possible to solve the problem of free will on the basis of quantum theory, even though we find that the fact that this theory makes it possible for us to think about problems related to the free will, within a new model of the universe, is important. In addition to this, we are also of the opinion that the most widespread interpretation of this theory - ontological indeterminism - shows us that divine action can happen also without violation natural laws, is important.

MIRACLES WITH BOTTOM-UP INTERVENTIONS

We can question whether or not by claiming the existence of a bottom-up intervention, the approach that reunites quantum theory with divine action can explain the great changes (miracles) in the world. First of all, let us remember the fact that all substance in the universe is made up of atoms and subatomic particles, and that interventions at a subatomic level will spread throughout the universe. In addition to this, as it has been shown to be on the basis of chaos theory, even what can be considered a very small change in one part of the universe, can cause great changes in another part of the universe. According to this approach, known as the Butterfly Effect, a butterfly fluttering its wings in London might cause a cyclone in Istanbul.[51] Consequently, by putting together God's intervention and his knowledge of the whole universe, we can explain how a cyclone of the kind that is mentioned in sacred texts can have been formed with the aim of destroying whole tribes, by means of an intervention that will lead a butterfly to change direction – through interventions on the butterfly's mind at quantum level or by creating an air current also through interventions at quantum level that will make the butterfly change its direction. The effect described as the Butterfly Effect can also be expressed as "sensitive dependence on initial conditions". Even before the importance of this was understood in physics, common people had noticed the existence of such an effect by means of common sense and simple observations. It had a place in folklore:

"For want of a nail, the shoe was lost;
For want of a shoe, the horse was lost;
For want of a horse, the rider was lost;
For want of a rider, the battle was lost;
For want of a battle, the kingdom was lost."[52]

In chaos theory the Butterfly Effect is studied within the framework of deterministic laws. If we take into consideration chaos theory together with quantum theory,[53] we can try to explain (by including in the process indeterminism) small changes that might have great consequences, by stating that God is determining indeterminacies. What is important from our point of view is to show what important results this kind of bottom-up interventions can have. In a time span of a few hours, which for us is a short time, the small particles of substance will get into quadrillions of relations consisting of collisions with other small particles surrounding them and with the environment. If, as Heisenberg thought, the laws of the universe are in their essence of a probabilistic nature, then by intervening on probabilities during quadrillions of interactions, a great difference can be made. Let us take the case of a rocket that rotates once around the world and returns to the same spot; if the orbit of this rocket deviates by a trillionth of a grade, there will not be a great difference in the first tour,

[51] James Gleick, *Chaos,* New York, Penguin Books, p.8.
[52] James Gleick, *ibid*., p. 23.
[53] A lot of material has been written during the last 10-20 years, on the merging of these two theories and about related problems.

however, after a trillion tours a difference of a grade will appear, after 90 trillion tours the difference accumulated will be so much that the new orbit will be vertical to the original orbit, and after 180 trillion tours the new orbit will be parallel, but with the opposite direction of the first one. Small changes that are carried out by intervening knowingly on probabilities will cause very big differences and unexpected results, if repeated in a very high number of times, and when the probabilities are knowingly chosen according to a definite aim.

The laws of probability entered the world of physics for the first time towards the end of the 19^{th} century, with the entropy law. The entropy law is the second law of thermodynamics, which is one the most basic laws of the universe, and states that the disorder in the universe is constantly increasing. There are no important conflicts concerning the interpretation of the entropy law, contrary to the case of quantum theory; even though this law is consistent with determinism, there is a vast consensus regarding its probabilistic nature. The entropy law appears when there is a dispersion of molecules, as in the case of air molecules. Due to factors like the collision of quadrillions of molecules, we cannot calculate with precision the exact spot in the room where a single molecule of air will be after a few hours; however, on the basis of calculations of probabilities we can be sure that the room will not be without air. George Gamow says that for the air molecules of a room to collect in one half of the room, leaving the other half without air, we should wait $10^{299.999.999.999.999.999.999.999.998}$ seconds; if we take into consideration the fact that the estimated age of the universe is 10^{17} seconds, we can understand why we need not worry of being without air, due to the molecules having assembled in one half of the room.[54] Let us consider an imaginary event like the annihilation of a group of people, who had made an attempt to kill a prophet, by the transferal of the air molecules of the environment, in which they were, to a distant spot. Undoubtedly, from the point of view of a theistic approach, this event would be considered a miracle; however, in this case what is seen as a miracle would happen not by means of a violation of the laws of nature, but through the realization of very low probabilities. We can also consider an event like the separation of the waters for Moses, which is "a miracle" in which all three theist religions believe. From a physical point of view, the sea is made up of a very high number of molecules that move haphazardly. If we do not see all the molecules to the right of an imaginary line drawn over the sea move to the right, and those to the left move to the left, the reason for this is the same as in the case when we are never left without air, because of the distribution of air molecules; it is not that such a situation could not happen, it is that from a mathematical point of view its probability is so low as to be practically impossible. (In mathematics, probabilities lower than 1 in 10^{50} are generally considered impossible.) When we say that at the moment Moses came to the sea shore, all the water molecules in the sea to the right of Moses moved to the right, and all those to his left moved to the left, with the consequence that the waters separated, we are describing "a miracle", which consisted of a very, very low probability coming true, rather than of a violation of the laws of physics.

There is an important difference between the probabilistic structure of the entropy law and the probabilistic structure of quantum theory, which has to be underlined in the explanations of miracles based on them. Definitions of miracles in the examples that we provided on the basis of the entropy law show how miracles can happen in a deterministic universe through a choice of probabilities. Definitions of miracles based on the quantum theory on the other hand, show how miracles can happen in an indeterministic universe through the determination of indeterminacies. In the entropy law, probabilities and chance

[54] George Gamow, *1-2-3-Sonsuz (One, Two, Three…Infinity),* translated by: C. Kapkin, Istanbul, Evrim Yayınevi, 1995, p. 212-213.

depend from our epistemological circumstances; however, in the quantum theory, the fact whether probabilities and chance are epistemological or ontological, is a subject of debate. In a deterministic universe, if we accept the conception of a God who does not violate the laws of nature, then we have either to accept that God has already made all its interventions in the universe in the very beginning, as it is in Leibnizian model, and that when the time comes the miracles are actualized. On the other hand, if we, on the basis of the most widespread interpretation of quantum theory, accept the existence of objective indeterminacies in the universe, we can claim a conception of miracles that is not against the laws of nature, and which does not require God's intervention from the very beginning. According to this, we could explain the making of miracles, by having the molecules in the two examples based on the entropy law move through a determination of the indeterminacies: In the first example the air molecules are directed by a determination of the indeterminacies, and the enemies of the prophet are destroyed. In the second example on the other hand, by a determination of the indeterminacies, the water molecules in the sea in front of Moses are made to move right and left. Explaining how certain miracles may have happened, within the framework of natural laws, by considering at the same time both the entropy law and quantum theory, will be an interesting approach.

We are not of the opinion that such an approach is necessary from a theological point of view. This is why we do not claim that the examples we provide in this article, about how miracles may have happened within the framework of natural laws, reflect the way things actually went. However, this kind of an explanation of miracles provides the necessary response to those like David Hume who deny the possibility of miracles, by describing them as violation of natural laws, by stating that miracles might mean the realization of low probabilities which are immanent in natural laws, and not necessarily a violation of these laws. In addition to this, this approach is of the kind that will be an answer to the objections of philosophers like Spinoza and Schleiermacher who oppose the conception of miracles as a violation of natural laws, on theological grounds.

Our attitude towards natural laws is different from the Newtonian and Einsteinian approach that states that natural laws correspond exactly to a "universe within itself", and from the Hawking's approach that describes natural laws as just mathematical models that are the product of the human mind,[55] and that since it does not attribute importance to the correspondence of the "universe within itself", focuses only on an explanation of observations. As we see it, the aim of science should have a Newtonian and Einsteinian direction, rather than a Hawkingian one; however, our limitations as humans make it impossible for us to understand the "universe within itself" exactly. It is for this reason that we consider ourselves as part of the critical realist class, into which Barbour includes both himself and Bohr.[56] According to this, natural laws reflect the "universe within itself" only partially; natural laws are an approximation of truth, but they can never provide us with a full picture of the truth.[57]

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[55] Stephen Hawking, *Ceviz Kabuğundaki Evren (The Universe in a Nutshell*); Stephen Hawking, *A Brief History of Time.*

[56] Ian G. Barbour, *Religion in an Age of Science,* p. 99.

[57] When we define ourselves as "critical realist", we are not limiting the aim of science as only understanding, and we are not excluding the control of nature and the making of predictions from the aims of science, as Barbour did.

We consider ourselves as being "critical realists", because a "realistic" conception of science is not possible so long as the paradox between macro physics and micro physics is not solved, and because an approach that does not take into account the reality of a "universe within itself", typical of those, who think like Hawking, is unacceptable from our point of view. According to the Newtonian approach, a scientist is an explorer; he finds and shows laws that are there, waiting to be discovered. According to the Hawkingian approach on the other hand, a scientist is more like an inventor, since natural laws are not there waiting like an object to be discovered; they are the products of the mind. According to our approach, even though a scientist might be an explorer, there are important obstacles concerning a full comprehension of the mysteries of the object. Our situation can be compared to that of someone who is seeing an area from an airplane with his naked eye without landing; or a blind man, who is trying to perceive an elephant by touching him, without seeing him; or a deaf man, who is reading the notes of a composition without being able to listen to the music. As we see it, our scientific theories provide us with information concerning the "universe within itself", but this presentation is not sufficient; the situation may not be as tragic as it is portrayed in our examples, but we are in no doubt that we are closer to the truth than Laplace's optimism concerning scientific theories.

CONCLUSION

It appears that the claim concerning the impossibility of divine intervention is baseless in the light of the data of modern science. By determining at quantum level indeterminacies, miracles claimed by theism and also radical changes in the universe can be explained. This perspective cannot lead us to conclude that God's action must absolutely happen in this way, but it is precious nonetheless, because it shows that there is the possibility within the framework of modern science's data, of miracles and divine action happening without violation of natural laws. This approach has to be taken into consideration, because it permits us to correct David Hume's description, according to which miracles are a violation of natural laws, and also to correct the theological objections of Spinoza and Schleiermacher, according to which miracles are in contradiction with God's own Nature, and natural laws.

However, it would be wrong to state that this approach solves the problem of free will or that God must have certainly made his miracles in this way. As we see it, no approach, be it theistic or atheistic, solves the problem of free will satisfactorily. At this point, a theistic defense of the argument should be limited to stating that also atheism is caught in the problem of free will as much as theism, and even though theism's approaches on this matter cannot be proved and based concretely, nobody else can claim to have an explicative model of this subject either. Taking the fact that there is ontological indeterminism in the universe as a starting point, new perspectives on the problem of free will may be developed, and as in the case of Kant's third *antinomy*, adjustments can be brought to the way this problem is taken up, by accepting a deterministic universe. However, quantum indeterminacies cannot - either for atheism or theism - solve the question concerning the discussion about the free will of a creature that appeared for causes that preceded him. It could be said that theism may have an advantage in comparison to atheism, as far as the solution of this problem is concerned, since

it can refer to divine providence or to the mysteries of the soul; on the other hand, however, the real problem for theism is to establish where divine will ends and the individuals' free will begins, and also how to reconcile God's power with human's responsibility.

By claiming that God may have made his miracles happen within the framework of natural laws by determining quantum indeterminacies, we have only tried to show a possibility. That something is possible does not necessarily mean that it absolutely has to have happened in this way. A scientific approach can neither prove, nor disprove miracles that are hidden in history or certain personal experiences. As we see it, the most coherent approach should be that a theist should remain agnostic towards the way miracles have happened (not on whether or not they have happened), because not only do we not have scientific information on how God may have made his miracles, but also we cannot justify a Spinozian theological assumption about God not violating natural laws. The Spinozian assumption that "God does not violate natural laws" and the denial of miracles, implicitly carry two presumptions; the first of these is of a theological nature and presumes that we know all the laws/wisdoms of God, and the second is of a scientific nature and presumes that we know everything about the "universe within itself" by means of natural laws; this second presumption was a widespread misapprehension of the 19th century. First of all, it would be immensely naive to confuse all divine laws/wisdoms with the natural laws of physics. If we accept the fact that divine laws/wisdoms have a wider scope than the laws of physics, objections of a theological nature concerning the fact that it would be strange that God on the one hand should set laws and on the other violate them, lose all their validity. Nobody will think that a king, whose guards deny access to the palace of people, who have come to its gates, has violated his own laws when the guards admit an exceptional visitor, also because the king never set such a law in the first place; people watching the general attitude of the guards had by themselves set a law "binding" even the king! According to widely accepted theistic approach, natural laws are servants even more loyal than the king's servants; claiming that these servants limit divine action is unacceptable from the point of view of theism. With such an approach it could be claimed that in some circumstances, making miracles by suspending natural laws or the general way of things, could be part of the divine system; this would make it unnecessary to explain miracles without violation of natural laws.

Since a person, who has always lived at sea level and has carried out experiments on the boiling of water at this level, cannot imagine that the degree at which water boils will change when up on a higher level, he will think that the laws that he has found at sea level are valid throughout the universe; if one day he should go up on a mountain he will observe the fact that the degree at which water boils has changed, but since he thinks that the natural laws at sea level are universal, he will reach the conclusion that these laws have been violated. Certain people, who cannot penetrate the mysteries of Divine laws/wisdom, may think that the laws that they know (partial natural laws), correspond to all universal laws. For all these reasons, we cannot say that a deterministic model of the universe must absolutely render miracles impossible, or that we cannot believe in miracles if there is not an approach like Heisenberg's Indetermination Principle, which says that there are gaps in the way the universe operates. We should also keep in mind the existence of an approach, according to which the indeterministic interpretation of quantum theory is arguable and that there is no ontological indeterminism in the universe, since indeterminism is caused by our epistemological limitations. If there are "hidden variables" at quantum level, as Einstein thinks there are, and if the quantum level is deterministic, then the approach according to which miracles need the existence of indeterminacies at this level to exist, will find itself in a theological blind alley.

Notwithstanding this cautious approach of ours, we think that quantum indeterminacies may be very useful in explaining divine interventions like miracles, within the framework of natural laws. We are of the opinion that if we just manage to show that those criticizing theism by saying that miracles are impossible according to a scientific approach, are unaware of the possibilities presented by modern science and that this approach of theirs is erroneous, this article will have accomplished its aim. Denial of divine intervention and of miracles, is not based on scientific phenomena. However, if people, who believe *a priori* in atheism and naturalism as a metaphysical assumption, merge this philosophical belief of theirs with their scientific approach, they will reach a conclusion denying the possibility of divine intervention; however, this would not be a result of science, but of the philosophical-metaphysical approach of these individuals. As we have been seeing in this article, people with different philosophical-metaphysical approaches have developed models that reconcile divine action with modern science, and by merging their approaches in the fields of physics and theology, have shown that a theology of nature is possible within the framework of modern science. As also Philip Clayton has remarked, if we want to show how divine intervention can happen without violation of natural laws, the period in which we are living is the most suitable since Newton's time.[58] We must take into consideration theological and philosophical interpretations based on the physical interpretations of quantum theory, which is one of the two most important theories of physics, when evaluating matters like divine action, miracles and free will.

[58] Philip Clayton, *God and Contemporary Science,* Edinburg University Press, 1997, p. 173-174.

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