THE QUANTUM THEORY, PHILOSOPHY AND GOD

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To my beloved friend Kerem Aydınlar

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PREFACE

Every single piece of matter in the universe is made of atoms, and the atoms are made of even smaller building blocks. A modern scientific description of this microscopic realm is presented by the quantum theory. This theory has been substantially successful not only in its fundamental scientific glories, but also in paving the way to numerous technological marvels including computers, lasers, nuclear plants etc. Despite its indispensability in modern science and technology, this theory also contains some aspects which seem to be in radical opposition to the rest of the theories in the natural sciences. In fact, no other scientific theory contains such ontologically intriguing elements as 'indeterminism' and 'action at a distance'. Moreover, the quantum theory also shakes the grounds of dominant paradigms in the methodology of natural sciences, by showing the impossibility of 'reductionism' and 'avoiding the observer effect'.

By virtue of its groundbreaking ontological and epistemological implications, the quantum theory has always been subject to ardent philosophical and theological scrutiny. Between the 17th and 20th centuries, theological inquiries such as Divine action, miracles, the problems of evil and free will had been carried out with a priori acceptance of 'determinism' - this assumption is not uncommon to date. With the quantum theory, for the first time in history, the idea of 'objective indeterminism' has attained scientific footing. As a consequence, all of the mentioned philosophical-theological matters (as well as their relatives) had to be reevaluated, almost from scratch, under the light of this new theory. In this book, we shall see how the quantum theory relates to these historical debates. As we shall see, sometimes the implications of this theory are stretched a little too far (I will present my critique therein). Besides, many alternative interpretations of the quantum theory exist; they often yield diverging philosophical-theological resolutions.

In the first chapter of the book, I will present a brief review of the history of science and philosophy on areas related to our subject matter. In Chapter II, I will lay out scientific and philosophical description of the quantum theory. The first two chapters constitute a

prelude to the actual problems of our interest, in philosophy of religion, to which the latter three chapters are devoted. The issues of Divine action, miracles and the problems of evil and free will are subject matters of Chapters III, IV and V, respectively. In scrutinizing the implications of the quantum theory on these issues, I've endeavored to refrain from 'exaggerating or demeaning' them. When relevant, I have also included other views on these issues, apart from the quantum theory.

I am indebted to numerous people in preparation of this book, for their valuable discussions, criticism and suggestions. I am pleased to acknowledge the support I received from the Faraday Institute of Cambridge University, by giving me access to its resources and providing a calm atmosphere to interact and collaborate with many leading experts on the subjects related to the contents of this book. Last but not least, I am sincerely thankful to my readers for their interest. For comments, critiques and suggestions, please visit my web page www.canertaslaman.com, where you will also be able to access my other works.

INTRODUCTION

The incompatibility of science and religion[1] is often taken for granted. Few religious believers share this opinion; indeed, the majority of its advocates are atheists. Auguste Comte, the founding father of positivism, regarded the theological and metaphysical beliefs as byproducts of societies and minds that have not yet completed their evolution, and further claimed that in the stream of historical evolution, these faiths will eventually be superseded by science.[2] Even though Comte's evolutionary objective failed to come to reality as of today, many contemporary atheists, most notably Richard Dawkins, follow his legacy and vehemently contend that science should oust religion.[3]

1 Unless mentioned otherwise, throughout this book I use the term 'religion' to cover the three monotheistic religions: Judaism, Christianity and Islam.

2 In his famous "law of three stages", Comte has claimed that the positive (scientific) stage will follow the theological and metaphysical stages: Auguste Comte (Author), Frederick Ferré (Translator) *Introduction to Positive Philosophy*, Hackett Publishing Company, Inc, Indianapolis (1988).

3 In all his books, Dawkins fight against religion with the sword of science. See, for example: Richard Dawkins, *The God Delusion*, Black Swan, Berkshire (2007).

The clash between science and religion is ubiquitous; you must have witnessed numerous refutations or accusations from one camp against the other. On the other hand, some thinkers prefer to abstain from such debates, considering religion and science to be two completely unrelated fields; their conflict or harmony is thus meaningless. Science is about the causal understanding of natural phenomena, whereas religion enquires into the meaning and purpose of life; hence, religion and science are totally separate fields, even though they might sometimes complement one another.[4] Lastly, many thinkers maintain that there cannot be any conflict between science as an endeavor to understand the universe created by God, and religion inscribed by the same God. Since they have their roots in the same soil, religion and science must inevitably be in harmony. According to 12th century Muslim philosopher Ibn-Rushd, religion and science are companions.[5] In a similar fashion, contemporary Christian theologian John Polkinghorne considers the relationship between science and religion to be 'cousinship'.[6]

4 Ian Barbour, *When Science Meets Religion*, Harper Collins, New York (2000), p. 11-12.

5 Averroes (Author), C.E. Butterworth (Translator) *The Decisive Treatise*, Brigham Young University, Provo (2002).

6 John Polkinghorne, *Quantum Physics and Theology*, SPCK, London (2007), p. 15.

Establishing proper relations between science and religion is of paramount importance regarding philosophy of religion. To this end, in the last couple of decades several classifications have been suggested. Among them, we can mention four-fold categorization by John Haught, eight-fold by Ted Peters, nine-fold by Willem Drees and four-fold by Ian Barbour.[7] All these works are quite valuable as they facilitate interdisciplinary works between diverse areas of science (biology, physics etc.) and equally diverse branches of philosophy (philosophy of science, philosophy of religion etc.). Notwithstanding, since such classifications tend to generalize the very complex notions of science and religion, they are prone to causing misconceptions. In my opinion, the mentioned classifications are preferable for introductory studies to science and religion, whereas for more advanced studies, they would be rather more misguiding than beneficial.

The initial response to whether or not science and religion contradict should be "Which science and which religion?". One should notice that the generalizations of 'religion' and 'science' are often misleading. For example, the quantum theory - our main focus in this book - is one of the most fundamental and widely accepted

7 Barbour's categories are: Conflict, Independence, Dialogue and Integration.

theories of modern science and it has paved the way to countless technological products; whereas, as we will see in the following pages, there is not a consensus among scientists (including the founding fathers of the theory) about how to interpret the results of this theory. Likewise, within every religion are numerous schools of thought, denominations, sects etc., with a broad spectrum of philosophical perspectives. For example, there have been many different interpretations of free will among the philosophers of monotheistic religions. Those who reject free will or argue that there is no contradiction between free will and determinism (also called 'soft determinism') would probably be less comfortable with indeterminist interpretation of the quantum theory, as compared to the advocates of a libertarian model of free will.

It is possible to follow - as I shall do in this book - an independent route, where a certain scientific issue is investigated with its idiosyncrasies and philosophical aspects. In order to question the relationship of this particular issue with religion, one must consider views from different faiths and their shades. Even though this methodology can be applied to every field of science, it is particularly beneficial for discussions on the quantum theory. Many famous scientists, who completely

agree on its mathematical formulations, interpret the quantum theory in totally different ways. We often witness diverse philosophical and theological interpretations of a scientific theory, and yet, no other scientific theory has ever been interpreted by its adopters in such diverse ways as in the case of the quantum theory. More importantly, the divergent views happen to be in the most philosophically intriguing matters such as the determinist or indeterminist structure of the universe. Einstein, for example, vehemently advocated for interpreting the quantum theory in accordance with determinism, whereas Heisenberg insisted on 'ontological indeterminism'. Anyone who attempts to evaluate this theory and its relationship to philosophy and religion must first properly understand its different interpretations. While those who are more inclined to adopt the idea of a deterministic universe (from a philosophical or theological standpoint) would tend to follow Einstein's approach, those who prefer indeterminism would be more sympathetic to Heisenberg's angle. This is why, as mentioned above, it is critical to ask 'which science' and 'which religion' prior to studying science-religion relations, and particularly so in the case of the quantum theory. The answers given to these questions will shape the following evaluations. A person who adopts Heisenberg's approach (as do

the majority of contemporary physicists) would argue that science supports indeterminism and his answer to 'which science' would be the 'science that shows the indeterminism of the universe'; thus, his approach to the relationship between the quantum theory, philosophy and religion would be entirely different from another person who follows Einstein's interpretation. We should keep in mind that no general consensus exists within the scientific or theological communities about these controversial subjects. One of my goals in writing this book is to show that, like religion, science also has hermeneutic aspects.[8]

It would be more beneficial to address each subject of science-religion relationships with corresponding idiosyncrasies of the subject, without being restricted by any particular classification. This is the strategy I follow in this book. Nevertheless, even though I do not strictly follow any particular classification, my arguments stand against constructing solid walls between science and religion. In addition, I also follow a moderate 'critical realist' methodology, and avoid being over-skeptical or naive towards science and religion.

8 Stephen Happel, *"Metaphors and Time Asymmetry: Cosmologies in Physics and Christian Meanings"*, (ed: Robert John Russell, Nancey Murphy and C. J. Isham, Quantum Cosmology and The Laws of Nature), The Center for Theology and the Natural Sciences, Berkeley (1999), p. 108-109.

Indeed, this 'independent handling' approach can be applied to many other topics about science and religion: scientists who study the motion of the planet Saturn, the communication of ants or the properties of acids, and theologians who study how to be sincere in prayers, be merciful to others and avoid lying, often focus on these issues without building an explicit link between science and religion. On the other side, both science and religion make judgments about the same universe we live in. Since 'God's creation' is the most fundamental element in religions, when scientific theories about the roots of the universe and life are handled, the question of 'Divine action' surfaces out by itself and it becomes impossible to isolate scientific and theological considerations. Inspired by Wittgenstein's 'language games',[9] some thinkers argue that the corresponding languages of science and religion belong to entirely different realms, and hence it would be nonsense to think about relating science and religion to one another. However, we perceive the world in its entirety and since the languages of science and religion speak about the same world, they are inseparable. According to modern psychology, human consciousness

9 According to Wittgenstein, just as the rules of a game make sense only within that particular game, any spoken language is only meaningful within the system it belongs to: Ludwig Wittgenstein (Author), G. E. M. Anscombe (Translator), *Philosophical Investigations*, Blackwell Publishing, New York (1997).

should be handled in its entirety, and both science and religion possess elements in shaping consciousness. It is thus impossible to construct a divide between science and religion.

The primary goal of this book is to evaluate the implications of the quantum theory on certain problems in philosophy of religion. To that end, we should be equipped with a basic scientific understanding of the theory - at least at a level to properly follow the corresponding discussions - and investigate its aspects related to our main subject matter. For this reason, we devote the first two chapters of this book to the description of the quantum theory in its historical and scientific context. Equipped with this understanding, we then address the questions of Divine action, miracles and free will by using the implications of the quantum theory. Obviously, this book is not a textbook on quantum mechanics: we will not present a mathematical description of the theory, nor apply the theory to calculate the orbits of electrons and properties of laser beams. Likewise, we will not make any attempt to stretch the philosophy of quantum mechanics to prove or disprove a particular theological doctrine. Instead, after a brief - but sufficient for our purposes - scientific description of the theory, I will discuss its implication

on certain controversial philosophical and theological matters such as Divine action, miracles and free will. I will scrutinize whether the theory does in fact open up new horizons in these matters, as advocated by some philosophers. In doing so, I will abstain from pursuing 'natural theology'; in other words, I will not attempt to 'prove' any theological argument using the quantum theory.[10] Instead, like in Ian Barbour's notion of 'theology of nature',[11] I will argue that centuries-old theological debates must be studied under the light of modern scientific results and they should be interpreted in accordance with the laws of nature as described by modern science.

Theological interest in science should not be restricted to digging out scientific results that would support theological arguments - as done in natural theology. Instead, theological perspectives should be broadened towards determining which one of the abiding theological interpretations are in harmony with science, thereby constructing a theological view in coherence

10 In saying this, I do not mean that I am against 'natural theology'. To the contrary, in my other works I advocate that when properly formulated, natural theology can be supported by modern science. See, for example: Caner Taslaman, *Twelve Arguments for the Existence of God*, Istanbul Publishing, Istanbul (2020).

11 Ian Barbour, *Issues in Science and Religion*, Harper and Row Publishers, New York (1971), p. 453-454.

with modern scientific findings. A high school student today might - correctly - claim to know more physics than Galileo. Neither religion nor philosophy can completely turn away from scientific findings that present invaluable information about the universe. Of course, when the scientific results are being interpreted, one must be careful to consider all possible perspectives (as I will aim to do in this book). It should also be kept in mind that a person who is set to search for the truth always knocks on the doors of science, philosophy and theology. Even though each of these three fields has their own methodologies and (sometimes) their own objects of study, they have a common goal of 'finding the truth'.[12] It would be quite worthwhile to search for the truth at the crossroads, in harmony with each one of these fields. Finding a harmony between science and religion in places where they overlap is psychologically more satisfying. Theology cannot overlook this need.

We should understand right from the beginning that the quantum theory is by far the most important modern scientific description of the microscopic world. A comparably significant modern theory about the macroscopic world is the theory of relativity. Both theories were formulated in the early 20th century. Intriguingly,

12 Louis P. Pojman, *Philosophy of Religion*, Waveland Pr Inc, Long Grove (2008).

the theory of relativity has put an end to the idea of the absoluteness of time and brought about substantial philosophical confusion. However, including relativity, no other physical theory has ever been as mind-boggling as the quantum theory. This theory has many counter-intuitive ideas that have remained steadfast against all empirical scrutiny. Niels Bohr, the famous physicist and one of the founding fathers of the quantum theory, once said: "If the quantum mechanics hasn't profoundly shocked you, you haven't understood it yet."[13] If you are not already familiar with the ideas of quantum mechanics, as you read along this book you will be astonished that there are many seemingly 'nonsense' predictions of this theory (such as a particle simultaneously being 'here' and 'there'), which are all proven by numerous experiments. It is most natural that we have difficulty in digesting such counter-intuitive ideas at once. However, there is no better scientific description of the microscopic world. You may find it useful to prepare your minds in a 'blank slate' phase before you read texts about the quantum theory.

If you feel confused or perhaps totally lost about the paradoxical-looking predictions of quantum mechanics, you may find some comfort in Paul Davies' view: you

13 Paul Davies, *God and the New Physics*, Simon and Schuster, New York (1984), p. 100.

are on the same track as Einstein.[14] In my opinion, even though the predictions of quantum mechanics against our common daily experiences make the theory quite elusive, in the meantime the same aspect also makes it more appealing from a philosophical point of view. It is this theory that has shaken the grounds of a mechanical-deterministic universe, on which the philosophies of many prominent historical figures (including Spinoza, Leibniz, Kant and Marx) stood for many years. This fact alone would suffice to make the theory philosophically appealing. On top of this, however, the quantum theory also has critical implications for highly-debated philosophical and theological topics, including Divine action, miracles and free will.

As noted above, some thinkers prefer to compartmentalize religion and science, and view them as two totally unrelated fields. However, placing such a perspective on a solid ground would require a priori understanding of the teachings of the two fields. A theologian or a scientist may 'adopt' compartmentalization, without crossing into the other's territory. However, if one intends to 'defend' this approach, he should be equipped with a pertinent understanding of the two fields. In this book, even though I argue against compartmentalist approaches,

14 Paul Davies, p. 100.

I do not necessarily sympathize with all struggles to establish a positive relation between science and religion. For example, in the following chapters you can find my criticism on establishing superficial analogies between the quantum theory and religious beliefs, as well as on the presentation of open-ended discussions about the quantum theory as absolute truths, in order to support certain religious doctrines. Interpretations of the results of quantum mechanics are much more controversial than any other theory of physics; therefore, we should be aware that the philosophical arguments we develop will be linked to controversial matters. On the other hand, this theory is so fundamental in modern physics, it has been so successful against all experimental scrutiny, and it has been so fruitful in paving the way to new technologies that no serious philosopher who studies science-religion relations can turn a blind eye to it. Even though some aspects of the theory might cause us discomfort, we have no other option than struggling to develop philosophical ideas on these loose grounds.

It is impossible to follow the Cartesian method of supporting every single one of my claims with pertinent proof: this book inevitably contains certain presuppositions. For example, when we discuss Divine action, we

presuppose the existence of an omnipotent and active God as described in theism (the roots of this presupposition - rational arguments, fideism, ontological inquiries etc. are beyond the scope of this book). When I evaluate theological consideration, I give priority to certain mainstream schools of thought. Furthermore, my focus will remain on the philosophical and theological implications of quantum mechanics; associated speculative ideas about the beginning of the universe - such as quantum cosmology - will be beyond my scope.

Throughout this book I am going to discuss new philosophical questions brought about by the quantum theory; how this theory comes into play when looking at older philosophical problems; and which interpretation of the theory is more in line with which philosophical and theological approach. We will see that in the light of modern scientific results, it is no longer possible to argue against miracles and free will based solely on Newtonian mechanics. Religion is not as subjective, and science is not as objective as some might presume. In developing my arguments, I will refrain from exaggerating or demeaning the results of quantum mechanics. In addition, when discussing miracles and the problems of evil and free will, I will include arguments from other fields. Obviously, in writing this

book, I intend to support certain ideas and conclusions. In addition to this, however, I also consider it a valuable philosophical endeavor to determine where people err before going awry. I never make a bold statement such as: "The quantum theory resolves theological problems of miracles, evil and free will". Notwithstanding, I do stress that the implications of quantum theory on the way we understand the universe are so profound that we cannot turn a blind eye to this theory when investigating certain philosophical matters.

CHAPTER I

BEFORE THE QUANTUM THEORY

Description of the Chapter

Scientific progress and emerging philosophical debates cannot be understood out of their historical context. Hence, it would be appropriate to start with a historical overview of the scientific and philosophical discussions about the microscopic world, prior to the emergence of the quantum theory.

In this chapter, you will find answers to the following questions: How did the ancient Greek atomists conceive the idea of the first (known) philosophical understanding of the microscopic world and how did this affect their perception of the universe? How did the scientific revolution initiated by Kepler, Galileo and Newton affect philosophical regards to science? Which scientists adopted a realist scientific perspective? What was Newton's description of the universe and how did it affect philosophical and theological views in the centuries that followed? What was the early scientific

model of the atom, and who made the corresponding contributions?

Early Thoughts on the Microscopic World: Atomism

In the history of thought, the earliest ideas about the microscopic world date back 2500 years. The earliest philosophical works about this realm are known as "atomism". Atomism was formulated into an ontological concept by Leukippus.[15] However, it was Democritus who molded a systematic theory out of raw hypotheses. According to atomism, matter is made of tiny, indivisible building blocks called atoms, which are eternal entities; every existing entity is but a collection of atoms spread out in space. Atoms are infinitely numerous, they have different sizes and shapes; differences in macroscopic properties of matter can be reduced to the differences in the constituent atoms. What we perceive as change in the macroscopic world is nothing other than the combination or separation of different atoms.[16] The only real existence is that of the atoms; everything else is imaginary. Atomism also describes a mechanical and causal view of the world.

15 C.C.W. Taylor, *The Atomists: Leucippus and Democritus*, University of Toronto Press, Toronto (2010).

16 F.A. Lange, *The History of Materialism*, Routledge, London (2010).

Even though his thoughts about the finiteness of the shapes of atoms and their masses deviated from Democritus', it was Epicurus (he also built a school of philosophy in Athens) who made the most important contribution to spreading out Democritus' atomism.[17] Another famous figure who adopted materialistic atomism is Lucretius.[18] Atomism had also been advocated by theistic philosophies. Some Muslim philosophers, for example, rejected the idea of eternal and infinitely-numerous atoms, and instead advocated an atomism accessible to Divine action.[19]

The fundamental tenet of atomism is that all matter is made of individual, invisible, tiny building blocks called 'atoms'. Modern scientific results have shown that atoms actually consist of smaller sub-atomic particles such as protons and neutrons, which are made of even smaller sub-units called quarks.[20] It is not inconceivable that the quarks themselves might be made of smaller units. Therefore, we should be careful to distinguish the metaphysical concept of 'atom' (as used by atomism) from its modern scientific (experimental

17 C.C.W. Taylor (2010).

18 F.A. Lange (2010).

19 Harry Austryn Wolfson, *The Philosophy of the Kalam*, Harvard University Press, Cambridge MA (1976).

20 Steven Weinberg, *The Discovery of Subatomic Particles*, Cambridge University Press, Cambridge (2003).

and theoretical) description. Both concepts of atom are used to describe the universe we observe in terms of invisible tiny units. The philosophy of atomism was limited by the lack of any possibility of observation of the microscopic world. Nevertheless, as noted by Popper, Democritus' work is quite noteworthy as it shows us how useful some metaphysical (non-falsifiable) hypotheses can be.[21]

The onset of developments in modern physics brought about new possibilities to penetrate into the microscopic world. Surprisingly, however, the outcomes of those new studies brought about new challenges to the idea of explaining the observed universe in terms of the microscopic world. The gap between the most important physical theory about the macroscopic world (i.e. the theory of relativity) and the quantum theory, as well as other problems we will see later on in this book, make it impossible to bridge the macro and micro worlds.[22] As a result, despite all its glorious advances, modern scientific results have not yet reached a level that would have made Democritus perfectly content.

21 Karl R. Popper, *Conjectures and Refutations*, Routledge, London (1998), p. 81-84.

22 Stephen Hawking, *The Quantum Theory of the Universe World*, Scientific Press, Singapore (1996).

The first solid scientific findings about the microscopic world originated a couple thousand years after philosophical conceptions on this realm. One of the most important reasons for this is the extreme smallness of the atom: until the last century, we did not have any means to "observe" it. Advances in microscopy (the development of scientific tools that enable us to see things invisible to naked eye), brought about tremendous new developments in biology and physics, together with philosophies of these fields.[23] Our knowledge about the atomic realm has been further expanded by the research carried out in mega-laboratories (technologically and financially gigantesque institutions) such as CERN.[24] Compared to the long history of mankind, all these developments are actually quite new. When the level of knowledge accumulated in natural sciences met with advances in equipment and laboratory designs, the microscopic world has ceased to become merely a subject of philosophical speculation. However, the microscopic realm has never ceased to allure philosophers, although they now have to keep their eyes open to new developments in the natural sciences.

23 Catherine Wilson, *The Invisible World: Early Modern Philosophy and the Invention of the Microscope*, Princeton University Press, Princeton (1995).

24 www.cern.ch

From the Physics of Aristotle to Copernicus, Kepler and Galileo

Prior to Newton, by far the strongest authority in the physical sciences (or natural philosophy) had been Aristotle. Aristotle explained motion as a tendency of objects to move towards their natural place; this tendency makes fire move towards the sky and objects released from height fall to earth.[25] 'Change' is a realization of the potentiality in objects. According to Aristotle, science should search for a 'purpose', which also explains causality. A seed germinates with a 'purpose' of becoming a tree; the purpose of rain is to make plants grow etc.[26] In medieval times, Aristotle's philosophy was so authoritative that it has been profoundly mixed up with Christian and Muslim theologies. This was particularly apparent in the Christian world, in which the Catholic Church announced Aristotle's ideas synonymous to its official opinion (Thomas Aquinas played a significant role in this adoption), thereby making all corresponding philosophies an integral part of the Christian theology.

25 James T. Cushing, *Philosophical Concepts in Physics*, Cambridge University Press, Cambridge (1998).

26 Joe Sachs, *Aristotle's Physics*, Rutgers University Press, New Brunswick NJ (1995).

During the middle ages, the most widely accepted cosmological paradigm was essentially made up of Aristotle's and Ptolemy's conjectures. According to this geocentric model, the Sun, the Moon and the planets orbit around the Earth in circular paths. The emergence of experiment and observation as a method of science, together with the development of better observational instruments like telescopes, initiated a revolution, which would eventually cast a death blow to geocentricism. In this epoch of scientific revolution, the laws of motion have been written from scratch, teleological arguments have moved away from the focus of science, and the geocentric model of the universe has been replaced by the heliocentric model of the solar system.[27] Regarding our goals in this book, we should pay close attention to the epistemological approach that accompany the revolutionary ideas of Galilean, Newtonian and Einsteinian physics. This epistemology had not been seriously questioned (with exceptions in certain philosophical arguments, including Kant's) in scientific quarters until the emergence of quantum mechanics. The common epistemological element in these three perspectives is 'realism'. According to this, the human mind is capable of comprehending the external world; as a result, we can expect that physical theories

27 James T. Cushing, p. 34-39, 45-46, 89-127.

can describe actual 'realities' (which are independent from these theories) in nature.[28]

Actually, even in ancient Greece and also in the Islamic middle ages, there were philosophers who claimed that a heliocentric solar system made more sense in explaining observed phenomena. Despite these voices, however, lack of sufficient observational data, the demeaning of experimental work as compared to 'mental' (i.e. philosophical) studies, and partial success of Aristotelian-Ptolemaic system in explaining certain phenomena (together with the strong authority of the duo) sustained the widespread acceptance of the geocentric model.[29] In 1514, Copernicus wrote (in his book published shortly before his death) that the observed motion of celestial objects would make much more sense if the Sun were in the center of rotation.[30] This book has become a milestone of physics. In the years to follow, the Danish nobleman and astronomer Tycho Brahe carried out extensive observations and tabulated positions of many celestial objects. Meticulously studying these results over many years, Kepler successfully

28 Ian Barbour, *Issues in Science and Religion*, p. 19.

29 Ernan McMullin, "*Formalism and Ontology in Early Astronomy*", (ed: Robert John Russell et al. Quantum Mechanics), Center for Theology and the Natural Sciences, Berkeley (2001), p. 61-69.

30 Nicolaus Copernicus, *On the Revolutions of Heavenly Spheres*, Prometheus Books, Amherst (1995).

constructed a mathematical model for the heliocentric system.[31] Kepler has said that it is a gift of God that we live in a mathematical universe, comprehensible by the human mind.[32] Kepler's success in using mathematics together with observational data is accepted as one of the earliest establishments of modern scientific methodology. This methodology sprouted first in the Muslim world, and was later transferred to the Western world by medieval thinkers including Roger Bacon. Influenced by his contemporary Muslim schools, Bacon defended that knowing natural phenomena better is a way of better understanding religion, and hence, mathematics and observation can be means to become more pious.[33] Kepler maintained a very similar approach, and despite fierce threats from Catholic clergy, he never considered the heliocentric system against his sincere faith.[34]

Like Copernicus and Kepler, Galileo also felt no discomfort in reconciling his devout Christianity with the

31 H. Thomas Milhorn and Howard T. Milhorn, *The History of Physics*, Virtualbookworm.com Publishing, College Station (2008).

32 Alfred W. Crosby, *The Measure of Reality*, Cambridge University Press, Cambridge (1998), p. 126.

33 John Hedley Brooke, *Science and Religion*, Cambridge University Press, Cambridge (1991), p. 58-59.

34 Richard S. Westfall, "*The Rise of Science and the Decline of Orthodox Christianity*" (ed: David Lindberg and Ronald Numbers, God and Nature), University of California Press, Berkeley (1986), p. 219-224.

heliocentric system.[35] However, his piety had not sufficed to save him from Catholic Inquisition. He criticized the integration of Aristotelian philosophies into Christian doctrines and shook Aristotle's authority in the Western world.[36] He further argued that since we cannot know the purpose of God for sure, teleology cannot be a proper scientific methodology; instead, science should focus on 'causes and effects'. Just like Kepler, Galileo also amalgamated observation with mathematics, becoming highly influential in the scientific revolution of the years to follow. Modern physics (including the quantum theory) is a product of this methodology.

Galileo also deviated from Aristotle in explaining the change not as a realization of a potential, but as a description of state depending on mass and velocity. This view was somewhat similar to Democritus' description of change as the combination and separation of atoms (in fact, Galileo was much more sympathetic to Democritus).[37] About the microscopic world, however, Galileo had little chance to formulate a theory, since at his time the available knowledge on this realm had still not gone beyond philosophical speculations.

35 Hal Hellman, *Great Feuds in Science: Ten of the Liveliest Disputes Ever*, Wiley, Hoboken (1999).

36 James, T. Cushing, p. 111-126.

37 C.C.W. Taylor, *The Atomists: Leucippus and Democritus*, University of Toronto Press, Toronto (2010).

Nevertheless, Galileo assumed that the motion of atoms could be described in terms of their mass and velocity, just like macroscopic objects. In the following pages, we will see that the quantum theory failed these 'common sense' expectations.

The contributions of Copernicus, Kepler and Galileo had shaken cosmology, as well as Aristotelian authority, from its ground. The emergence of Protestantism accelerated these changes and the doctrines of the Catholic Church slowly loosened their holds against better scientific understanding of the cosmos. As the Church kept losing its leverage on domains like science, philosophy and politics, theological views also started to diversify. It is important to keep these historical facts in mind when evaluating the relationship between the quantum theory and religion, since the theory emerged in the Western world and the resulting philosophical and theological debates have also predominantly occurred within the same cultural environment.

As a result, the scientific progress initiated by the Copernicus-Kepler-Galileo trio triggered many changes not only in cosmological, but also in sociological and political domains. People slowly got used to the idea of questioning Aristotelian physics, and realized the need for better instruments in order to make more reliable

observations. The importance of mathematics in the formulation of scientific theories was realized in the same era. The medieval methodology of physics was significantly altered, despite the trio's steadfast adoption of medieval 'realism'. Galileo called the mathematical values of mass and velocity 'primary qualities', and subjective perception like color and taste 'secondary qualities'.[38] His idea of realism led Galileo to believe that the mathematical description of primary qualities are consistent with their real values. Kepler and Galileo had no doubts about the ontological realities of mathematical formulas. Mathematics was the language in which God wrote the universe; these philosophical and theological thoughts also helped them explain the accord between mathematics and nature.

The Reign of Newtonian Physics

Publication of Newton's *Principia* in 1687 was truly a landmark, not only for science but for the entire human history. *Principia* was the very first detailed description of the cosmos. Newton constructed his cosmology on the shoulders of Copernicus, Kepler, Descartes and Galileo. In doing so, he also made numerous corrections to the results formulated by his predecessors.[39]

38 Ian Barbour, p. 27.

39 H Sir James Jeans, *Physics and Philosophy*, Dover Publications, Mineola (1981).

While the works of Copernicus-Kepler-Galileo had shaken the authority of Aristotelian physics, Newton's works completely demolished it. Newton is one of the most successful representative figures to demonstrate how to combine observation, experiment and mathematics. His law of universal gravity explained how the planets stayed in their orbits, and why the things on the 'bottom' of the earth did not 'fall'.[40] Perhaps more importantly, Newton established that the laws of physics are universal (they hold the same in every corner of the universe); there is no such divide as 'terrestrial region' and 'celestial region', as instructed by Aristotle.

Like Galileo, Newton suggested that the physical phenomena we observe in the universe can be reduced to the motions of particles. Properties expressible in terms of mathematical values, such as velocity and mass are objective and they can be used to describe realities; whereas properties like smell and taste are rather subjective. Newton also followed Democritus in claiming that every occurrence and change can be explained in terms of re-organization of atoms. Unlike Democritus, Epicurus and Lucretius, however, the mechanical picture of the universe drawn by Newton had

40 According to the law of gravity, the gravitational force between two bodies is proportional to their mass, and inversely proportional to the square of the distance between them.

a special place for the notion of "God". Newton considered mechanics as means of supporting his theological ideas.[41] In 1679, about eight years before the publication of *Principia*, Newton debated against Hobbes' materialism (i.e. all natural phenomena can be explained in terms of matter and motion).[42] According to Newton, order in nature did not stem from matter itself; it is installed by God, primarily via the laws of nature, and occasionally by His direct intervention.[43]

According to Newton, God could intervene in the mechanical functioning of nature. However, many other thinkers of that era, including Laplace, interpreted the Newtonian cosmos as a closed system, bringing about the question of how God can play a direct role therein.[44] For this reason, some philosophers consider Newton as the grandfather of 19th century materialism.[45] For many philosophers and theologians, the impor-

41 Michael J. Buckley, *Newtonian Settlement and Atheism*, (ed: Robert John Russell, William R. Stoeger and George V. Coyne, Physics, Philosophy and Theology), Vatican Observatory Publications, Vatican (2005), p. 87-88.

42 Margaret C. Jacob, "*Christianity and the Newtonian Worldview*", (ed: David Lindberg and Ronald Numbers, God and Nature), University of California Press, Berkeley (1986), p. 242.

43 Margaret C. Jacob, p. 244-246.

44 Thomas Tracy, "*Creation, Providence and Quantum Chance*", (ed: Robert John Russell et al., Quantum Mechanics), Center for Theology and the Natural Sciences, Berkeley (2001), p. 236.

45 C. H. Kaiser, "*The Consequences for Metaphysics of Quantum Mechanics*", The Journal of Philosophy, vol: 37 no: 13 (20 June 1940), p. 337.

tance of the quantum theory surfaces out at this point. While Newtonian mechanics could be interpreted to describe a closed, deterministic universe, the quantum theory could be interpreted to indicate an indeterministic universe, and the 'gaps' in this theory are viewed as an indicator that the universe is not 'closed'. Some people further claim that the gaps in the quantum theory are filled by Divine action; we will elucidate these ideas later on.

The immense success of Newton's laws in describing mechanical phenomena also contributed to 'enlightenment', by strengthening trust in human reason. The glories of Newtonian mechanics brought the perception of physics to its climax; every other field of science from biology to philosophy, from history to sociology began to regard the methodology of physics as a role model for its own studies. As a result of this increasing authority of science, atheists advocated for replacing all religious doctrines with scientific thinking. On the other side, theists struggled to find ways to support their theological views with the new scientific data in hand (this approach is referred to as '*natural theology*'). Paradoxically, Newtonian physics has been interpreted to support both atheism and natural theism, as well as deism. After this epoch, the interaction

between religion and science became much more interwoven than ever. Newtonian physics has been very influential on philosophy; it would be impossible to properly understand how Kant formulated his antimonies or why Marx tried to build an analogy between physics and history, without understanding the paradigm shift in reasoning, brought about by physics.

The idea of a deterministic-mechanical universe has become quite widespread, mainly due to the influence of Newton and his follower Laplace.[46] In the meantime, the belief was strengthened that all natural phenomena can be reduced to the motion of building blocks of matter. Like many other of his contemporaries, Newton was a 'realist': he believed that mathematical formulas and theories could describe the realities in the universe. Quantum theory is also a product of the methodology that ascribes a particular importance to mathematics and experiments in doing science (Newton firmly followed this methodology). On the other hand, the quantum theory initiated severe deviations from other aspects of the Newtonian paradigm, including determinism, reductionism and realism. Prior to the emergence of this theory, there had

46 Roger Hahn, "*Laplace and the Mechanistic Universe*", (ed: David Lindberg and Ronald Numbers, God and Nature), University of California Press, Berkeley (1986), p. 267-270.

been philosophical and theological objections against these aspects. For example, Muslim scholar al-Ghazali criticized determinism and held that the relationship between cause and effect is not necessarily a mandatory one.[47] Kant objected to realism in his critique of pure reason.[48] However, what distinguishes the quantum theory from these earlier arguments is that it is constructed upon scientific results supported by experiments and mathematical formulation.

Very recently, J.D. Norton came up with an interesting thought experiment, which appears to be in violation with determinism in Newtonian Physics, even for a relatively simple system.[49] Norton considers an ideal particle sitting motionless on top of a specially-formulated dome (a.k.a. Norton's Dome). The mathematical solution of the motion of the particle gives two alternatives, both equally correct. In the first, the particle sits motionless forever. In the second solution, after sitting steady for a while, the particle spontaneously starts moving in an arbitrary direction. This latter

47 Abu Hamid Muhammad al-Ghazali (Author), Michael E. Marmura (Translator), *The Incoherence of the Philosophers*, Brigham Young University, Provo (2002).

48 Immanuel Kant (Author), J. M. D. Meiklejohn (Translator), *The Critique of Pure Reason*, William Benton, Chicago (1971), p. 129-159.

49 John D. Norton, "*Causation as Folk Science*", Philosopher's Imprint, (3 November 2003), p. 1–22.

motion starts with no apparent reason, at a completely undetermined time, suggesting indeterministic motion, yet compatible with Newtonian mechanics. Many critics of this hypothetical system claim that it is unphysical, even though there is no consensus on why it is so. As far as our arguments in this book are concerned, there is no apparent reason to deviate from considering Newtonian physics to be fully deterministic, as assumed generally.

Early Scientific Models of the Atom

In the 17th century, Newton explained the free expansion of gases as the diffusion of atoms into empty space.[50] Nevertheless, the atomic theory of Leucippus and Democritus has never been subject to experimental scrutiny prior to the 19th century, and until that time, the theory remained merely a subject of philosophical debate. The scientist who suggested the earliest theory of the atom and finally brought the concept into the scientific framework was John Dalton, via experiments he conducted between 1803 and 1808. Dalton realized that chemical compounds are formed by combination of atoms with different masses. Despite large errors in the atomic masses he calculated, his work constitutes

50 Steven Weinberg, p.3.

one of the most important developments in the history of science.[51] Since he did not have any technical means to directly observe the atom, Dalton used chemical reactions to investigate the properties of atoms (which he modeled as billiard balls).

Another milestone in understanding the structure of the atom was installed by John Thomson in 1897. In his lab at Cambridge, Thomson realized that atom is made up of smaller particles in motion. While Dalton discovered that the size of atoms differ from one element to the other, Thomson discovered that all atoms share a common unit: the electron. He also conjectured that there has to be a positive charge distribution inside the atom to neutralize the negative charge of the electron orbiting around it.[52] The word 'atom' comes from the Greek 'atomos', which means 'indivisible'; Democritus' atomism regards the atom as the smallest, indivisible unit of matter. In this regard, Thompson's findings of sub units inside the atom put an end to this paradigm of indivisibility. Nevertheless, the terminology remained, albeit in a broadened context.

51 Leon Lederman and Dick Teresi, *The God Particle: If the Universe Is the Answer, What Is the Question?,* Mariner Books, New York (2006).

52 George Gamow, *One Two Three . . . Infinity: Facts and Speculations of Science*, Dover Books, Mineola (1988).

In 1911, Ernest Rutherford performed elaborate experiments where he bombarded atoms inside a very thin sheet of gold, with positively-charged particles. As result of these so-called scattering experiments he realized that the positive charge of the atom cannot be smeared out over a continuous background (as conjectured by Thomson), but instead should be concentrated inside a very small volume. The electrons orbit around the 'nucleus' like the planets orbit around the Sun. Between the nucleus and electron is simply a huge 'emptiness'.[53] Quite naturally, in order to develop a mathematical model of this atomic structure, Newtonian mechanics were employed. To the profound surprise of the scientific community of the time, the long-standing classical theory of mechanics thus encountered its first and most profound failure.

53 Barry R. Parker, *Quantum Legacy: The Discovery That Changed the Universe*, Prometheus Books, Blue Ridge Summit (2002).

CHAPTER II

THE QUANTUM THEORY AND ITS PHILOSOPHICAL IMPLICATIONS

Description of the Chapter

In this chapter I will revise the historical development of the quantum theory. In order to be able to discuss the philosophical and theological implications of the quantum theory, we do not need to be able to solve physical problems via equations of quantum mechanics; however, it is pertinent to have at least a basic understanding of the principle of complementarity, the uncertainty principle, indeterminism and non-locality, as well as of some fundamental experiments. In this chapter, while learning about scientific aspects of this theory, you will also be introduced to some of the philosophical and theological problems related to it. The actual scrutiny of these problems, however, is presented in the chapters to follow. The present chapter mainly prepares the background for the proceeding discussions.

By the end of the chapter, you will have found answers to the following questions: How has the quantum theory altered our understanding of the universe? What are the experiments that support the non-intuitive claims of quantum mechanics? How should Bohr's complementarity principle be interpreted? How should we approach the analogies between certain philosophical-theological problems and the complementarity principle? How has the quantum theory changed our epistemological understanding of 'experiment'? Can this theory be related to Berkeleyan idealism? Is there a unanimous consensus about the indeterminist interpretation of quantum mechanics? Why is 'critical realism' preferable over 'scientific realism' and 'instrumentalism'? Can 'critical realism' be applied to religion; if so, what would be its consequences in terms of science-religion relations? Is the quantum indeterminism ontological or epistemological? How do metaphysical preferences bias the interpretations of the results of quantum mechanics? What is the philosophical significance of quantum non-locality? How has the quantum theory affected epistemology and ontology?

The Emergence of the Quantum Theory and the Double-Slit Experiments

The first step towards the development of the quantum theory was taken by Max Planck in 1900.[54] About fifty years earlier, Maxwell had mathematically discovered electromagnetic waves, and shortly afterwards, these waves were experimentally observed by Hertz.[55] Maxwell's equations are regarded to be one of the most significant developments in the history of science. The electromagnetic wave description was in perfect accord with initial experiments. Towards the end of the 19th century, however, a surprising 'catastrophe' happened: experiments performed with electromagnetic waves emitted by hot objects irreconcilably deviated from Maxwell's results. This is where Max Planck came into the game: According to Maxwell's description, there was no lower limit to the energy of electromagnetic waves (their energy could be infinitesimally small), whereas Planck mathematically showed that the experimental mismatch would disappear completely if the electromagnetic waves were made of indivisible 'quanta' of energy packets. At first, this assumption seemed quite artificial and the scientific quarters (indeed, even Planck himself) approached it with acute skepticism.

54 Stephen Hawking, *The Universe in a Nutshell*, Bantam, New York (2001).

55 Barry Parker, p. 42-46.

The clouds of skepticism cleared in 1905 with Einstein. Based on the long-studied experimental results on the so-called photoelectric effect, Einstein showed that light (or, in general, all electromagnetic waves) are made of indivisible quanta of energy (which were later termed 'photons')[56] This discovery has so far-reaching consequences that even though Einstein published his famous work on the special theory of relativity in the same year (1905), his Nobel prize was awarded for his explanation of the photoelectric effect. Ironically, within a couple of decades, the ideas triggered by Einstein's quantization evolved into quantum mechanics, a theory that Einstein profoundly disliked and argued against.[57]

Einstein's description of light is also known as the 'particle' model, since it implies that a beam of light is a stream of numerous individual photons. Actually, about two-hundred years ago, Newton also suggested that light is made of tiny particles. However, Newton was unable to support his claim with any empirical evidence. To the contrary, all experiments performed in the 18th and 19th centuries (including Young's double-slit and and Hertz's electromagnetic experiments)

56 Alastair I. M. Rae, *Quantum Physics: Illusion or Reality?,* Cambridge University Press, Cambridge (1994).

57 Murray Gell-Mann, *The Quark and the Jaguar*, W. H. Freeman and Company, New York (1995), p. 168-169.

were in harmony with the wave model. As a result, when Planck's and Einstein's works showed that in certain experiments the particle model of light emerges out, the scientists were shocked. In the end, was light a particle or a wave? According to our daily experience, a particle is always localized (at a given time, a billiard ball is in a certain position), whereas a wave essentially describes a non-local spread (i.e. ripples on a pond spread on the water surface). So, how can we reconcile this dual behavior? How do we explain the fact that in certain experiments light behaves like a wave, while in certain others, it acts like a particle? There were even jokes about this situation, such as scientists use the wave model Monday through Friday and the particle model over the weekend.[58]

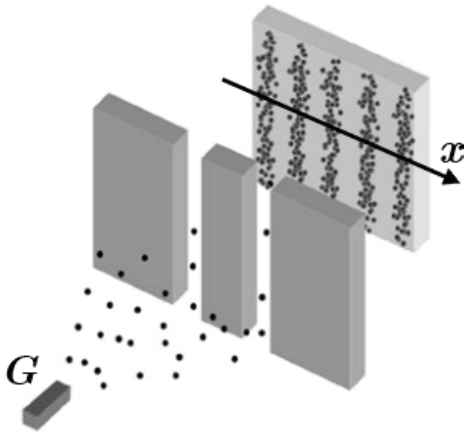
We have just seen that waves (i.e. light) can behave like particles. The quantum theory is based on the reciprocal of this statement: particles can also behave like waves! One of the most manifest demonstrations of these surprising claims are the famous double-slit experiments. We are going to consider experiments where an opaque screen with two narrow parallel slits is illuminated by a beam of light (or a stream of electrons). When we look at the light pattern on a screen

58 Barry Parker, p.51.

behind the slits, we observe a series of dark and bright bands. These so-called 'interference fringes' are natural result of wave behavior. The waves coming from each one of the slits overlap on the screen. When the peak of one wave meets the valley of the other they cancel each other and form a dark band. When two peaks or two valleys overlap, the waves reinforce each other and we see a bright band in the corresponding position. This is a very typical example of wave behavior (you may have observed similar phenomena with ripples of water on a pond). So, where does the particle model come into the picture? In our daily lives, we typically interact with light consisting of a very large number of photons: a typical light bulb emits about one hundred million times one trillion photons per second.[59] It is impossible to identify individual units in such a numerous stream of particles. However, if we dim the light sufficiently, and use proper equipment to detect the weak energies of light, we can repeat the same experiments photon by photon. When we repeat the experiment in this setting, we observe that the single photons sporadically hit different parts of the screen. However, when we perform careful statistics by doing the experiments over and over again, we observe that a photon never hits a spot where we previously observed a dark

59 Roger Penrose, *Fashion, Faith, and Fantasy in the New Physics of the Universe*, Princeton University Press, Princeton (2017).

band, and it is much more likely to be observed in regions where we observed the brightest light bands.[60] When we perform the experiments in the intermediate regime (send a relatively small number of photons together to the slits), we observe that the interference bands start to appear, but they are 'grainy', as indicators of individual photons.



The double-slit experiment performed with light, with a relatively low number of photons. The tiny spots indicate where individual photons are detected.

The peculiarity of the wave-particle duality can be seen in the following scenario. When we block one of the two slits, all previously dark bands disappear and we observe photons everywhere. So it seems that by

60 Alastair I. M. Rae, p. 16-17.

giving the photon another 'choice' to follow, we actually prevent it from following its earlier path.[61] Of course, to describe this peculiarity we used the particle picture. On the other hand, when we consider the wave behavior of light, the same scenario makes much more sense: when we open the second slit, the waves emerging from it 'cancel out' those from the first, in places where we observe dark bands.[62]

Here is where things become even more intriguing, and this time, it is not as straightforward to uncover the secret. Consider the same experiment, but performed with one photon at a time; we make statistics of where photons fall on the screen. When one of the slits is blocked, individual photons are observed everywhere on the screen; there is no place on the screen that any photon avoids. When the block is removed, we observe that even though we are sending single photons, each photon 'avoids' going to places where there had previously been a dark band! This means that a photon actually interferes with itself.[63] As we briefly mentioned above, the wave behavior can also be observed for things that we had previously known as mere particles, such as electrons. In fact, the double-slit experiment can be

61 Roger Penrose, p. 105.

62 Roger Penrose, p. 104.

63 Stephen Hawking, *A Brief History of Time*, Bantam, New York (1998).

repeated in the same manner, using a beam of electrons, instead of light. When we do this, we observe that the same kind of interference pattern occurs with electrons: there are bands where electrons never hit, and bands where electrons are more grouped together. And just as with the case of photons, when we repeat the experiment electron-by-electron, we observe that the interference pattern still holds: even if we send a single electron at a time, it is never observed in regions of dark bands. As Roger Penrose says, what is more extraordinary than wave-particle duality is that each particle by itself behaves like a wave and different probabilities about a single particle can cancel each other out![64] These physical results also have a serious philosophical consequence: as a result of such observations, should we modify the logical 'law of excluded middle'?[65] If someone claims he is in two different places at the same time, a physicist would consider him a liar and a medical doctor may suspect schizophrenia; whereas in the microscopic world, 'being in different places at the same time' is scientifically legitimate. According to

64 Roger Penrose, p. 107.

65 Andrej A. Grib, "*Quantum Cosmology, Observer, Logic*", (ed: Robert John Russell, Nancey Murphy and C. J. Isham, Quantum Cosmology and the Laws of Nature), The Center for Theology and the Natural Sciences, Berkeley (1999), p. 175-183; Chris Clarke, "*Quantum Histories and Human/Divine Action*", (ed: Robert John Russell et al., Quantum Mechanics), The Center for Theology and the Natural Sciences, Berkeley (2001), p. 169-170.

Werner Heisenberg, one of the most important figures in the early history of quantum mechanics, as a result of quantum phenomena like wave-particle duality, we should modify the law of excluded middle. He suggested establishing a new kind of logic (e.g. 'quantum logic'), as a way of broadening the corollaries of classical logic.[66] This claim is so important that it would even lead us to question epistemological fundamentals. It is further notable that the claim is actually verbalized by one of the most prominent figures in the modern history of science, and is supported by solid experimental evidence.

Bohr's Model of the Atom and The Principle of Complementarity

Niels Bohr has made critical contributions to the initial development of the quantum theory. Before Heisenberg, Schrödinger and Dirac formulated quantum mechanics in the 1920s, Bohr published his work, in 1913, on how to resolve the problems arising from the 'planetary-like' atomic model of Rutherford. Bohr's model was an amalgamation of Kepler-Newton type orbits with the emerging idea of quantization.[67] Accord-

66 Werner Heisenberg, *Physics and Philosophy: The Revolution in Modern Science*, Harper Perennial Modern Classics, New York (2007).

67 Roger Penrose, *The Road to Reality*, Jonathan Cape, London (2004), p. 572-573.

ing to electromagnetic theory, a charge under rotation (more generally, any charge under acceleration) radiates out waves and loses energy. As a result, the electron in Rutherford model should lose all its energy and 'fall' onto the nucleus within a very brief time. To turn around this problem, Bohr postulated that the electron cannot orbit at any arbitrary radius; instead, it can only dwell in certain 'energy levels' (rotate only in 'allowed' orbits). Electrons can also make transitions from one level to the other by emitting or absorbing radiation, thereby conserving total energy. These 'quantum jumps' perfectly explained the observed pattern of light (so-called 'line spectra') coming out of a heated tube filled with gaseous hydrogen. Despite its partial success, Bohr's model was only limited to the hydrogen atom, and could not be used for more complicated atoms or molecules.[68]

Bohr has played critical roles in fixing the limitations of his own model. He also played a central role in the development of the philosophical interpretation of the quantum theory. He is the father of the famous 'Copenhagen interpretation' of the quantum theory, which he named after the city he lived in and carried out most of his contributions to science. As we will see

68 Stephen Hawking, p. 71.

in the following pages, what distinguishes the Copenhagen interpretation is that it dictates indeterminism and non-locality as inherent facts of nature. In other words, these phenomena are are interpreted as ontological realities.

Bohr's *principle of complementarity* constitutes another vital contribution he has made to the philosophy of quantum mechanics. As we have seen in the double-slit experiments, the wave-particle duality observed with light or electrons is something quite elusive. Bohr intended to explain the contradictory-looking observations using the principle of complementarity.[69] According to this principle, the classical concept of a 'passive observer' (making observations with no impact on the observed phenomena) is no longer viable. According to John Hedley Brooke, in his youth Bohr was deeply influenced by Kierkegaard, and Bohr's complementarity contains many elements in parallel to Kierkegaard's emphasis on individualism.[70] All experiments performed during the early days of quantum mechanics suggested that the process of observation always affects

69 Niels Bohr, *Atomic Theory and the Description of Nature*, Cambridge University Press, Cambridge (1961), p. 56.

70 John Hedley Brooke, *Science and Religion*, Cambridge University Press, Cambridge (2014), p. 333.

the measurement.[71] Barbour summarizes the principle of complementarity as follows:

1. We cannot avoid the use of conventional concepts in describing the experiment, which employs apparatus and observations in space and time.

2. No sharp line can be drawn between the process of observation and what is observed; thus conventional concepts inevitably enter our attempts to picture what is going on in the atomic world. Moreover, the process of observation influences what is observed, so we cannot form a picture of the atom-in-itself apart from the total experimental situation. No clear line can be drawn between subject and object; various lines can be drawn for purposes of analysis, yielding alternative representations. We are actors rather than spectators, and we freely choose the experimental arrangement we will employ.

3. Familiar concepts, such as wave and particle, are inescapable and useful in referring to the atomic world, but we have to use different models in different experimental situations. Their alternate use is "complementary" rather than contradictory, since they do not occur in the same experimental situation.

71 Arlen J. Hansen, "*The Dice of God: Einstein, Heisenberg, and Robert Coover*", A Forum on Fiction, vol: 10, no: 1 (Fall-1976), p. 50.

4. We cannot make from conventional concepts a unified image of the atomic world, because of the limitations of such concepts when applied in a new range of dimensions.[72]

When we investigate the nature of light, we observe that in certain experimental scenarios it behaves like a particle and in others it behaves like a wave. A similar situation also holds for particles. In all cases, no matter what we do, we cannot simultaneously determine 'particleness' and 'waveness'. In these situations, according to Bohr, it is 'us' who determine the dominant property via the experiments we design and conceptions we use. Moreover, at the microscopic level, it is impossible to make observations without affecting the particle under study. Consider as an example, observing an electron under a microscope. In order to 'see' the electron, at least one photon should be sent to it, and the photon bounced back by the electron should come to the detector. When this happens, the electron is unavoidably affected (e.g. it recoils) by the photon and it is no longer in its state prior to the observation. Bohr has claimed that the type of observation we choose, the conceptions we make and the effects we introduce during experiments determine the

72 Ian Barbour, *Issues in Science and Religion*, p. 282-283.

knowledge of the atom before the experiment (*atom-in-itself*).[73] In this respect, Bohr's perspective is similar to Kant's idea on the impossibility of knowing the 'thing-in-itself'[74], though Bohr supported these ideas by ample experimental evidence, not merely by philosophical reasoning.

Philosophical and Theological Interpretations of the Principle of Complementarity

After Bohr's formulation, the principle of complementarity has been used by many thinkers to support long-standing philosophical arguments. For example, there have been attempts to 'prove' the priority of human mind over matter, by combining complementarity with the properties of 'wave function' in quantum mechanics. Similar claims were used to support Berkeleyan realism.[75] George Berkeley has rejected the existence of material substance independent from the mind that perceives it.[76] Even though analogous philosophies existed before and after Berkeley, 'subjective idealism' is

73 Niels Bohr, p. 10-12.

74 Immanuel Kant, *The Critique of Pure Reason*, p. 129-159.

75 Raymond Y. Chiao, "*Quantum Nonlocalities: Experimental Evidence*", (ed: Robert John Russell et al., Quantum Mechanics), Center for Theology and the Natural Sciences, Berkeley (2001), p. 36-39.

76 George Berkeley, *A Treatise Concerning the Principles of Human Knowledge*, Hackett Publishing Company, Indianapolis (1982).

most commonly associated with him. During the earlier development of quantum philosophy, some materialist and Marxist philosophers considered the principle of complementarity to be 'dangerous' as it leads to Berkeleyan idealism.[77] Nevertheless, not all Marxist scientists and philosophers adopted this view. M.A. Markov, famous Soviet scientist and prominent Marxist, followed Bohr's interpretation of the quantum theory and did not hesitate to use the principle of complementarity.

It would not be appropriate to associate the principle of complementarity with immaterialism or Berkeleyan idealism. Even though some philosophers prefer to adjoin the two, there is no obvious reason to make a transition from the principle of complementarity to subjective idealism. It is a fact of quantum mechanics that we cannot observe an 'atom-in-itself', or more generally, it is impossible to avoid the effect of the observer on the system being observed. However, it would be false to claim that the process is determined by the effect of the mind. In reality, what interferes with the system is not the mind, but the experimental apparatus. The mind cannot be used as an experimental reference, while physical objects such as a clock, a meter

77 Loren R. Graham, "*Quantum Mechanics and Dialectical Materialism*", Slavic Review, vol:25, no: 3 (September-1996), p. 383.

stick or photographic plate can. The experimental results can be recorded on some kind of medium and studied years later. When we study results of previous experiments from recorded data transferred on a computer screen, it would be nonsense to claim that our 'mind' determines the outcomes of the experiments.[78] As a result, there is no reason to make a transition from the quantum theory to immaterialism or Berkeleyan idealism. It appears that those who prefer to make such a transition with philosophical or theological motivations do not reach this conclusion by carefully evaluating the results of the quantum theory; instead, they remain steadfast to their philosophical prejudice and attempt to stretch the results of quantum mechanics to their favor.

Another important aspect of the complementarity principle is that it paves the way to propose solutions to many philosophical problems via analogies.[79] Numerous philosophical arguments have been developed through such analogies. For example, science and religion are attempted to be reconciled by claiming that they are not contradictory but 'complementary' (analogous to the wave and particle behaviors

78 Ian Barbour, *When Science Meets Religion*, p. 80.

79 Douglas Hofstadter and Emmanuel Sander, *Surfaces and Essences: Analogy as the Fuel and Fire of Thinking*, Basic Books, New York (2013).

being complementary).[80] Since the quantum theory was developed in the Western world, these kinds of arguments are predominantly about Christian theology. In fact, the principle of complementarity has even been interpreted in favor of trinity, the most fundamental Christian doctrine, by claiming that the humanity and divinity of Jesus are 'complementary'.[81]

One should be very careful before attempting to exploit the principle of complementarity to resolve a philosophical paradox. The first thing to pay attention to is that applying this principle in areas outside physics is a mere analogy; hence, it cannot be used as a rule of logic to resolve metaphysical problems.[82] Secondly, in the physical world, there are numerous occasions where seemingly contradictory phenomena are observed. For example, an electron behaves like a particle in one experimental scenario, while it acts like a wave in another. To the contrary, in most of the situations where analogies are made to the principle of complementarity, there is no convincing evidence to persuade us that each one of the contradictory aspects really ex-

80 See, for example: Harold H. Oliver, "*Complementarity of Theology and Cosmology*", Zygon, no: 13 (1978).

81 Christopher Kaiser, "*Christology and Complementarity*", Religious Studies, no: 12 (1976); John Polkinghorne, Quantum Physics and Theology, p. 16-20.

82 Ian Barbour, *Religion in an Age of Science*, Harper and Row Publishers, New York (1991), p. 100.

ists. For example, apart from a fideist approach, there is no material evidence for the divine nature of Jesus. As a result, an analogy to the principle of complementarity would be acceptable if and only if we can show convincing evidence for the existence of each one of the contradictory-looking phenomena. Only in that case one can argue that the two phenomena are not contradictory but complementary, just as in the case of quantum theory. Otherwise, this physical principle can be stretched out so much as to show that every possible claim is true. For example, one can argue that "two apples plus five apples equals twenty apples, since complementarity allows seven and twenty to coexist"! From this perspective, the complementarity explanation to the trinity inherently implies that "one and three can be equal". In short, the primary blunder in most analogies of the principle of complementarity is the omission of the fact that this physical principle is supported by ample experimental evidence.

Furthermore, in physics this principle is about the emergence of different aspects of a single entity (electron, photon etc.) on different occasions, whereas in some analogies, the compared aspects belong to objects from different areas (such as religion and science).[83] It

83 John Hedley Brooke, *Science and Religion*, p. 331.

might be reasonable to claim that the brain and mind are complementary aspects of the same entity, whereas this kind of analogy cannot be used between religion and science.[84] Of course, one may defend that science and religion do not contradict but complement each other. This claim, however, should be supported by arguments other than the physical principle of complementarity.

In general, one should be prudent when the principle of complementarity is exploited to resolve a paradox. Beside the general limitations of analogies, such attempts often disregard even the most fundamental elements of this principle. As a result, most such analogies are inaccurate and unreliable. The verity of quantum mechanics is firmly established by its success under countless experimental scrutiny, accurate predictions of its mathematical formulations, and application to the development of numerous technologies (from transistors to lasers and superconductors).[85] On the other hand, we should keep in mind that there is no consensus about the philosophical and theological implications of this theory, even among the most prominent physicists. One may adopt, for example, Einstein's perspective that quantum mechanics is

84 Ian Barbour, *Issues in Science and Religion*, p. 293.

85 Barry Parker, p. 165-210.

incomplete and should be further developed; in that case, apparent paradoxes such as the wave-particle duality will be associated with the incompleteness of the theory, which will in turn determine the approach to analogies made in metaphysical problems. As a result, when evaluating philosophical and theological consequences of the quantum theory, one should respect that the theory does not have a unanimous interpretation. Since interpretations often diverge from one another on the most fundamental issues, the stance we adopt may completely alter the corresponding philosophical and theological corollaries.

Interpretations of the Quantum Theory

One of the most fundamental reasons why the quantum theory has been interpreted in so many different ways is that its interpreters exhibit a broad spectrum of philosophies regarding the relations between scientific laws and the nature. These essentially philosophical differences shape up the scientific understanding of the theory, as well as the philosophical-theological consequences emerging from it. Philosophical approaches to scientific theories can be grouped under three categories:[86]

86 While we currently group the relations between scientific theories and nature in three categories, in Chapter 4 we will investigate philosophical approaches to the laws of nature under four categories.

1. Scientific Realism: The main arguments of scientific realism are briefly the following: the picture of nature drawn by scientific theories describes ontological realities; time, space, wave and similar quantities proposed by these theories are real; scientific theories are discoveries, not inventions.[87] Obviously, this is a very general description and most followers of scientific realism agree that theories might be incorrectly formulated. Nevertheless, the description above shows the approach of scientific realists to the ontological status of scientific theories, and indicates that they believe in the possibility of reaching 'thing-in-itself'. According to realists, acceptance of a scientific theory accompanies the belief that the world really exists in the way described by this theory. Realists also argue that the profound success of scientific theories in bearing new technologies can only be explained by the universal reality of these theories.[88]

Many famous scientists, including Galileo and Newton, have followed scientific realism. Their epistemological opinion was that scientific theories describe

87 Bas C. Van Fraasen, "*Arguments Concerning Scientific Realism*", (ed: Martin Curd and J. A. Cover, Philosophy of Science), W. W. Norton and Company, New York (1998), p. 1065.

88 Arthur Fine, "T*he Natural Ontological Attitude*", (ed: Martin Curd and J. A. Cover, Philosophy of Science), W. W. Norton and Company, New York (1998), p. 1187.

universal realities. Einstein also adopted this approach, even though he was quite hesitant to apply realism to the quantum theory, as it was not in complete harmony with his macroscopic theory of relativity;[89] the former contained paradoxical and counterintuitive elements like uncertainty and indeterminism. In fact, Einstein was the most prominent dissident of the quantum theory.[90] He was well aware of the accomplishments of this theory in describing experimental findings; nevertheless, he believed that the theory was incomplete so it should either be revised or replaced by a new one.[91] The incompleteness of the quantum theory was agreed upon by numerous other scientists including Schrödinger, De Broglie, Dirac and Penrose.[92] Consequently, views on the relationship between 'reality' and scientific theories determines perspectives to the quantum theory, and yields divergent philosophical and theological interpretations. Consider, for example, someone who adopts Einstein's perspective and tries to reconcile Divine action with

89 Robert John Russell, "*Divine Action and Quantum Mechanics*", (ed: Robert John Russell et al., Quantum Mechanics), Center for Theology and the Natural Sciences, Berkeley (2001), p. 313.

90 Werner Heisenberg, *Encounters with Einstein*, Princeton University Press, Princeton (1989).

91 Albrecht Fölsing (Author), Ewald Osers (Translator), *Albert Einstein*, Penguin Books, New York (1997), p. 566-592.

92 Roger Penrose, *Fashion, Faith, and Fantasy in the New Physics of the Universe*, Princeton University Press, Princeton (2017).

an indeterminist interpretation of quantum mechanics. This person would most likely argue that indeterminism is epistemological, stemming from our lack of complete theoretical understanding; thus, it would be wrong to assume that Divine action happens in an indeterministic universe.

2. Instrumentalism: Instrumentalists are pragmatic to scientific theories. According to them, scientific theories should not be regarded as description of realities; what matters is the power of a theory in making new predictions, evaluating experiments and observations, and yielding new technologies.[93] Stephen Hawking was a follower of this perspective. Hawking views instrumentalism as a requirement of positivism:

"If you take a positivist position, as I do, questions about reality don't have any meaning. All one can ask is whether imaginary time is useful in formulating mathematical models that describe what we observe."[94]

Even though the quantum theory contains counter-intuitive and paradoxical elements - such as the principle of complementarity - many scientists and philosophers agree that it is in accord with instrumentalism

93 Jarrett Leplin, "*Realism and Instrumentalism*", (ed: W. H. Newton- Smith, A Companion to the Philosophy of Science), Blackwell Publishers, Massachusetts (2001), p. 394.

94 Stephen Hawking, *The Universe in a Nutshell*, Bantam (2001).

as it has been profoundly successful in describing observed phenomena, making new predictions and paving the way to new technologies.[95] We cannot know the state of the atoms between measurements ('atom-in-itself'); however, we can use quantum mechanics to make probabilistic predictions about the outcomes of experiments.

It is fairly easy to understand that instrumentalism is a projection of Kant's philosophy (impossibility to reach the 'thing-in-itself') onto the scientific domain. The relationship between ontological realities and scientific theories is of paramount importance not only for the philosophy of science, but also for other branches of philosophy, as well as for theology. Likewise, opinions on this relationship also play a determining role in our approach to science-religion relations. Instrumentalism can be considered to be a more 'humble' approach towards scientific theories, as it does not enforce ontological reality. As a consequence, it is more unlikely to regard science as the sole means to reach reality, or to claim that the authority of science should replace all religions. On the other hand, from the perspective of natural theology, instrumentalism becomes somewhat

95 Peter Achinstein, "*Observation and Theory*", (ed: W.H. Newton-Smith, A Companion to the Philosophy of Science), Blackwell Publishers, Massachusetts (2001), p. 330-331.

problematic; deprived of reality, scientific theories cannot be directly interpreted in support of theological theses. Not all supporters of instrumentalism follow the same approach to science-religion relations; nevertheless, we can safely assume that instrumentalism is more aligned with a compartmentalist approach to science and religion, regarding them as independent, unrelated domains.[96]

3. Critical Realism: According to some philosophers, 'realism' and 'instrumentalism' suffice to encompass all approaches to scientific theories.[97] Alternatively, it is possible to group all stances under 'realism' and 'anti-realism', where anti-realism includes 'instrumentalism'.[98] Therefore, there are many other alternatives to the classification I use in this book; however, I prefer to present instrumentalism and critical realism independently, as it makes it easier to handle science-religion relations.

The development of quantum mechanics and its philosophy has been particularly influential in shaping up critical realism. Its followers claim that the success of a theory in making correct predictions about natural

96 Ian Barbour, *When Science Meets Religion*, p. 76.

97 Jarrett Leplin, p. 393-401.

98 Alan Musgrave, "*Realism versus Constructive Empiricism*", (ed: Martin Curd and J. A. Cover, Philosophy of Science), W. W. Norton and Company, New York (1998), p. 1088-1113.

phenomena and producing new technologies does not warrant its reality. In this way, they object to the very basic element of realism. Critical realists also draw attention to the fact that science is a product of the human mind and during scientific studies, humans inevitably interfere with natural phenomena via experiments and observations.[99] The involvement of human factor and the inevitable conditioning of the human mind by social factors, as well as its limited capacity, calls for being 'critical' about scientific theories. On the other side, even though the success of theories does not show that they perfectly describe 'nature-in-itself', we can logically assume that they partially bring us to the truths about nature.[100] As William Stoeger once said, "*the reality is covered, but not completely*".[101] It appears that following a realist approach, not naively but critically, is more reasonable than completely rejecting any link at all between natural realities and science (i.e. instrumentalism). Many prominent philosophers of science and philosophers of religion, including Polkinghorne,

99 John Polkinghorne, *Science and Theology*, SPCK, London (2003), p. 16-17.

100 There are many philosophical works about approach of sciences to realities. See, for example: Chris Brink and Johannes Heidema, "*A Verisimilar Ordering of Theories Phrased in a Propositional Language*", The British Journal for the Philosophy of Science, no: 38 (1987).

101 William Stoeger, "*Epistemological and Ontological Issues Arising from Quantum Theory*", (ed: Robert John Russell et al., Quantum Mechanics), Center for Theology and the Natural Sciences, Berkeley (2001), p. 95.

Barbour and Peacocke are critical realists.[102] I share their opinion that critical realism is more in accord with common sense as compared to naive realism and instrumentalism.

Critical Realism and Science -Religion Relations

Consequences of quantum mechanics, such as the effect of observer, are very commonly used as supportive arguments to critical realism. This perspective on the scientific theories also have important implications for the relationship between science and religion.[103] First of all, by avoiding approaches that ascribe science a complete authority in describing objective truth, and claims that science is independent of human interference, one would abstain from common sources of friction between science and religion. On the other hand, the idea that scientific theories bring us closer to the realities of nature is more coherent with natural theology, where the findings of modern science are used to support certain theological arguments.

102 Robert John Russell, "*Introduction*", (ed: Robert John Russell, Nancey Murphy and C. J. Isham, Quantum Cosmology and the Laws of Nature), The Center for Theology and the Natural Sciences, Berkeley (1999), p. 23.

103 Since the main subject of quantum mechanics is physics, we prefer to use the term science-religion relations. However, since we are primarily focusing on the philosophical interpretations of this theory, what we actually discuss is interrelations between science-religion-philosophy.

It is also possible to apply critical realism to theology.[104] In doing so, however, I suggest that instead of making a direct analogy of critical realism for religion, we should establish its own critical realist perspective. The critical realist approach to religion would draw attention to the fact that the 'human factor' inevitably interferes with the understanding of religion. Social prejudices, presuppositions, lack of complete understanding etc. all affect the interpretations of religious doctrines. As a result, the source of religion is unimpeachable Divine revelation, whereas the way people understand it may differ (some understandings might be flawed); sectarian and denominational divergences in religion stem from human involvement. However, theologically it would not be appropriate to claim that 'revelation-in-itself' is unreachable. God inscribes religion for the benefit of mankind; it contains rules to be practiced, as agreed by all three monotheistic religions. This latter approach is more in line with 'realism' and when combined with the critical elements resulting from human involvement, 'critical realism' for religion emerges as the position I suggest.

104 Applying critical realism to both religion and science is advocated by John Polkinghorne. He thinks that since nature and religion are created by the same Creator, they deserve the same regard. John Polkinghorne, *Quantum Physics and Theology*, SPCK Publishing, London (2007), p. 14-15.

If we apply critical realism to both science and religion, when human reason (and hence science, as the most sophisticated endeavor of human reason) contradicts Divine revelation, we will have broader options than preferring either one or the other. In case of a contradiction, we should first realize that both domains contain elements of human involvement; while 'nature-in-itself' and 'revelation-in-itself' cannot contradict, our limitations in understanding them cause the apparent conflict. Being 'critical' is also protective of the absolutist aspect of religion, since what is being critiqued is not the Divine revelation but the way we interpret it. This kind of critical realism approaches a conflicting matter of science and religion from both perspectives, and as opposed to alternative views where the problem is sought in either one or the other, it is granted that the problem may be in either scientific or religious interpretations (or both). As it requires a careful scrutiny of data from both fields, critical realism is a considerably more elaborate endeavor. Furthermore, it requires a sufficient level of knowledge of both domains, as well as in philosophy. The accumulated level of scientific information in modern times and the widespread compartmentalization of science-religion relations complicate the matter even further. Despite all these challenges, I believe that critical realism

provides the best framework to resolve the science-religion issues. With this approach, one essentially means to say: "The nature created by God and the religion inscribed by Him do not conflict. However, science, as the human endeavor to understand nature, and theology, as humans interpret Divine revelation, may contradict. The problem stems from a lack of complete understanding of nature or religion, or both."

These aspects of critical realism also apply to evaluation of the results of quantum mechanics, our main focus in this book. For example, let us take the question of free will and its relation to quantum mechanics (this subject will be dealt with in Chapter 5): on one hand, we need to answer science-related questions such as "Does the quantum theory prove 'objective indeterminism' of the universe?", and on the other, we should consider alternative answers to theological questions such as "What does religion teach about free will?". A double-critical approach towards the quantum theory (about how successful it is to reveal 'universe-in-itself') and towards religion (about the way different theologies explain free will), while being much more elaborate, will also be the best method for reaching the most meaningful results, and avoiding artificial solutions. To wrap up, our ontological and epistemological

approaches to scientific theories and theological interpretations play a determining role in shaping our opinion on the matter of science-religion relations.

Heisenberg's Uncertainty Principle and its Interpretations

It was Louis de Broglie who first suggested that just as light exhibits wave-particle duality, microscopic objects that we knew as mere particles also exhibit wave-like behavior. After he suggested this peculiar idea, many experiments were performed, all of which supported the claim. As an interesting turn of fate, John Thomson received a Nobel Prize for discovering the electron as a particle; a couple of decades later, his son George Thomson received another Nobel Prize for discovering the wave behavior of electrons.[105]

Quantum mechanics as we know it today was formulated as 'matrix mechanics' by Werner Heisenberg in 1925, and independently as 'wave mechanics' by Erwin Schrödinger in 1926. The two approaches were later combined by Paul Adrien Maurice Dirac.[106] Fundamental scientific findings about the microscopic world have never failed to surprise us. One of the most

105 Barry Parker, p 70.

106 Roger Penrose, *Road to Reality*, p. 505-511.

surprising outcomes of quantum mechanics is the uncertainty principle, discovered and formulated by Heisenberg. Schrödinger described the atom as consisting of a positively-charged nucleus, and a negatively charged electron orbiting around it in a probability distribution described by its wave behavior. The corresponding probabilities to find the electron in different 'states' is found from the solution of the so-called Schrödinger's equation. When an observation is made, we observe the electron in a certain state. We can observe the probabilistic behavior through statistics over a number of independent observations. As we have previously seen, Bohr interpreted being a wave and a particle as two complementary aspects of the same entity. According to Heisenberg, however, both descriptions (probabilistic and complementary) are correct, though incomplete. The missing piece of the puzzle was the uncertainty principle.[107] According to this principle, the more precisely we determine the position of a particle, the more uncertain its velocity becomes (or, to be more formal, its momentum).[108] This would be a completely unexpected result in classical mechanics. According to classical mechanics, if we determine the position and

107 Werner Heisenberg, *Physics and Philosophy: The Revolution in Modern Science*, Harper Perennial Modern Classics, New York (2007).

108 Werner Heisenberg, *Encounters with Einstein*, Princeton University Press, Princeton (1989).

momentum of a particle at a certain time, we can calculate its trajectory at any time in the future. There is no limitation on perfect knowledge of position and momentum. As a result, during the earlier development of quantum mechanics, the uncertainty principle caused a lot of discomfort in the scientific quarters. However, it was verified by countless experimental results. In fact, the commonly known physical phenomenon of radioactive decay is nothing other than a clear manifestation of the uncertainty principle.[109]

The uncertainty principle shows that the universe does not possess a deterministic structure; instead, it contains ontological probabilities, uncertainties and indeterminism. Not all scientists and philosophers understood this principle in the same manner, however. Following Barbour's approach, we can summarize different interpretations of the uncertainty principle under three categories:[110]

1. Uncertainty Resulting from Our Limited Knowledge: Steadfast followers of determinism (including Schrödinger, Dirac, Planck and Penrose) insist that uncertainties in the atomic realm are not ontological. Einstein profoundly disliked the idea of 'ontological uncertainty';

109 Eric Chaisson and Steve Mc Millan, *Astronomy Today*, Prentice Hail, New Jersey (2002), p. 180-181.

110 Ian Barbour, *When Science Meets Religion*, p. 67-70.

his opposition is very well known through his famous quote *"God does not play dice with the universe."*[111] In his work together with Podolsky and Rosen, Einstein argued that our knowledge of the atomic realm is incomplete.[112] According to this perspective, uncertainties result from our limited knowledge; a probabilistic formulation of quantum mechanics does not show that nature is probabilistic; in reality, natural phenomena are governed by deterministic laws. Most followers of this interpretation anticipate that one day science will uncover the deterministic laws that describe the microscopic world.

David Bohm speculated that there are 'hidden variables' in the atomic world, and since we are unable to determine them, quantum mechanics is essentially incomplete. His works constitute the most sophisticated struggle towards seeking a new formulation of quantum mechanics, in an 'objective determinist' manner.[113] However, it should be noted that Bohm's approach is

111 Albrecht Fölsing, *Albert Einstein,* Viking Press, New York (1997), p. 585. While this quote is often treated in the framework of indeterminist interpretation of quantum mechanics, one may notice that it also contains clues about Einstein's view about the nature of God.

112 Albert Einstein, B. Podolsky and N. Rosen, "*Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?*", Physical Review, no: 4 (1935), p. 778-779.

113 James T. Cushing, "*A Background Essay*", (ed: James T. Cushing and Ernan McMullin, Philosophical Consequences of Quantum Theory), University of Notre Dame Press, Notre Dame (1989), p. 3-5.

quite different from classical determinism, particularly in containing nonlocality. As a result, the uncertainty principle and resulting indeterminism is still being linked to our lack of knowledge by many philosophers. However, one must be aware that, in order to insist on the 'objective determinism' of the universe, it should be mandatory to address the implications of the quantum theory. It would be safe to claim that the interpretation of uncertainty as an outcome of limited knowledge is aligned with the classical realism we have seen above.

2. Uncertainty Resulting from Experimental and Conceptual Limitations: According to this alternative perspective, quantum uncertainties do not result from theoretical shortcomings or 'hidden variables'; instead, they stem from unavoidable limitations in our experimental and conceptual capabilities. This approach to the uncertainty principle yields to 'agnosticism' on the question of whether the universe is dominated by 'objective determinism' or 'objective indeterminism'. In other words, we cannot know whether the uncertainties are ontological or epistemological. This is also the position I am inclined to: since our limitations prevent learning about 'atom-in-itself', we should agree that we cannot make a judgment on whether uncertainties are ontological or epistemological.

We may be hopeful, like Penrose, that one day the remaining mysteries of quantum mechanics will be completely unveiled. However, it is hard to imagine how this will come about and how we will work around the current limitations.[114] As we have seen previously, in order to observe an electron, we should send at least one photon to it and detect the photon after it is bounced back by the electron. This process, however, irreversibly destroys the state of the electron prior to the experiment and affects the measurement we make. In order to measure the position more accurately, we should use a photon with smaller wavelengths; however, the energy and momentum of a photon is inversely proportional to its wavelength, therefore, when a smaller wavelength is used, we essentially induce more 'impact' on the electron. In other words, when we attempt to reduce the uncertainty of the position, we unavoidably increase the uncertainty of momentum.[115] We do not have the least clue about how to work around so fundamental a limitation. Worse, we are also constrained by the concepts of 'wave' and 'particle' to define a microscopic particle; our conceptions in turn limit our

114 Roger Penrose, *Fashion, Faith, and Fantasy in the New Physics of the Universe*, Princeton University Press, Princeton (2017).

115 According to Heisenberg's uncertainty principle, uncertainty of position multiplied by uncertainty of momentum is always larger than a constant number, known as Planck's constant.

descriptions. These experimental and conceptual limitations indicate that we cannot picture 'atom-in-itself' the way we picture macroscopic objects via classical mechanics.

One may assume that uncertainty of the position and momentum of the electron is something purely epistemological, resulting from our limited capabilities. However, there are situations, like radioactive decay, where the uncertainty cannot be reduced to human involvement or limitations. According to Barbour (he is a supporter of 'objective indeterminism'), there is no reason to believe that an ontologically non-existing uncertainty is created by human involvement.[116] In my opinion, we should consider this claim with caution. It is possible that Barbour fills our lack of knowledge about radioactivity with indeterminism. Phenomena related to radioactivity, which we cannot explain via classical physics, but about which we can make probabilistic predictions according to quantum mechanics, are regarded by certain thinkers as evidence for ontological indeterminism. Gaps in unresolved problems are often filled by a priori presuppositions, philosophical thoughts or theological concerns. This kind of a subjective approach is very common and, in my

116 Ian Barbour, *Religion in an Age of Science*, p. 102.

opinion, Barbour follows this same path to find refuge in the micro world in favor of his philosophical and theological ideas. Likewise, it is possible to claim that Einstein's insistence on the determinist structure of the universe is linked to his metaphysical ideas and presuppositions. It is often forgotten that not every opinion of a scientist has to be 'scientific'; scientists naturally hold different opinions about various matters, determined by their philosophical, theological, ideological, cultural etc. Backgrounds. More importantly, they can be biased by these factors when they comment on scientific phenomena. To reiterate, not every opinion of a scientist is necessarily scientific.

3. Uncertainty as Objective Indeterminism: Lastly, according to the objective indeterminist interpretation of the uncertainty principle, neither the fictitious 'hidden variables' nor our lack of instrumental and conceptual capabilities are the source of uncertainties; the uncertainty principle is an ontological reality of the nature. A truly objective indeterminism dominates nature; not an epistemological or subjective one. This claim shakes the ground on which many philosophies of science stand. It is in complete opposition to what is taught by Newtonian physics, which was the main scientific paradigm until the onset of the 20th century. In

the philosophical domain, considering that many prominent philosophers including Spinoza, Leibniz, Kant and Marx built their ideas on the grounds of scientific determinism, we can appreciate how much of an impact 'objective indeterminism' induces on philosophy.

The problem of measurement is one of the main motivations of objective indeterminism. Schrödinger's wave equation, the most fundamental formula of quantum mechanics, gives the position or momentum of a particle, albeit probabilistically. When a measurement is made, we observe a definite value among the probabilities; in the jargon of quantum mechanics, this is called the 'collapse of wavefunction', since the particle 'collapses' in a definite state among other possibilities.[117] The impossibility to predict the exact outcome of the experiment via Schrödinger's equation has inspired the idea of objective indeterminism, as well as New Berkeleyan philosophies that attribute a particular emphasis to the effect of the human mind. A very common misunderstanding about the probabilistic nature of quantum mechanics is that it is seen analogous to throwing a dice: before the throw, all numbers from one to six are equally likely to occur - hence the probability for a particular number to be observed is

117 Roger Penrose, *The Road to Reality,* p. 516-517.

1/6 - and after the throw, one of them is observed. In a quantum mechanical sense, all probabilities 'coexist'; the dice before throw is in a 'superposition' of all six distinct states, and it collapses to one of these states after the 'observation' (i.e. the throw). It is these objective probabilities that inspired 'indeterminism', and the collapse of all probabilities into a definite state by observation inspired New Berkeleyan interpretations.

According to advocates of 'objective indeterminism', even though the observations we make contain 'necessary causes', they do not contain 'sufficient causes'.[118] Prior to the experiment, there is a superposition of many probabilities, while afterwards, a single definite result occurs. If we do not assume - like Einstein did - that Schrödinger's equation is incomplete, we are faced with the reality of 'ontological probabilities' and 'ontological indeterminism'.[119] In other words, the quantum theory is not incomplete and uncertainty is not a result of our limitations; it is an ontological fact of nature.

In order to better appreciate how the results of quantum mechanics, such as the uncertainty and collapse of the wavefunction, conflict with our common sense, we can consider fictitious analogies in the macroscopic

118 Robert John Russell, p.307.

119 Schrödinger has always been supportive of Einstein's opposition to Copenhagen interpretation. James T. Cushing, "*A Background Essay*", p. 2.

world. Perhaps the most famous of such analogies is the 'Schrödinger's cat' thought-experiment (proposed by the scientist himself). Here is the experiment: consider an opaque box, with a cat locked up inside. Inside the box is also a special setup triggered by a 'quantum event', e.g. radioactive decay. The radioactive substance decays randomly, and when it happens, the setup triggers a special mechanism that breaks a bottle filled with poisonous gas, which will in turn kill the cat. According to the Copenhagen interpretation of quantum mechanics, until the observation is made (that is, when the lid of the box is open to see the cat), the cat is in a superposition of being dead and being alive. When the lid is opened, the state of the cat 'collapses' into one of the two states. If the quantum state were assumed to be an 'epistemological uncertainty', there would be no surprise, whereas here the assertion is about 'ontological uncertainties and probabilities', and a physical object jumping to a certain state after observation.[120] This forces us to accept that the cat can exist in a superposition of being dead and being alive. Schrödinger himself said that he cannot accept this claim. Bohr's response to Schrödinger was that the experiment confounds mac-

120 Abner Shimony, "*The Reality of the Quantum World*", (ed: Robert John Russell et al, Quantum Mechanics), Center for Theology and the Natural Sciences, Berkeley (2001), p. 13.

roscopic phenomena (i.e. the cat being alive or dead) and microscopic quantum events.[121] This response is not entirely satisfactory; while the macroscopic world is in accord with classical and Boolean rules of logic, why should there be a totally different set of rules for the microscopic world? Worse, it is unclear where to draw the line between the micro and macro worlds, and how a determinist system emerges out of an indeterminist one.

Objective Indeterminism and Metaphysics

What makes the psychologically intriguing claims we saw above particularly noteworthy is that they are backed up by a very fundamental theory of science, and supported by solid experimental evidence. A prominent scholar of the chaos theory, Prigogine, asserts that physical indeterminism dictates itself independent of metaphysical or philosophical choices. In his words: *"Indeterminism as conceived by Whitehead, Bergson and Popper, now appears in physics."*[122] In my opinion, Prigogine's - like Heisenberg's - claim about the dictation of indeterminism by physics, independent of metaphysical considerations, is erroneous. In his books, Prigogine

121 Chris Clarke, "*Quantum Histories and Human/Divine Action*", p. 161.

122 Ilya Prigogine and Isabelle Stengers, *The End of Certainty: Time, Chaos, and the New Laws of Nature*, Free Press, New York (1997).

complains that a deterministic universe leaves no place for free will.[123] In the end, Prigogine's choice to take the side of Heisenberg, instead of Einstein, cannot be the picture drawn by physics alone; just as Einstein interpreted that picture in accord with his metaphysical preferences, so did Prigogine by seeking refuge in an interpretation that abolishes the 'determinism' he detests. More interesting is Popper's case. During the past century, the majority of the defenders of 'objective indeterminism' have been those inspired by the results of quantum mechanics: in particular, Heisenberg's uncertainty principle. To the contrary, Popper criticized the uncertainty principle;[124] he adopted objective indeterminism against Laplacian determinism, since he saw the latter as a threat to freedom of human actions.[125] In other words, even though Popper has chosen indeterminism over determinism, according to him, both determinism and indeterminism are metaphysical doctrines, which we cannot access by empirical methods.[126]

123 Ilya Prigogine and Isabelle Stengers, *Order Out of Chaos*, Verso, Brooklyn (2018).

124 Karl R. Popper, *The Logic of Scientific Discovery*, Routledge, London (2002).

125 Karl R. Popper, *The Open Universe; An Argument for Indeterminism*, Routledge, London (1998), p. 29-38.

126 Karl R. Popper, "*Indeterminism in Quantum Physics and in Classical Physics: Part 1*", The British Journal for the Philosophy of Science, vol: 1, no: 2 (August-1950), p. 120-122.

While Heisenberg and his followers describe what we can determine epistemologically, they make a transition to an ontological description, and defend that indeterminism does not stem from our ignorance or limitations, but instead is an ontological reality. Polkinghorne said, *"Epistemology models ontology"*; we sometimes assume - wrongly - that what we can and cannot know is a proper guide to what really exists or not.[127] Newton also followed a similar strategy. His angle differs from that of Heisenberg in the following way: Newton believed in an 'ontologically determinist' universe, based on what he knew, whereas Heisenberg suggested an 'ontologically indeterminist' universe, based on what he did not know (i.e. the uncertainties). In a determinist universe, all alternatives but one are ontologically impossible, while indeterminism allows different alternatives to coexist simultaneously. This critical point also shapes perspectives on the relationship between God and the universe, as well as the problems of miracles, evil and free will; we will revisit this point in the corresponding discussions.

Heisenberg takes uncertainty as an inherent phenomenon of the real world and interprets this within

127 John Polkinghorne, *Quarks, Chaos and Christianity*, SPCK, London (1994), p. 68; John Polkinghorne, Science and Theology, p. 31.

the concept of 'potentiality'.[128] In the Aristotelian approach, 'potentiality' is related to the concept of purpose. In Heisenberg's picture, however, from among a potentiality of many alternatives, some - previously unknown - come into existence. Other thinkers also have drawn attention to the concept of 'potentiality' and the existence of probable but uncertain phenomena.[129] Accordingly, we do not know how potentiality will turn into 'actuality' in the future; despite the defined potentiality, the future is open-ended. 'Ontological chance' is an objective fact of the universe; it is real, it does not stem from ignorance and it is independent of deterministic rules.

Barbour considers the explanation of uncertainty via objective indeterminism to be an extension of 'critical realism'.[130] In my opinion, his effort is rather towards unification of his critical realism with objective indeterminism and uncertainty. Such a unification may indeed be possible. However, the critical realist approach to scientific theories would be in much better accord with the second interpretation of quantum uncertain-

128 Werner Heisenberg, *Physics and Philosophy: The Revolution in Modern Science*, Harper Perennial Modern Classics, New York (2007).

129 Abner Shimony, "*Conceptual Foundations of Quantum Mechanics*", (ed: Paul Davies, The New Physics), Cambridge University Press, Cambridge (1989), p. 374-375.

130 Ian Barbour, p. 103.

ties above (limitation in instruments and conceptions), thereby staying agnostic to whether the apparent indeterminism is ontological or epistemological. Since this agnostic stance will play a critical role when we discuss (later in this book) whether Divine action happens in a determinist or indeterminist universe, we will be faced with the hardship of obligation to scrutinize both possibilities. Despite this additional hardship, however, this pathway is the safest, and much more consistent than pretending that we 'know' about the nature of the indeterminist structure of the universe and evaluating the relationship between God and the universe based on this assumption.

Furthermore, staying agnostic about the nature of indeterminism does not mean that we should stay silent about how God interacts with the universe. It is a proper philosophical stance to stay agnostic about whether the results of quantum mechanics necessitate determinism or indeterminism. If Heisenberg's interpretation is right - though I prefer to stay agnostic on this matter - it is important to determine its philosophical implications on God-universe relations. Philosophically or theologically, even if we do not reach clear-cut conclusions in certain matters, it would be worthwhile to clarify the mistakes of those who claim (wrongly)

to reach definite conclusions (for example, taking the determinist structure of the universe for granted and rejecting the existence of miracles and free will). Even though the quantum theory does not provide the ultimate answer on matters like miracles and free will, it still has to be studied carefully in order to make a proper evaluation of philosophies of these matters under the light of modern scientific findings.

Completeness and the EPR Paradox

As we have seen above, with the onset of quantum mechanics, for the first time in the history of science, philosophical discussions about scientific realism, determinism, the effect of observation on the system, and even the fundamental rules of logic, have become amalgamated with scientific findings. In addition, as a result of the mental paradigm shift caused by this theory, concepts like reductionism, causality and locality entered into the corresponding discussions.[131] According to the reductionist approach, the whole is made up of the properties of its pieces. In other words, the information about the whole can be deduced from the laws governing its pieces. If we assume to have complete knowledge of the laws governing the combination and sepa-

131 Paul Davies, *God and the New Physics*, p. 64.

ration of individual pieces, complete knowledge about the whole can be obtained. Prior to quantum mechanism, reductionism had been the dominant paradigm, even in areas where it did not provide completely satisfactory answers.[132]

Ironically, even though it was believed for a long time that matter could be understood perfectly by reduction to its constituent atom, with quantum mechanics it is understood that the atom itself cannot be understood by reduction to its constituent particles. According to quantum mechanics, the structure of the atom cannot be thought as a 'planetary-like system' constituting of protons and neutrons in the center and electrons orbiting around them (as suggested by Rutherford). As described by Schrödinger's equation, the electron cannot be treated as an independent entity; it is rather described by a 'wavefunction' which in turn is determined by other properties of the system in which the electron exists. Stated more plainly, the rules of the atom cannot be constructed from the rules describing independent electrons, protons and neutrons. Furthermore, the *Pauli Exclusion Principle* also forbids the simple construction of an atom out of

132 George Ellis, "*Quantum Theory and the Macroscopic World*", (ed: Robert John Russell et al, Quantum Mechanics), Center for Theology and the Natural Sciences, Berkeley (2001), p. 272.

independent electrons. These complementary aspects in the sub-atomic world are very important; in practice, they play determining roles in the design of technological marvels like transistors, superconductors and nuclear power plants.[133]

The most important experiments to scrutinize the completeness of quantum mechanics were performed by Alain Aspect and coworkers in the 1980s, at their labs near Paris. These experiments were motivated by a long debate, initiated by an influential article written by Albert Einstein, Boris Podolsky and Nathan Rosen.[134] In this article (commonly referred to by the initials of the authors: EPR), some thought experiments are suggested in order to show the inconsistency (or 'incompleteness') of quantum mechanics. In the EPR experiments, we imagine two particles separated from one another, moving in opposite directions. Quantum mechanically, we can generate two such particles in an 'entangled' way; that is, no matter how far away they are separated, they still carry the signatures of one another. For example, if one is in spin-up[135] state, the other has

133 Ian Barbour, p. 104-106.

134 Albert Einstein, Boris Podolsky and Nathan Rosen, "*Can Quantum Mechanical Description of Physical Reality Be Considered Complete?*" p. 778-779.

135 All sub-atomic particles possess spin. Even though the name implies a motion like a ball's 'spinning' about itself, the quantum mechanical spin is somewhat different; it is an 'inherent' aspect of particles. Entangled particles with

to be in spin-down.[136] As a result of the 'entanglement' of the two particles, when we measure the spin of the one, say, on the right, we essentially also determine the spin of the one on the left. According to the Copenhagen interpretation, we cannot talk about the exact state of the particles prior to the measurement (they are in the superposition of the two possibilities); hence, the spin of the particle on the left seems to be determined by the measurement we make on the particle on the right.[137] Via these thought experiments, Einstein, Podolsky and Rosen argued that these counter-commonsense results indicate that the quantum mechanical description is incomplete. When the particles (say, A and B) are separated by hundreds of miles from each other, how can particle B 'learn' about the news of the measurements on particle A? This kind of a result necessitates nonlocality and 'action at a distance', in radical opposition to fundamental physical principles, as well as common sense. Einstein rejected this possibility and called the implications of the thought experiments 'ghostly action at a distance'.[138] The thought experiments of EPR intended to show that the quantum

spin are crucial in EPR experiments: Roger Penrose, *The Road to Reality*, p. 549-562, 594.

136 Murray Gell-Mann, *The Quark and The Jaguar,* p. 171.

137 Paul Davies, p. 104.

138 Paul Davies, *The Mind of God*, Simon and Schuster, New York (1993), p. 158.

theory brings about nonlocality and hence cannot describe physical realities; as a result, the theory is incomplete. According to Einstein's theory of relativity, no information can travel faster than the speed of light; thus, it would be unphysical to claim that the news of the measurements on particle A reaches particle B instantaneously.[139]

As the father of the Copenhagen interpretation, Niels Bohr attempted to refute the claims of EPR, and criticized Einstein's approach to 'physical reality'.[140] In the 1930s, it was not possible to carry out real experimental scrutiny of the related claims; as a result, the corresponding discussions have long remained speculative. Einstein's attack on quantum mechanics strengthened the ideas about the existence of 'hidden variables'. One of the famous supporters of hidden variables, Bohm, also defended that there is no reason to abandon determinism in favor of indeterminism. However, his determinist-realist approach also included belief in 'nonlocality', in opposition to requirements of classical

139 Henry P. Stapp, "*Quantum Nonlocality and the Description of Nature*", (ed: James T. Cushing and Ernan McMullin, Philosophical Consequences of Quantum Theory), University of Notre Dame Press, Notre Dame (1989), p. 160; Linda Wessels, "*Bell's Theorem: What to Give Up*", (ed: James T. Cushing and Ernan McMullin, Philosophical Consequences of Quantum Theory), University of Notre Dame Press, Notre Dame (1989), p. 89-91.

140 Niels Bohr, "*Can Quantum-Mechanical Description of Physical Reality Be Considered Complete*", Physical Review, no: 48 (1935), p. 696-702.

physics.[141] In other words, Bohm accepted the existence of what Einstein called 'ghostly action at a distance'. As a result, even though Bohm is a realist, his realism is quite distinct from classical realism of Galileo, Newton and Einstein.

Bell's Theorem, Nonlocality and Aspect's Experiments

Prior to John Bell's works in the 1960s, the debates on nonlocality and hidden variables seemed to be moving towards a dead end. Worse, no one had been able to construct an experimental setup to test the corresponding claims.[142] Via famous 'inequalities' named after him, Bell managed to show that a determinist theory with hidden variables cannot be in accord with locality and at the same time consistent with quantum mechanics.[143] What is meant by locality in physics is the rejection of action at a distance, or in other words, rejection of 'telepathic' communications between particles.

141 David Bohm, "*Classical and Non-Classical Concepts in the Quantum Theory*", The British Journal for the Philosophy of Science, vol: 12, no: 48 (February 1962), p. 265-280.

142 Henry P. Stapp, p. 167-172; Arthur Fine, "*Do Correlations Need to Be Explained*", (ed: James T. Cushing and Ernan McMullin, Philosophical Consequences of Quantum Theory), University of Notre Dame Press, Notre Dame (1989), p. 177-180.

143 John Bell, "*On the Einstein-Podolsky-Rosen Paradox*", Physics, no:1-3 (1964), p.195-200.

Despite its significant predictions, it was indeed very hard to devise experiments to test Bell's propositions. In fact, all experimental efforts had failed until Alain Aspect's work in 1980s.[144]

Aspect's experiments demonstrated that Einstein's propositions were wrong; the results supported Bohr's defense against Einstein. These experiments show that what EPR considered impossible (on the grounds of causality violation), is actually possible. In his experiments, Aspect used the polarization state of photons emitted by certain atoms to mimic entanglement.[145] No matter how far away these pairs propagate from one another, according to quantum mechanics, their polarizations must be perpendicular to each other. Recall that the effect of observation on the system is an essential element of quantum mechanics. The apparatus that measures the state of polarization (called a 'polarizer') also alters the polarization state of the photon. Here is the crux of the problem: prior to any measurement, each one of the entangled photons is in a superposition of the horizontal and vertical polarizations. However, when we make a measurement on one of the photons

144 Don Howard, "*Holism, Separability, and the Metaphysical Implications of the Bell Experiments*", (ed: James T. Cushing and Ernan McMullin, Philosophical Consequences of Quantum Theory), University of Notre Dame Press, Notre Dame (1989), p. 228-232.

145 Polarization of photons is similar to the spin of electrons.

and determine that it is, say, horizontally polarized, the other one 'immediately' jumps to a vertical polarization state. This is precisely what Einstein deemed impossible. From the perspective of classical physics, when we determine the polarization state of the photon on the right, we do not have any effect whatsoever on the photon on the left; whereas quantum mechanics predicts that after such a determination, the photon on the left 'jumps' to the perpendicular state.[146] Even though our common sense seems to favor the former prediction, the experiments clearly favor the latter.

No one was able to provide an alternative explanation to Aspect's experiments, in order to reject the apparent effect of the measurement at a certain place on a distant photon. Perhaps no other experiment in the history of science has ever provided more counter-intuitive results. Via the EPR thought experiments, the trio had aimed to demonstrate that quantum mechanics yields nonsense predictions, and hence has to be incomplete. To the contrary, Aspect's experiments showed that the physical reality in the universe is in harmony with the predictions of quantum mechanics, and that classical physics and hidden-variable hypotheses do not properly describe the atomic realm.

146 Alastair Rae, *Quantum Physics: Illusion or Reality?*, Cambridge University Press, Cambridge (1986).

Besides supporting the quantum theory, these and similar other experiments show that a realist explanation of the universe cannot be made using classical concepts. This result is also of paramount importance for the philosophy of science, as well as for the philosophy of religion (regarding the determination of the ontological nature of the universe). Some philosophers interpret the picture drawn by Aspect's experiments as a necessitation of abandoning realism but keeping locality, whereas others interpret the same results in totally different way.[147] It seems that it is no longer possible to simultaneously support locality and classical realism. This in turn means that we need to accept the failure of scientific concepts in completely describing the universe. One can claim that formal structures of scientific theories would be completely reliable tools to reach a 'thing-in-itself', if and only if both realism and locality were correct. As it appears from discussions above, only one of the two is correct. This result may discomfort the followers of Comte's positivism or Dawkins' atheism, who idolize the authority of science and claim that it should replace the authority of all religions. According to Jean Staune, the picture drawn by quantum theory shows that science alone is unable to bring us answers to universal truths. He further defends that this

147 Ian Barbour, p. 107.

theory disproves materialism, and opens the door towards understanding God.[148]

There is also an alternative post-modern interpretation of the results of the quantum theory, supposedly 'proving' that the scientific results are relative and unreliable. Against both the idolization of science and the rejection of its authority, I advocate for 'critical realism'. Rejecting the authority of science means demeaning all technological marvels (satellites, bridges, computers, televisions, etc.) made possible by scientific developments. In my opinion, these developments alone indicate, at least partially, the ontological reality of scientific theories. It would not make much sense to claim that a collection of information totally unrelated to universal realities can be used so successfully in the exploitation of the raw materials in the universe. Refraining from demeaning or idolizing science would also be a proper path to follow in evaluating the relationship between science and religion. From a religious angle, it would be improper to idolize science. On the other side, demeaning science also means demeaning human reason, which would be unacceptable in most religious interpretations (except, perhaps, for fideism). The majority of theists believe that a close reflection

148 Jean Staune, "*On the Edge of Physics*", Science and Spirit, no: 10 (1999), p. 14-15.

upon phenomena in the universe, combined with reasoning, provides arguments for the existence of God.[149] There is no room here for demeaning reason and science (as the most sophisticated product of reason).

Quantum mechanical experiments, as well as the mathematical structure of this theory, show that 'reductionist physicalism' is not consistent with the ontology of the universe, and that 'relational holism' (the idea that the parts making up the universe are in relation to each other) is an ontological reality.[150] By realizing the thought experiments of EPR, Aspect has shown that the whole is more than a combination of its pieces and we cannot understand the whole by reducing it to its constituents: even when pieces are separated from each other by large distances, they can still correlate (i.e. exhibit holistic properties) with one another. These are in accord with what we previously discussed in the framework of Pauli Exclusion Principle, and also in harmony with holistic metaphysics of theistic views (the universe, with all its pieces, is a creation of one unique God). On the other side, there have also been claims that quantum mechanics is in

149 Holy scriptures give particular emphasis to reason. In the Quran in particular, there are many verses that contain encouragement for making deductions via reason.

150 Paul Teller, "*Relational Holism and Quantum Mechanics*", The British Journal for the Philosophy of Science, vol: 37, no: 1 (March 1986), p.71-81.

harmony with philosophies of far-east religions.[151] As a result, the holistic picture of the quantum mechanical universe is totally surprising from a materialist-reductionist angle, whereas it is compatible with metaphysical teachings of unity.

The failure to explain the whole in terms of its parts can also be explained in terms of 'emergence'. This approach has very important implications in philosophy of religion, philosophy of science and philosophy of mind. For example, those who notice that the aspects of the human mind cannot be explained by 'eliminative materialism' often find refuge in 'emergence'.[152] The kind of holism presented by the Aspect experiments provide the long-sought-after link between macroscopic emergence and the microscopical world. Those who defend eliminative materialism had been hoping to explain human reason by reducing the mind to the brain, the

151 See, for example: Fritjof Capra, *The Tao of Physics*, Shambhala Publications, Boston (2000). Capra's approach contains numerous false-analogies and stretched-out interpretations: John Polkinghorne, "*The Quantum World*", (ed: Robert John Russell, William R. Stoeger and George V. Coyne, Physics, Philosophy and Theology), Vatican Observatory Publications, Vatican (2005), p. 340-341.

152 Philip Clayton, "*Neuroscience, the Person and God: An Emergentist Account*", (ed: Robert John Russell et al., Neuroscience and the Person), Vatican Observatory Publications, Vatican (2002), p. 181-214; Arthur Peacocke, "*The Sound of Sheer Silence: How Does God Communicate with Humanity?*", (ed: Robert John Russell et al., Neuroscience and the Person), Vatican Observatory Publications, Vatican (2002), p. 215-247.

brain to neurons, neurons to chemicals, chemicals to atoms and atoms to electrons, protons and neutrons. This attempt, however, has failed at the lowest rung of its ladder: the atom cannot be reduced to its constituents like electrons and protons. The atom being 'more' than its pieces and the fact that when the pieces are separated from one another, they remain to be somehow related, reveal holism at a much higher level than what was hoped for by the supporters of 'emergence'.[153] This situation necessitates a holistic ontology about the universe, as well as an epistemology where the knowledge about the whole cannot be constructed from its pieces. These considerations about ontology and epistemology yield very important implications about philosophy of religion, philosophy of science and philosophy of mind, as well as many other branches of philosophy.

153 'Emergence' approaches can be - and have been - defended in accord with locality. However, the fact that when the whole is separated its parts remain correlated even at large distances provides more than what is needed by those (including myself) who regard 'emergence' with sympathy.

CHAPTER III

DIVINE ACTION AND THE QUANTUM THEORY

Description of the Chapter

Debates about Divine action have occupied philosophers' minds for millennia. From the establishment of the notion of a determinist universe in the 17th century, these debates gained a new momentum; henceforth, philosophers and theologians started to scrutinize Divine action in the framework of the widespread belief that the universe is of a determinist structure. After a couple of centuries of dominance, the authority of determinism was strongly shaken by the emergence of quantum mechanics; inevitably, the corresponding debates on Divine action were altered to stay in accord with the implications of this most recent and most important theory of modern science. In this chapter, I will first consider Divine action under four categories; and then evaluate the implications of the quantum theory on these philosophies. Later in

this chapter, I will briefly describe another important theory of modern physics, the chaos theory, and discuss its implication on the results of quantum mechanics and Divine action. The subject matter of the next chapter - miracles - will be a continuation of the discussions in the present one.

Some of the questions that I will answer in this chapter are the following: How can we classify Divine action? How can quantum gaps be related to Divine action? How can Divine action enter into play in a universe completely reigned by well-defined laws? Can Divine action be defined as a fixation of quantum uncertainties? Who were the forerunners of the idea of associating Divine action with a fixation of quantum uncertainties? What is Nancey Murphy's approach to Divine action and quantum mechanics? Is it more appropriate to relate Divine action to the quantum theory, or to the chaos theory? What is the significance of the chaos theory as an explanation of Divine action?

Theological Classification of Divine Action

All monotheistic religions share the common doctrine that the universe is created and sustained by one unique God, who inscribes religion, and also answers to the prayers of His servants (i.e. human beings). One of

the critical distinctions of monotheistic religions from other faiths is the belief in the existence of an active God. Since materialists reject the existence of anything but matter, they cannot accept God's existence; as a result, Divine action has no place in materialism. In Deism, a philosophy which gained momentum after the 17th century, in general, Divine action is limited to initial creation; God created the universe and let it to itself (He does not retain an active relationship with the universe by sending down religions, answering prayers etc.). In fact, Divine action is one of the issues that is used to draw the line between theism and deism, together with related questions such as the ontological status of the laws of nature and miracles.

In the literature, discussions about Divine action are often presented under two categories: 'general Divine action', and 'special Divine action'. The former includes the creation of the universe and sustaining it via laws; the latter describes acts of God on particular occasions, such as miracles and answering prayers.[154] I find it more appropriate to classify Divine action under four categories. It is of course possible to unite some of these four classes I describe below (indeed, there have also been attempts to unite the concepts of general and special

154 Nicholas Saunders, *Divine Action and Modern Science*, Cambridge University Press, Cambridge (2002), p. 18-23.

Divine action).[155] I should clarify, however, that with the four-fold classification, I do not insist that Divine action happens only in these ways. From the perspective of God himself, everything we call Divine action might be unified. From a human perspective, however, as many theists realize, there are nuances in the roles played by Divine action in the creation of the universe at the beginning, the growing of a tree, answering a prayer etc. My classification below is 'pragmatic' from a human perspective, in the sense that it serves to better understand the nature of Divine action.

In short, I do not make any assertions about the ontological differences between the roles played by Divine action in different occurrences; instead, I make a heuristic classification for our practical benefit in making the matter more lucid. To be even clearer, in every case I will make a comparison between Divine action and the particular case of creation of rain.

1- Divine Action as Creation out of Nothing: This is the case for God's creation of the universe and the laws that govern it. Accordingly, God has created the atoms and energy needed for rain, as well as the laws of physics and chemistry that accompany the phenomenon.

155 Maurice Wiles, *God's Action in the World*, SCM, London (1986).

Throughout history, numerous arguments have been developed to prove the existence of this type of Divine action.[156] Contemporary debates on this issue often include modern scientific findings such as the Big Bang theory and the law of entropy. In monotheism, God is the Creator of all laws in nature, including the ones governing the micro-cosmos, like the quantum theory. This establishes a link between Divine action and the quantum theory. Regarding our discussions in this book, however, it is more critical to understand the role of Divine action after the initial creation of the universe; as a result, I will not focus much on this type of Divine action.

2- Divine Action as God's Sustaining: What is meant here is God's sustaining of the matter and laws He created. Accordingly, it is thanks to God's sustaining of the matter and physical-chemical laws that He created about 13,8 billion years ago, that rain is possible today.

This type of Divine action is important in understanding the difference between deism and theism. According to the former, God created everything out of nothing; however, after this initial creation, He left the universe to itself. In the theist perspective, on the

156 These discussions are usually presented under title 'the cosmological argument'.

other hand, God is not only the Creator at the beginning, but also the Sustainer of all material existence, as well as all of the laws that govern the universe (including the laws of quantum mechanics). Any amount of rain, at any time, is related to Divine action. The reign of law in the universe makes all phenomena, as well as all technological developments of human beings, possible. Based on this fact, some philosophers - such as Leibniz or Swinburne - developed arguments for the existence of God (commonly referred to as the argument from design).[157] In this book, I will focus on how Divine action happens together with the laws of nature, rather than how the laws are sustained. As a result, I will not say much more about this particular case.[158]

157 Richard Swinburne, *The Existence of God*, Clarendon Press, Oxford (1991), p. 28-30, 306.

158 According to some thinkers, the existence of God and Divine action cannot be proven; one can only have faith in those via fideism. In my view, modern science provides ample opportunities to support the 'cosmological argument' and the 'design argument'. Many phenomena discovered in the 20th century, including the fine tunings in the universe (and the corresponding 'anthropic principle') and the creation of life on the earth, are supportive of the 'design argument', as well as our claim that Divine action is not limited to initial creation. These, and similar arguments, are coherent only with the notion of an active God. Deriving arguments for the existence of God based on natural phenomena is referred to as 'natural theology'; even though I believe that modern scientific findings strengthen this position, I do not include such discussions in this book. Instead, the presented matter here is based on a priori acceptance of the existence and activeness of God - via fideism or any kind of argument. In other words, I primarily focus on how to understand the picture drawn by modern scientific results, in the framework of our theological beliefs.

3- Divine Action as God's Creation of Phenomena: This includes the phenomena created by God via the materials and laws He sustains. The difference between this kind of Divine action and the previous is somewhat elusive. What is meant in the previous category is about what some calls 'necessity', whereas here, it is about 'chance'[159] (that is, God's creation of a certain event, among many other possibilities determined by the laws he inscribed). God might as well have created the universe in the same way as it is now, but have made the Earth orbit at another place around the Sun, making it impossible to hold an atmosphere and allow the rain. What is meant in the second title above is the possibility of rain about 13,8 billion years after the creation of the universe, by the simultaneous creation of the corresponding laws, whereas the subject of the current category is about the event of rain at a definite place and time.

The quantum theory is built on probabilities. Many philosophers and theologians defend that God can

159 One of the most influential works on this issue is Jacques Monod's 'Chance and Necessity'. While Monod explains both via a naturalist-materialist approach, theists do so via different interpretations of Divine action. Furthermore, theist discussions also include God's initial creation and the creation of miracles. Jacques Monod (Author), Austryn Wainhouse (Translator), *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*, Vintage Books, New York (1972).

make any choice among 'objective probabilities'[160] - without overriding any law of nature - thereby bringing into existence something that had been in the universe only as a potentiality, and could not have come to existence without God's action. Some scientists, philosophers and theologians thought that God's role in most natural phenomena takes place via this kind of Divine action. Associating the results of the quantum theory with this philosophical/theological approach is one of my goals in this book. I will delve further into this matter in the following pages.

4- Divine Action as Creation of Miracles: There are two alternative ways of understanding this: God's exceptional suspension of the laws of nature at particular places and times, or God's choosing to bring exceedingly low probabilities into existence. The second alternative is tied together with the Divine action defined in the previous class. According to this view, God can create rain in a place where there is no cloud, upon, for example, the prayer of a human being.

160 The term 'objective probability' refers to cases where probabilistic nature is ontological, and not related to our lack of knowledge (i.e. not epistemological). Similar terminologies such as 'objective/ontological gaps', 'objective/ontological uncertainty' etc. refer to the same phenomenon: the reality of indeterminism as an objective fact of the universe. As we have seen above, these perspectives usually are identified with the Copenhagen interpretation: William Stoeger, "*Epistemological and Ontological Issues Arising from Quantum Theory*", p. 92.

The problem of miracles is one of the most controversial issues of philosophy of religion. This problem should be handled from theological (regarding whether or not God would suspend His own laws), as well as scientific (how should we interpret the laws of nature) perspectives. I devote the next chapter entirely to these and related discussions about 'miracles'. Since I treat Divine action from a general perspective in this chapter, and since 'miracles' are also manifestations of Divine action, discussions in this chapter can be considered to be an introduction to the next one.

Determination of Quantum Uncertainties by Divine Action

With the Copenhagen interpretation, ideas like the existence of 'ontological gaps' in the atomic realm, and the laws of atoms being not deterministic but probabilistic, started to become widely accepted in scientific and philosophical circles. Some thinkers draw attention to the possibility that God can act upon nature by choosing any one of the 'ontological probabilities' He desires. In the Newtonian perspective of a 'closed' universe, it is rather difficult to find a place for Divine action to enter into play.[161] According to some theists (including

161 John Hedley Brooke, *Science and Religion*, p. 144-145.

Newton himself), there is no problem with God interfering with His own laws, if He desires. Others object to this view by arguing that "God would not suspend/break His own laws". With the quantum theory, the idea of the universe being not entirely fixed by deterministic laws has reached the level of scientific debates, for the first time in history, as a complete surprise to philosophy and theology. Karl Heim was one of the earliest thinkers to suggest Divine action through quantum gaps. He asserted that all quantum gaps are fixed by God and defended a concept of God who is active at every instant of microscopic phenomena.[162]

William Pollard, a physicist and a priest, pioneered the idea of Divine action as determination of quantum uncertainties (in developing this idea, he was influenced by Heim and other philosophers). He also believed that God is always active in the universe, through quantum uncertainties: laws of nature are not deterministic but probabilistic; God determines the flow of events in the universe by making choices among probabilities (i.e. determining uncertainties).[163] Accordingly, objective indeterminism is a dominant fact of the universe, and

162 Karl Heim, *The Transformation of the Scientific World View*, SCM Press, London (1953).

163 William Pollard, *Chance and Providence: God's Action in a World Governed by Scientific Law*, Faber and Faber, London (1958).

yet, when Divine action comes in, it attains a deterministic level. We can see that Einstein's famous quote "God does not play dice with the universe" cannot be used against every indeterminist interpretation of the quantum theory. Philosophers who advocate the idea of God's fixation of all quantum uncertainties, like Heim and Pollard, argue that when we include the notion of God in our ontology, 'objective indeterminism/chance' (what Einstein called 'playing dice') disappears. According to them, even though 'objective indeterminism' is a fact of the universe, it does not apply to God; God leaves no space for chance in the universe, by filling up all the gaps.

On the other hand, not every thinker agrees with Heim and Pollard on the interpretation of Divine action as determination of uncertainties in the quantum world. For example, Arthur Peacocke thinks that quantum uncertainties remain uncertain even for God; in creating the universe, God has taken the risk of 'self-limitation' and hence even He does not know the future[164] (we should recall that Peacocke is a pantheist).[165] According to Peacocke, Divine nature is related to the laws of the universe. A similar philosophy was also

164 Arthur R. Peacocke, *Theology for a Scientific Age*, SCM Press, London (1993).

165 Pantheism is the idea that God encompasses the universe and is inherent to it.

adopted by Spinoza; however, in accord with the dominant scientific paradigm of his time, he related Divine action to determinism, whereas Peacocke, influenced by the development of quantum mechanics, believed in objective indeterminism and associated it with Divine nature. According to Peacocke, God does not determine the flow of events in the universe by determining uncertainties, or by overruling the laws of nature. He also suggests that the latter approaches would create a divide between God and the universe, and they would also have unacceptable implications on the problem of evil.[166]

There is a critical difference between the ontological indeterminism of the universe and the indeterminism applying to God. Thinkers like Pollard assert that indeterminism holds only for the universe; since God fills the gaps, nothing is indeterminable to Him. As a result, 'scientific determinism' is not correct, whereas 'theological determinism' is. On the other side, according to thinkers like Peacocke, ontological indeterminism remains intact even if we include God in the picture. Peacocke tried to reconcile the idea of a 'God active in creation' with a 'God who does not know the future'.[167]

166 Arthur R. Peacocke, p. 141-145.

167 We will criticize the idea that God cannot know the future in Chapter 5, together with discussions on the problem of evil and free will.

He emphasized that God acts on the universe as a whole, and used the following analogy to describe this argument: human beings can reason via their brains, and the brain acts upon the entire human body; in a similar way, God continuously acts upon the universe.[168] Peacocke advocated a top-down model, where God indirectly influences all pieces by controlling the whole; at the same time, however, he asserted that God does not interfere with the uncertainties.[169]

Quantum Gaps and Divine Action

According to some thinkers God fills up all gaps in the quantum world, and to others, He leaves uncertainties totally intact. Alternatively, thinkers like Thomas Tracy and Philip Clayton argue that God fills only a certain part of the quantum gaps. Robert Russell suggests an even more complicated alternative that God has determined all quantum uncertainties until the emergence of the earliest forms of life on the earth and afterwards continued His actions via fillings gaps in heredity and similar areas; whereas after the emergence of conscious human beings, He stopped filling in the gaps,

168 Arthur R. Peacocke, "*God's Interaction with the World*"; (ed: Robert John Russell, Nancey Murphy and Arthur R. Peacocke, Chaos and Complexity), The Center for Theology and the Natural Sciences, Berkeley (2000), p. 272-274.

169 Arthur R. Peacocke, *Paths from Science towards God: The End of All Our Exploring*, Oneworld, Oxford (2001), p. 107-111.

in order not to tamper with free will.[170] Tracy draws attention to the idea that God's determination of quantum gaps is totally different from the idea of 'God of the gaps'. In the latter approach, one first lays out the gaps in our knowledge about the universe and then fills these gaps with God. According to Tracy, quantum gaps are unrelated to gaps in our knowledge; instead, they are ontological.[171]

Tracy grants that his idea would be theologically acceptable only if God's determination of ontological chances in the quantum world yields macroscopic effects.[172] In this respect, we can recall Schrödinger's cat thought experiment (see the corresponding discussions in Chapter 2). One can say that in this thought experiment, God can determine the microscopical uncertainties inside the box and let the cat live or die. This would be an example of how a determination at the quantum level can affect a macroscopic event. Tracy further suggests that analogous determinations can occur during

170 Robert John Russell, "*Special Providence and Genetic Mutation: A New Defense of Theistic Evolution*", (ed: Robert John Russell, W. R. Stoeger and F. J. Ayala, Evolutionary and Molecular Biology: Scientific Perspectives on Divine Action), Center for Theology and the Natural Sciences, Berkeley (1998), p. 215.

171 Thomas F. Tracy, "*Creation Providence and Quantum Chance*", p. 258.

172 In classical physics, 'chance' is epistemological, whereas according to the Copenhagen interpretation of the quantum theory, it is ontological. This difference constitutes the essence of the mental revolution triggered by the quantum theory.

neurophysiological and genetic phenomena, thereby creating profound changes in the macroscopic world.[173] Somewhat similarly, Russell believed that God controls genetic mutations via determination of the outputs of quantum events, thereby creating new species.[174]

Tracy regarded the chaos theory and butterfly effect (i.e. minor changes in the present, having major impacts in the future) to be supportive of his hypothesis. Likewise, Clayton held the opinion that when the chaos theory is combined with a large number of determinations in the quantum world, major alterations can be made in the macroscopic world.[175] Tracy did not consider Divine action to be limited to the initial creation and sustaining of the universe; instead, God determines the flow of history, without breaking the rules he installed. In other words, Divine action is embedded inside the laws of nature; no law is broken during Divine 'intervention'. Tracy further suggests that God does not need to fill all of the quantum gaps; it would be sufficient to fill a small portion of these gaps to accomplish

173 Thomas F. Tracy, "*Particular Providence and the God of the Gaps*", (ed: Robert John Russell, Nancey Murphy and Arthur R. Peacocke, Chaos and Complexity), The Center for Theology and the Natural Sciences, Berkeley (2000), p. 317-318.

174 Robert John Russell, p. 205-208.

175 Philip Clayton, *God and Contemporary Science*, Edinburgh University Press, Edinburgh (1997), p. 194.

His purpose.[176] In Tracy's model, God has created and sustained everything, He placed ontological chance inside the structure of the universe, and exploited these probabilities to determine the flow of history.[177]

Clayton has also suggested a model where God fills only a small portion of quantum gaps, even though he refrained from making strong statements about this position. He has emphasized that we do not completely possess sufficient information to establish the relationship between the quantum theory and theology; rather, this is an ongoing effort. He has further suggested that the propositions about quantum mechanics and Divine action should not go beyond claiming how God 'might act', and they should never claim to find how God 'actually acts'.[178] On this matter, I completely agree with Clayton. Polkinghorne has also pointed out that there are numerous alternative interpretations of the quantum theory, and hence care should be taken when Divine action is being related to this theory.[179] It is important

176 Thomas F. Tracy, p. 318-320.

177 Thomas F. Tracy, p. 321-322.

178 Philip Clayton, "*Tracing the Lines: Constraint and Freedom in the Movement from Physics to Theology*", (ed: Robert John Russell et al., Quantum Mechanics), The Center for Theology and the Natural Sciences, Berkeley (2001), p. 234.

179 John Polkinghorne "*Physical Process, Quantum Events and Divine Agency*", (ed: Robert John Russell et al., Quantum Mechanics), The Center for Theology and the Natural Sciences, Berkeley (2001), p. 188-189.

to understand the 'possibility' of Divine action on the universe, without suspension of the laws that govern it. Notwithstanding, as we have seen in Chapter 2, the quantum theory has been interpreted in many different ways; as a result, one should always keep in mind the difference between 'might' and 'is'.

Nancey Murphy and Buridan's Ass

Keeping these caveats in mind, one of the most successful approaches in relating Divine action to determination of quantum uncertainties without suspending the laws of nature has been established by Nancey Murphy. Like Heim and Pollard, Murphy defends that Divine action fills all of the quantum gaps.[180] According to Murphy, the notion of an active God is theologically mandatory, she is in opposition to Peacocke, who regards uncertainties to be unknown even to God. Additionally, she has stated that in defending God's active role in filling quantum gaps, one should avoid the 'occasionalism' loophole.[181]

180 Nancey Murphy, "*Divine Action in the Natural Order: Buridan's Ass and Schrödinger's Cat*", (ed: Robert John Russell, Nancey Murphy and Arthur R. Peacocke, Chaos and Complexity), The Center for Theology and the Natural Sciences, Berkeley (2000), p. 326.

181 For further discussions on Murphy's ideas, see: Robert John Russell, "*Divine Action and Quantum Mechanics: A Fresh Assessment*", (ed: Robert John Russell et al., Quantum Mechanics), The Center for Theology and the Natural Sciences, Berkeley (2001), p. 314-316.

While establishing her arguments against deism, Murphy is prudent to avoid pantheism, occasionalism and the problem of evil.[182] According to her, when God creates something (even a minor thing like an electron) He essentially grants some sort of 'freedom' and 'specific nature' to it. She differs from pantheists; according to her every entity in the universe has an independent nature, granted in creation by God. As a result, properties of the particles in the quantum world are their 'natural rights' and God's sovereignty in this realm does not interfere with these rights.[183] In other words, while God determines all quantum uncertainties, He does not violate the laws specific to electrons, protons or the atom. Just as He allows humans to act via their free will, God allows other creatures to exercise their 'natural rights'. Murphy has also defended that nothing can take place without the contribution of God; all His creatures possess their own potentialities, yet, they are activated only via the act of God.[184] Murphy's perspective is similar to Pollard's and as she defends the notion of an active God, it is coherent with mainstream monotheist theologies. Furthermore, re-

182 Pantheism is the philosophical doctrine that associates the entire contents of the universe with God: according to this view, God and the universe are of the same substance.

183 Nancey Murphy, p. 343.

184 Nancey Murphy, p. 344.

garding the problems of evil and free will, Murphy's stance is more prudent than Pollard's.[185]

Like most other philosophers who reconcile Divine action with the quantum theory, Murphy avoids 'God of the gaps' type of arguments in her endeavor. She regards indeterminism as an ontological fact of nature; as a result, gaps are not epistemological - they do not stem from our ignorance, as claimed by Einstein. At this point, Murphy's ideas are aligned with Barbour, Tracy and many other philosophers. According to Murphy, we do not need to search (like Bohm said) for 'hidden variables' in the atomic world, since God is the 'hidden variable'.[186]

Murphy and others who approach quantum philosophy in a similar manner regard quantum uncertainties as the arena of Divine action: not as pure 'chance', as considered by atheists. However, since this action takes place without intervening in any laws of physics at all, such a claim cannot be scientifically proven or disproven.[187]

185 For Murphy's discussions on the problem of evil, see: Nancey Murphy and George Ellis, *On the Moral Nature of the Universe: Theology, Cosmology and Ethics*, Fortress Press, Minneapolis (1996).

186 Nancey Murphy, "*Divine Action in the Natural Order: Buridan's Ass and Schrödinger's Cat*", p. 342.

187 Ian Barbour, *Nature, Human Nature and God*, SPCK Press, London (2002), p. 27.

One of the most important aspects of Murphy's approach is that it explains Divine action in a 'bottom-up' structure. If God is active in all natural phenomena, He should also be so in the most minute ones (the ones modern science calls quantum phenomena).[188] On the other side, Murphy has formed her views on free will by making reference to the aspects of the human mind that cannot be reduced to material interactions.[189] Her coworker, George Ellis, has pioneered the efforts of combining Divine action with the significance of quantum mechanics at the level of the human mind. Ellis defends that our thoughts and feelings are affected by quantum phenomena inside our brain; religious experiences and revelations also happen in this way. The events in the brain also trigger changes in macroscopic world, via our bodies (i.e. top-down action).[190]

Quantum phenomena and the human mind were linked to each other in various ways. According to one alternative, developed by Ellis, the quantum gaps in our

188 Robert John Russell, "*Introduction*", (ed: Robert John Russell, Nancey Murphy and Arthur R. Peacocke, Chaos and Complexity), The Center for Theology and the Natural Sciences, Berkeley (2000), p. 30.

189 Nancey Murphy, "*Nonreductive Physicalism: Philosophical Issues*", (ed: Warren S. Brown, Nancey Murphy, H. Newton Malony, Whatever Happened to the Soul), Fortress Press, Minneapolis (1998), p. 127-148.

190 George Ellis, "*Ordinary and Extraordinary Divine Action: The Nexus of Interaction*", (ed: Robert John Russell, Nancey Murphy and Arthur R. Peacocke, Chaos and Complexity,), The Center for Theology and the Natural Sciences, Berkeley (2000), p. 359-395.

minds are filled by God, yielding religious experiences and Divine revelations, without intervening in physical laws. Secondly, making free choices between different possibilities (as needed for a libertarian interpretation of free will) can be associated to 'objective probabilities' inside the brain (I will further scrutinize this view in Chapter 5). And lastly, the results of quantum mechanics on the impossibility of reductionism - as previously discussed - can be extended to the impossibility of reductionism for the human mind (Murphy emphasizes the importance of non-reductionism). These approaches to the structure of the human mind can mold our perspectives on God-human relations.

Russell has said that as it abides with 'the principle of sufficient reason', Murphy's approach (i.e. all quantum uncertainties are determined by God) is philosophically more appealing than Tracy's, which does not abide by this principle.[191] In Murphy's approach, all uncertainties are determined, whereas in Tracy's, many are left intact. While taking sides with Murphy, Russell also grants that God is not obliged to create a universe in accord with the principle of sufficient reason (as also noted by Tracy). It is philosophically more advantageous to stay in accord - as done by Murphy

191 Robert John Russell, "*Divine Action and Quantum Mechanics: A Fresh Assessment*", p. 316.

- with this principle that has actually become synonymous to Leibniz's philosophy.

Murphy uses the parable of 'Buridan's ass' to assert that every phenomenon should have 'sufficient reason'; hence, for her, it is the appropriate philosophical position that all the quantum gaps brought about by 'ontological indeterminism' should be filled by Divine action.[192] In John Buridan's famous example, an ass is placed exactly midway between two identical haystacks; however, since it does not possess 'sufficient reason' to prefer one over the other, it starves to death.[193] By making an analogy of Buridan's ass, Murphy claims that quantum uncertainties cannot be determined by themselves; thus, if Divine action is to be associated with quantum gaps, it would be more appropriate to do so for all of them. This way, quantum events with 'sufficient reason' occur (analogous to the ass in the example choosing to go towards one of the stacks and staying alive). Murphy further extends the analogy to explain her notion of 'natural rights' of microscopic particles: it would be natural to expect that the choice made by Buridan's ass is determined by Divine action, whereas it would be unnatural to expect the

192 Nancey Murphy, "*Divine Action in the Natural Order: Buridan's Ass and Schrödinger's Cat*", p. 341

193 Gunter De Bruyn, *Buridan's Ass*, Seven Seas Publishers, Berlin (1973).

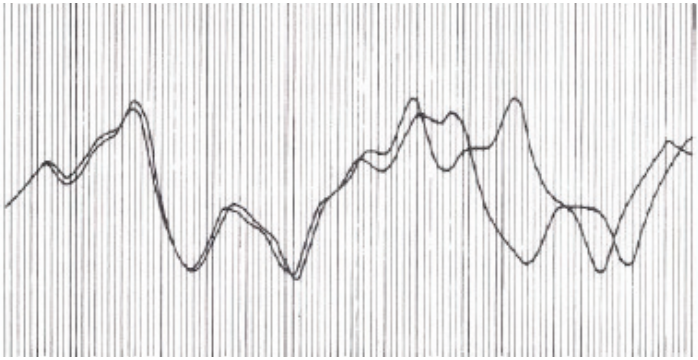
ass to speak. Murphy leaves it to her readers to scrutinize whether or not this perspective can explain why certain phenomena occur while others do not.[194] There are other important issues in Murphy's approach that would require further criticism and scrutiny. Notwithstanding, Murphy's arguments constitute probably the most fruitful ideas on understanding Divine action in harmony with modern science, one of the most arduous matters of modern philosophy of religion.

John Polkinghorne on Divine Action and The Chaos Theory

Regarding its impact on the philosophical and theological realm, the most influential contemporary theory of physics after relativity and quantum theory, is the chaos theory. The theory was founded on experimental data about meteorological research. Until the 1960s, it was widely accepted that if we can determine the details of all phenomena related to meteorological events, we can make a perfect weather forecast. Armed with this goal in mind, Edward Lorenz was hoping that the computations he was performing would be the first perfect weather forecasters. This confidence was born out of a tacit belief in the determinism of the laws of

194 Nancey Murphy, p. 357.

physics; a sufficiently powerful computer could calculate the weather in the future, based on the atmospheric measurements taken now.[195] To his great surprise, Lorenz noticed that extremely minute modifications on the data provided as input to the computer generated profound changes in the output. As a consequence of this, it was practically impossible to make any certain forecast about weather conditions. This phenomenon, 'sensitive dependence on initial conditions' is the prime aspect of the chaos theory.



Lorenz noticed that when he made minute modifications or rounding on the input data, the computational outputs started to deviate from one another, and in fact, after sufficient time, they become completely uncorrelated. This picture shows one of the original results Lorenz obtained in 1961

195 James Gleick, *Chaos: Making a New Science*, Penguin Books, New York (2008).

'Sensitive dependence on initial conditions' is also known in popular literature as 'the butterfly effect'. In one of his original papers, Lorenz exemplified the phenomenon he discovered via the following question: *"Does the flap of a butterfly's wings in Brazil set off a tornado in Texas?"*[196] Soon after this discovery, scientists observed similar 'sensitive dependence' in many other areas. In particular, systematic research led by Ilya Prigogine in 1970s shaped the chaos theory as a new branch of physical research. In the following years, the theory was applied to numerous phenomena from earthquakes to heartbeats and stock market prices.[197] The popular fractal geometry has also been utilized in the modeling of the theory.[198] Even though the chaos theory is not expressed by a simple mathematical formula, it has brought many complex phenomena to the scrutiny of physicists.

The chaos theory studies non-periodical, non-predictable behavior of dynamical systems, which evolve in the framework of deterministic laws of dynamics.[199] Since the behavior of a chaotic system strongly depends on how much time passes after the setup of

196 James Gleick, p. 15-16.

197 James Gleick, p. 114-119.

198 Benoit Mandelbrot, *The Fractal Geometry of Nature*, W. H. Freeman, New York (1982).

199 James Gleick, p. 361-362.

initial conditions, the concept of 'time' attains more significance than most other physical theories. The equations described by Newton's laws, the theory of relativity and the quantum theory are all reversible. Chaotic events, to the contrary, are irreversible; the direction of time matters.[200] This makes the chaos theory appealing for philosophical discussions about the ontological nature of time. Leaving such discussions aside, I will now focus on the implications of the chaos theory on our discussions of Divine action.

The chaos theory has been centralized in an explanation of Divine action by the scientist and theologian John Polkinghorne. Like his contemporaries Tracy and Russell, and precedents Spinoza and Schleiermacher, Polkinghorne believes that God does not break the laws of nature.[201] In this respect, Polkinghorne's ideas are aligned with an interpretation of Divine action in a quantum world by determination of part or all of uncertainties. On the other hand, due to the controversies about the ontological indeterminism, he prefers to focus on the chaos theory to explain Divine action and regards chaos theory to be much more significant for

200 Ilya Prigogine and Isabelle Stengers, *The End of Certainty: Time, Chaos, and the New Laws of Nature*, Free Press, New York (1997).

201 John Polkinghorne, *Quarks, Chaos and Christianity*, SPCK, London (1994).

this purpose.[202] He defends that God controls a system via 'inputs of information', but not energy.[203] As a result, Divine action does not suspend the fundamental physical law of conservation of energy. By this assertion, Polkinghorne assumed that chaotic processes are inherently 'flexible'; there are many possible outcomes to these processes, and God makes choices among them by inputting information. As we shall see below, Polkinghorne has received a lot of criticism about this point: how can a deterministic system be 'flexible'?

In chaotic processes, it is important to comprehend whether there is ontological or epistemological indeterminism (even though many fail to recognize this importance, Polkinghorne is well aware of it). Considering the fact that in chaos theory, the complex movements inside the system are governed by deterministic equations, we can realize that the apparent determinism here is rather epistemological, emerging from our lack of complete information or prediction capability. This epistemological situation is against the idea that chaotic processes are 'flexible' (ontologically indeterministic) and God can act upon them without suspending

202 John Polkinghorne, "*The Metaphysics of Divine Action*", (ed: Robert John Russell, Nancey Murphy and Arthur R. Peacocke, Chaos and Complexity, The Center for Theology and the Natural Sciences, Berkeley (2000), p. 152-153.

203 John Polkinghorne, *Belief in God in an Age of Science*, Yale Nota Bene, New Haven (2003), p. 62-63.

natural laws.[204] Tracy has mentioned that the chaos theory has no place for surprises. According to Tracy, this theory shows rather that there is a 'veil of ignorance' between us and predicting the future; some theologians might assert that Divine action takes place behind this veil. This assertion, however, corresponds to the idea of a God who breaks or suspends the laws of nature. For this reason, Tracy prefers to resort to the quantum theory, rather than the chaos theory, when searching for gaps in nature.[205]

Similarly, Clayton has mentioned that the mathematics behind the chaos theory are deterministic, and hence, this theory yields no 'ontological gap'.[206] Murphy has also seen no reason to make a transition from the 'epistemological unpredictability' of the chaos theory to 'ontological indeterminism. She has stressed that the epistemological concept of 'prediction' should not be confused with the ontological concept of 'causal indeterminism'. As a result, while the quantum theory possesses some gaps which Divine action can fill without

204 God's intervention in a deterministic system can be possible by His fine tuning of the initial conditions at the beginning of the universe (I will handle this approach in Chapter 4). This alternative aside, deterministic systems have no gap for God to fill, in order to create miracles without intervening in natural laws.

205 Thomas Tracy, "*Particular Providence and the God of the Gaps*", p. 313-315.

206 Philip Clayton, *God and Contemporary Science*, p. 207.

breaking the laws of nature, the chaos theory lacks such an aspect.[207] Despite these objections, however, Polkinghorne is not alone in defending the existence of 'flexibilities' (ontological gaps) in the chaos theory. Paul Davies, for example, has said that the chaos theory shows the impossibility of calculating the end of the universe, and hence this end is 'unknowable'. Davies further claims that the chaos theory bridges the laws of nature with the 'laws of chance'.[208] Murphy's objections to Polkinghorne also constitute a response to Davies: how appropriate would it be to make a transition from epistemological unpredictability to ontological indeterminism?

Polkinghorne is well aware of his adversaries. He makes a distinction between the physical theory of chaos and chaotic phenomena observed in nature; he considers the former to be deterministic, and the latter indeterministic. By emphasizing Ilya Prigogine's opinion on the matter, Polkinghorne hopes that in the future a more 'holistic and open' theory can be developed.[209] In other words, Polkinghorne believes that deterministic laws are but 'approximations' to the ontologically

207 Nancey Murphy, "*Divine Action in the Natural Order: Buridan's Ass and Schrödinger's Cat*", p. 328-329.

208 Paul Davies, "I*s the Universe a Machine?*", (ed: Nina Hail, Exploring Chaos), W. W. Norton and Company, New York (1994), p. 219-221.

209 John Polkinghorne, *Belief in God in an Age of Science*, p. 65.

indeterministic structure of nature. This is similar to the assertion that Newton's law of universal gravitation is an approximation; in fact, with Einstein's general theory of relativity, a more general picture of gravity was revealed. Nevertheless, I should point out that there is no solid scientific evidence to support Polkinghorne's thesis. Polkinghorne views the chaos theory as an 'emergent downward approximation' to the truths of nature.[210] He believes that the chaos theory is a result of our attempt to describe the fundamentally indeterministic natural phenomena via deterministic laws.

It appears that Polkinghorne's particular interpretation of the chaos theory stems from his metaphysical preferences. Likewise, the divergent metaphysics of Einstein and Bohr were at the roots of their deviation in the interpretation of the 'apparently indeterministic' quantum theory in deterministic and indeterministic ways. Prior to studying Divine action in the framework of 'theology of nature' (the attempt to evaluate natural phenomena in the light of theological doctrines), one must be well aware of these different interpretations. Despite variances in their interpretations, the chaos theory and particularly the quantum theory are such fundamental outcomes of modern science that no one

210 John Polkinghorne, *Science and Christian Belief,* SPCK, London (1994), p. 26.

can turn a blind eye to them who is dealing with science-philosophy-religion relationship. As a result, on the route to understanding Divine action, one must certainly include these theories, together with their different interpretations, and keep in mind that no single interpretation is infinitely more authoritative than another.

In my preference, if one is to defend the existence of ontological gaps in nature, the quantum theory is a much better alternative (as defended by Tracy, Murphy and Clayton). Instead of interpreting a 'seemingly deterministic' law in an indeterministic way, it is more preferable to interpret a 'seemingly indeterministic' theory the way it is. Perhaps an even better approach would be to reconcile the implications of the two theories: the uncertainties at the quantum level might be the root of the 'sensitivity' to minute variations in the initial conditions, as observed in the chaos theory. This perspective also paves the way to understanding how God might control macroscopically major events by determining minute uncertainties in the quantum world. A particularly significant application of this interpretation is the interpretation of miracles within the framework of the laws of nature. This will be the main subject matter of the next chapter.

Some thinkers, such as Jason Colwell, materialize the idea of expanding the impact of minute determinations in the quantum realm by the chaos theory into a philosophical model to explain Divine action.[211] Indeed, the idea of small changes in the micro world creating macroscopic events is also present in the famous Schrödinger's cat thought experiment.[212] Despite its strong charm and laborious efforts in the past couple of decades, however, no significant scientific improvement has been made to bridge the micro and macro worlds via the chaos theory.[213] Nevertheless, since there is no sharp boundary between the two realms, one would not be so naive to expect this unification to happen in the foreseeable future.

211 Robert Russell, "*Divine Action and Quantum Mechanics: A Fresh Assessment*", p. 316.

212 Jason Colwell, "*Chaos and Providence*", *International Journal for Philosophy of Religion*", no: 48 (2000), p. 131-138.

213 Michael Berry, "*Quantum Physics on the Edge of Chaos*", (ed: Nina Hall, Exploring Chaos), W. W. Norton and Company, New York (1994), p. 184-195; James P. Crutchfield et al., "*Chaos*", (ed: Robert John Russell, Nancey Murphy and Arthur R. Peacocke, Chaos and Complexity), The Center for Theology and the Natural Sciences, Berkeley (2000), p. 35-48.

CHAPTER IV

MIRACLES, THE LAWS OF NATURE AND THE QUANTUM THEORY

Description of the Chapter

In this chapter, I will focus on one of the most elusive and controversial outcomes of Divine action: miracles. I should mention upfront that my discussions here are by no means meant to prove the existence of miracles. The paradigm of the mechanical universe originated in the 17th century is a milestone for the problem of miracles. In this chapter, my goal is to understand why the mechanical universe/determinism, as well as the quantum theory/indeterminism, are of paramount significance regarding the problem of miracles. Furthermore, we shall see that different approaches towards the laws of nature also determine views on miracles, in the understanding of whether their occurrence suspends/breaks the laws of nature or not. After demonstrating different philosophical perspectives, I will present my own stance on this matter.

In this chapter, you will find answers to the following questions: Why the spread of mechanical philosophy was a milestone in the problem of miracles? What was David Hume's objection to miracles, and is this consistent with his philosophy in general? Why do some thinkers associate a 'positive' meaning to miracles' breaking the laws of nature? What are the different approaches to the ontological status of the laws of nature, and what is their significance regarding our discussions? Is it possible to explain miracles by 'fine-tuning initial conditions'? Where does the quantum theory enter into the debate about miracles? Can God create miracles without breaking the laws of physics? Is there a theological mandate on interpretations of the way miracles occur (via violation of the laws of nature or not)? Why is it preferable to adopt a theological agnostic stance about miracles?

David Hume on the Problem of Miracles

Philosophical and theological problems are manifest from the very definition of 'miracle'. Etymologically, the word miracle derives from the Latin word 'mirus' which means 'wonderful'.[214] In its technical theological meaning, however, it refers to extraordinary events created by

214 Merriam Webster's Collegiate Dictionary, Merriam Webster, Massachusetts (1993), p. 742.

God to support His prophets. Through these 'wonderful' events, prophets challenge disbelievers. According to Muslim schools, even though the miracles happen in the hands of prophets, they are in fact manifestations of Divine action, and evidence for the authenticity of prophets. In Judaism, Christianity and Islam, belief in miracles is a theological tenet. In the Quran, as well as in the Old and New Testaments, there are numerous passages describing miracles. In addition to its technical theological meaning, the word 'miracle' is also often used to describe occurrence of unexpected daily events (e.g. passing a very hard exam), as well as to describe natural phenomena like the sprouting of a seed or the rising of the Sun every morning. In this book, however, we will exclusively focus on miracles as extraordinary occurrences created by God. Hence, miracles as we will discuss have two distinctive properties:

1- Being a manifestation of Divine action
2- Being extraordinary

The majority of the debates about miracles have roots in the second property, since 'being extraordinary' is often interpreted as violation of the laws of nature. In the history of philosophy, this kind of a description of miracles is identified with David Hume, who has rejected miracles entirely to avoid this 'violation'.

According to Hume, compared to convincing evidence through observation (e.g. a methodology of science) of natural laws, personal witnesses in the form of historical figures cannot create a significant argument to claim that these laws were violated.[215] Actually, in addition to the unreliability of the witnesses of miracles, if Hume had also meant to say that their occurrence is 'impossible', he would have contradicted his own views about causality.[216] This is because Hume has regarded causality not to be mandatory, but as a subjective product of human psychology. Consider the famous example: we observe that after two billiard balls collide, they start moving in different directions, and after our numerous observations of the same phenomenon over and over, we are led to believe that the result of this condition is a 'necessity'. Yet to Hume, we cannot claim the real existence of such necessities. Our judgment results from the fact that we always observe the same occurrence; the necessity is loaded onto nature by the human mind.[217]

215 David Hume, *An Enquiry Concerning Human Understanding*, Open Court, ed: Charles W. Hendel, The Library of Liberal Arts, Indianapolis (1955), p. 117-141.

216 John Hedley Brooke, *Science and Religion*, p. 185.

217 David Hume, *A Treatise of Human Nature*, ed: Ernest C. Mossner, Penguin Books, London (1985), p. 126-131, 205-223; David Hume, *An Enquiry Concerning Human Understanding*, p. 40-53.

If causality is not a real necessity, how can one reject miracles by stating that they are against the laws of nature? If the relationship between cause and effect is not a mandatory one, we cannot talk about any 'law of nature' and thus, 'breaking the laws of nature' ceases to confer any meaning. To this end, Muslim scholar al-Ghazali opposed causality in order to open up space for miracles in his philosophy:[218]

"In our view, the connection between what are believed to be the cause and the effect is not necessary... Take for instance any two things, such as the quenching of thirst and drinking; satisfaction of hunger and eating; burning and contact with fire…or any other set of events observed to be connected together…If one follows the other, it is because He has created them in that fashion, not because the connection in itself is necessary and indissoluble."

This line of reasoning facilitates an explanation of, for example, Abraham's miraculous exodus from fire.[219]

Strongly influenced by Hume, Malebranche has also rejected the necessity of the relationship between cause

218 Abu Hamid Muhammad al-Ghazali (Author), Michael E. Marmura (Translator), *The Incoherence of the Philosophers*, Brigham Young University, Provo (2002).

219 Surat al-Anbiya, 21:69.

and effect,[220] and defended that this relationship is filled by God.[221] However, unlike the occasionalist philosophers who reject the necessity of the relationship between cause and effect and define God as the entity that establishes this apparent relationship, Hume was an agnostic. Einstein mentioned that, if we accept Hume's approach, we have to abandon all our thoughts.[222] Regarding our subject, the critical point here is that the approach of Hume leaves no space for the notion of 'law of nature'; thus, it would be self-inconsistent to reject miracles by this approach, by arguing that miracles (supposedly) violate the laws of nature. As John Hedley Brook mentions, Hume attempted to show that miracles are 'highly' impossible, and assumed that the unreliability of historical accounts suffices to reject miracles.[223] As a summary, considering Hume's philosophy in its entirety, we can conclude that his opposition to miracles is not based on their impossibility, but on the unreliability of their witnesses.

220 Hume, in his letter to Michael Ramsey' (August 26 1737), emphasized Malebranche's impact on him. James Fieser, "*David Hume (1711-1776): Metaphysics and Epistemology*", The Internet Encyclopedia of Philosophy, www.iep.utm.edu/h/humeepis.htm; David Hume, A Treatise of Human Nature, p.17.

221 Nicolas Malebranche, *The Search after Truth,* Cambridge University Press, Cambridge (1997).

222 Albert Einstein, "*Remarks on Russell's Theory of Knowledge*", (ed. Paul Arthur Schilpp, The Philosophy of Bertrand Russell), Tudor, New York (1994), p.289.

223 John Hedley Brooke, *Science and Religion*, p. 186.

According to some philosophers, Hume's way of rejecting miracles enters into a 'vicious cycle': Miracles are deemed impossible since they are against the laws of nature. These laws are generalizations of our observations, and these generalizations tacitly exclude eye witnesses of 'miraculous' occurrences. The exclusion of eye witnesses is based on the assumption of the impossibility of miracles.[224] Likewise, Hume's approach can be phrased in reverse, implying that if there were sufficiently numerous and dependable eye witnesses, we would have to believe in miracles.[225] Despite these objections, Hume's idea that personal accounts cannot constitute an argument about occurrences violating the laws of nature has been used extensively in the past century, and repeatedly exploited by philosophers of religion such as Antony Flew.[226]

Regarding the confrontation of theism with atheism, rather than the miracles being an argument for supporting theism, it is much more relevant to discuss whether miracles can occur or not. This brings about a primarily epistemological question: what is

224 C. S. Lewis, *Miracles: A Preliminary Study*, Collins, London (1960), p. 106; R. J. Berry, "*Divine Action: Expected and Unexpected*", Zygon, vol:37, no:31 (2002), p. 718.

225 R. J. Berry, p. 718.

226 Antony Flew, "*Parapsychology Revisited: Laws, Miracles, and Repeatability*", Humanist, no:36 (1976).

the rationale in believing in miracles?[227] At this point, we are faced with three types of opposition to miracles: the first is essentially Hume's position; we cannot trust personal accounts about the violation of the natural flow of events. The second is brought against those who believe in miracles as violations of the laws of nature and attributes a positive meaning to these violations; we do not have a complete understanding of these laws and hence, we cannot associate miracles with them. Lastly, while accepting the extraordinariness of the event, some argue that it is an 'anomaly' that happens within the laws of nature, and has nothing to do with Divine action.[228]

As a response to these oppositions, some people mention that Hume's opposition is targeted to human witnesses, while there might also be 'indirect evidence' of miracles. When a homicide happens, even if no one actually sees the event, clues like fingerprints at the site and prior motives, such as animosity toward the victim, are used as factual evidence.[229] As a result, even though we have not witnessed the calamities which fell upon ancient societies described in the scriptures,

227 J. A. Cover, "*Miracles and (Christian) Theism*", (ed: Eleonore Stump and Michael J. Murray, Philosophy of Religion: The Big Questions), Blackwell Publishing, Malden (2006), p. 335.

228 J. A. Cover, p. 335-337.

229 J. A. Cover, p. 339-340.

archaeological remnants found around the locations mentioned in those texts form evidence in support of the authenticity of the described events.[230] On the other hand, the arguments against those who attribute a positive meaning to miracles, can be modified in order to refute Hume's angle. In this case, one would argue that historical experiences of natural phenomena do not show that we perfectly understand the laws of nature, and hence they cannot stand as a basis to reject witnesses of miracles.

At this point, it is worth recalling that monotheistic religions do not ascribe the terminology of 'miracle' to every anomaly. Instead, the events deemed miraculous are exceptional occurrences reported in religious sources, as direct manifestations of the will of God. For example, if a farmer observes that his seeds turn into plants only within a few hours, this would not be a 'miracle' in the theological sense, since we cannot

230 There have been numerous studies, particularly in the Christian world, about supporting theological claims with archaeological findings. In fact, the effort to find evidence for the verity of histories in Holy Texts has been a strong motivation behind many archaeological studies. See, for example: William Foxwell Albright, *Archeology and the Religion of Israel,* Westminster John Knox Press, Louisville (2006). Similar attempts have also occurred in the Muslim world, albeit on a much smaller scale. I will not delve into the question of whether or not such studies do indeed support the teachings in scriptures. Suffice it to realize that critics of Hume and Flew on the unreliability of personal accounts have been responded to by references to the searches for indirect evidence for miracles.

establish a direct link between this event and Divine intervention.[231] On the contrary, the parting of the water for Moses is precisely related to the message and the mission of his prophethood, and occurred right at when it was absolutely needed; therefore, this event is an example of a theological 'miracle'.[232] The critical distinction between an anomaly and a miracle is that the latter matches certain expectations of Divine behavior. The historical-religious context in which a miracle occurs is what makes it special.[233] As opposed to other instances of anomalies, miracles happen under certain expectations and at certain times, in the framework of Divine behavior.

Proper Approach to The Problem of Miracles

The majority of miracles described in the holy texts are related to the stories of the prophets. In other words, they have taken place during the most critical periods of the establishment of religions. The reliability of first-hand human witnesses from this period might be controversial. On the other hand, it would be

231 Michael Peterson et al, p. 260.

232 The Exodus, 16, 15-29; Surah al-Baqarah, 2:50.

233 William Lane Craig, "*Creation, Providence and Miracles*", (ed: Brian Davies, Philosophy of Religion), Georgetown University Press, Washington (1998), p. 154-155.

a false assumption to say that over thousands of years, all theists have constructed their faiths solely on miracles. Instead, most theists rather establish their faith in God via other arguments; and as a consequence of their God-centered ontology, they believe that if God wishes, he can create the phenomena we call 'miracles'. In other words, monotheistic believers typically make a transition from the existence of God to the existence of miracles: not vice versa. As R.J. Berry held, we do not need a supreme faith to believe in miracles; all we need is the belief in a supreme God.[234] As a result, we can comfortably assert that in general, a theist's belief in miracles does not rely on personal accounts; it is rather their faith in an omnipotent God, for whom it is possible to create miracles, as well as their reliance on the content of holy texts that motivates belief in miracles. Faith in God might be supported by rationale like the cosmological and design arguments, or it might be totally fideist.

Even those who doubt (or deny) the existence of God would readily agree that the existence of God is a far more critical matter as compared to the question of whether or not miracles happen.[235] For those who regard nature as a closed system immune to any external

234 R. J. Berry, p. 726.

235 Paul Davies, *God and the New Physics*, p. 197.

intervention (in other words, those who adopt naturalism as the only appropriate philosophical system or scientific method), miracles would obviously be impossible. In fact, according to naturalism, nature is the sole source of truth and values, and everything can be explained by resorting to nature. As a result, by its very definition, naturalism excludes miracles. Naturalism defends that nature is immune to any kind of external perturbation whatsoever, including intervention by God or any other kind of entity. On the other hand, technically, the term 'miracle', refers to an extraordinary action of the Divine on nature. As a result, it is impossible to reconcile naturalism with the concept of miracle as a form of Divine action. How can a philosophy that dictates rejecting Divine action be in harmony with a claim directly linked to Divine action? Consequently, the fundamental question we face about the problem of miracles is whether the ontology of theism or naturalism is correct.[236] Notwithstanding its general vitality, this question is out of the scope of this book.

Some philosophers defend an approach to miracles where Divine action fills the gaps in the quantum world, thereby triggering macroscopic events we know as miracles, without violating any natural laws. This kind of

236 Caner Taslaman, *Allah'in Varliginin 12 Delili*, Destek Yayinlari, Istanbul (2016).

approach would be much less problematic in 'methodological naturalism' (I will compare philosophical and methodological naturalism in the following pages), since it does not necessitate violation of the laws of nature; God retains nature's order, even when creating miracles. In addition, this approach is also theologically appealing as it is in accord with the doctrine: "God does not break His own laws". As a result, regarding philosophy of religion, it is crucial to determine whether the quantum theory can explain how miracles happen without breaking physical laws. It should be kept in mind, however, that this determination does not necessitate the adoption of miracles in which laws of nature are not intervened (as in Schleiermacher's philosophy). In my opinion, as pointed out by Berry, the fundamental issue is the belief in the existence of God, and belief in miracles is a follow-up.[237] On the other hand, I do not see any reason to insist on the notion of divine intervention (as done by Marin Mersenne and Richard Swinburne).[238]

If one can show that miracles can occur without breaking the laws of nature, he would also show the falsity of those who claim: "Religion contradicts science, since it defends that miracles intervene in the

237 R. J. Berry, p. 726.

238 Richard Swinburne, *The Concept of Miracle*, Macmillan, London (1970).

laws of nature". As a result, this kind of a determination would be quite valuable regarding philosophy of religion. One of my primary objectives in this book is to demonstrate that quantum mechanics opens up plenty of opportunities for the occurrence of miracles within the framework of natural laws. I would like to underline again that by describing the 'possibility' of miracles to happen this way, I do not make any strong assertion on the actual mechanism behind miracles.

As an alternative theological approach to miracles, one can propose that Divine laws are broader than what we know as the laws of nature; therefore, God's creation of miracles outside the borders of physics does not mean that 'God violates his own laws'. Our knowledge of Divine laws is not complete, and they are definitely not limited by the laws of nature as we know them. If we assume, as Spinoza did, that the laws of nature as we know them are equivalent to Divine laws - ignoring that the Divine laws can be broader than what we know - we will fall into this loophole (contradiction between miracles and natural laws). Indeed, as a result of such an assumption, Spinoza identified determinism (in accord with the dominant paradigm of his time) with Divine Nature.[239] However, the quantum theory

239 Spinoza (Author), Samuel Shirley (Translator) *Tractatus Theologico-Politicus*, Brill Academic Publishers, Leiden (1997).

has shown that the laws of nature are indeterminist, and non-locality is a fact of the universe. These developments have shown humanity once more that one should be extremely prudent before making any association between Divine Nature and the laws of nature. The framework of Divine laws is much broader than the laws of nature we currently know (whether deterministic or indeterministic); as a result, it would be erroneous to reject miracles on the grounds of natural laws. Nevertheless, I deeply respect the value of scrutinizing the implications of scientific findings on philosophical thoughts; this potential alone should suffice to motivate curious minds to learn what the most significant theory of modern physics has to tell about the occurrence of miracles.

Miracles and the Mechanical Universe

Voltaire and other thinkers have deliberately described miracles as 'supernatural occurrences', in order to argue that they violate the laws of nature, and thus reject them. Voltaire goes further, claiming that belief in miracles is insulting God.[240] The Newtonian model of the mechanical universe has been a critical milestone in the debates on miracles. If event B always

240 François Voltaire (Author), Theodore Besterman (Translator), *Philosophical Dictionary*, Penguin Classics, New York (1984).

follows A, and due to a miracle, instead of B, M follows A, the miracle would mean the suspension of the order of nature. Unlike Hume and Voltaire, many thinkers have observed no difficulty in the simultaneous adoption of the notion of the mechanical universe and miracles as the suspension of natural laws. Marin Mersenne, a notable scientific figure of the 17th century, openly expressed his discomfort against the identification of miracles as bogus stories made up by clerics. He believed that it would be beneficial to draw a line between miracles and 'marvels'. If nature has an order determined by certain laws, miracles can be described as a brief suspension of this order, whereas marvels are exceedingly unlikely occurrences within the natural order. This definition also stresses the theological value of miracles.[241] Mersenne perceived the mechanical universe to be a servant to Catholicism.[242] Likewise, Robert Boyle harmonized the mechanical universe with Protestantism and stressed the significance of the supernatural identity of miracles. In general, Protestants opposed the Catholic belief in miracles, outside what is mentioned in the holy texts. Their propensity to the

241 John Hedley Brooke, *Science and Religion*, p. 125-126.

242 William B. Ashworth, "*Catholicism and Early Modern Science*", (ed: David C. Lindberg and Ronald L. Numbers, God and Nature), University of California Press, Berkeley (1986), p. 138.

concept of the mechanical universe made them reject the Catholic notion of the magic universe.[243]

As a devout believer and founding father of the concept of the mechanical universe, Isaac Newton stressed the idea of 'Divine freedom' and believed that if He wishes, God can intervene in the laws of nature when necessary.[244] On the other hand, as an attempt to mold Christian doctrines in accord with the paradigm of enlightenment, Thomas Jefferson left out all mentions of miracles in his 'Bible'.[245] In all these approaches to miracles, the scientific revolution of the 17th century played a central role. Debates on miracles also occurred prior to this epoch; however, the onset of the mechanical universe brought the question to an unprecedented level of philosophical and theological scrutiny. The notion of the mechanical universe has played the utmost role in philosophical preferences such as: the rejection of violative miracles by atheists, deists or agnostics (as with Hume and Voltaire); association of a positive meaning to violative miracles (as done by Mersenne and Boyle); and extraction of miracles from the holy texts, as done by Jefferson.

243 David Ray Griffin, *Religion and Scientific Naturalism*, State University of New York Press, Albany (2000), p. 126-128.

244 John Hedley Brooke, p. 159.

245 Thomas Jefferson, *The Jefferson Bible: The Life and Morals of Jesus of Nazareth*, Wilder Publications, Radford (2009).

It is notable that, in addition to atheism and agnosticism, certain interpretations of theism also bring about the rejection of miracles. This might be a direct and complete rejection of miracles (as done by Jefferson), or alternatively, a rejection of miracles' violative aspects. Descartes, for example, attempted to explain some of the miracles in the holy texts via natural events.[246] His attempt can be associated with his general philosophy constructed upon the assumption of God's immutability, and correspondingly, the immutability of natural laws.[247] Schleiermacher, on the other hand, via theological motivations, argued that miracles as the violation of natural laws should be discarded from Christian doctrines. He regarded causality to be a logical necessity and all natural phenomena the act of God, albeit in the framework of laws (without any violation whatsoever).[248]

Despite the diverse approaches towards miracles we observe in philosophies of Voltaire, Mersenne, Newton,

246 Richard S. Westfall, "*The Rise of Science and the Decline of Orthodox Christianity: A Study of Kepler, Descartes, and Newton*", (David C. Lindberg and Ronald L. Numbers, God and Nature), University of California Press, Berkeley (1986), p. 228.

247 René Descartes (Author), Donald A. Cress (Translator), *Discourse on Method and Meditations on First Philosophy,* Hackett Publishing Company, Indianapolis (1999).

248 Freidrich Schleiermacher, *The Christian Faith*, T. and T. Clark Publishers, Edinburgh (1999).

Jefferson, Descartes, Spinoza and Schleiermacher, there is also a common element: all these historically prominent figures presuppose that the universe is dominated by 'objective determinist' laws. This is exactly where the significance of quantum mechanics regarding miracles becomes apparent. First of all, quantum mechanics has scientifically put an end to the reign of objective determinism. As a result of this fundamental paradigm shift, all philosophical discussions about the nature of miracles have to be redeveloped right from their fundamentals.

Despite this paradigm shift, however, not every philosopher in the 20th century chose to harmonize theological and philosophical positions on miracles with the indeterministic consequences of quantum mechanics. Richard Swinburne, for example, has regarded miracles as unique and exceptional interventions of the laws of nature (similar to Mersenne), and associated a positive meaning to this intervention (as opposed to Hume).[249]

Philosophical Approaches to The Laws of Nature

An overwhelming majority of the debates on miracles in modern times boil down to the question of

249 Richard Swinburne, "*Miracles*", Philosophical Quarterly, no: 18 (1968).

whether or not they violate the laws of nature. This question actually has two aspects: the first is about understanding the nature of Divine action, and the second about understanding the nature of physical laws. I think that the second aspect has not received the attention it deserves. There has been myriad of studies in the philosophy of science about the way we should understand the ontological status of the laws of nature; however, most of these studies have been overlooked in discussions about miracles. This is a serious deficiency. For example, for certain preferences about the ontology of laws, the problem of violative miracles disappears spontaneously, making it completely immaterial to debate whether God breaks His own rules or not. Therefore, determining the ontological status of the laws of nature is vital to the debates about the characteristics of miracles. Despite its appeal, many philosophers strongly oppose the idea of regarding the laws of nature to be 'universal truths'.[250] I will next summarize the corresponding approaches under four categories: regularity, instrumentalism, necessitarianism and probabilistic approach.

250 Rom Harre, "*Laws of Nature*", (ed: W. H. Newton-Smith, A Companion to the Philosophy of Science), Blackwell Publishers, Massachusetts (2001), p. 213-222.

1. Regularity: According to this approach, phenomena ontologically have priority over laws. What we call 'law' in the scientific terminology does not describe absolute truth; a scientific 'law' is rather a statement of the observed order in nature.[251] Instead of 'absolute law', we have 'law-like' statements. Defenders of this approach reject the evaluation of laws as 'Platonic ideas'. Despite nuances, all regularitans criticize necessitarianism. On the other hand, regularitans are criticized due to their unsatisfactory explanation of the fact that scientific laws are very often exploited to make successful predictions about the future. Some further critics focus on the fact that regularity does not explain the reason behind the apparent order in nature.[252]

One of the most prominent proponents of the regularity approach is Alfred Ayer. He links the roots of regularity to Hume's critics of causality and holds that Hume's approach is often not properly understood. According to Ayer, Hume did not claim that there is no relation between cause and effect; instead, he remarked that such a relation is not a 'logical necessity'. If it were the case, it would have been possible to deduce effects

251 Martin Curd and J. A. Cover, "*Commentary*", (ed: Martin Curd and J. A. Cover, Philosophy of Science), W. W. Norton and Company, New York (1998), p. 898-899.

252 Fred Dretske, "*Laws of Nature*", (ed: Martin Curd and J. A. Cover, Philosophy of Science), W. W. Norton and Company, New York (1998), p. 826-845.

from causes and we could have determined the outcomes of experiments, prior to conducting them. Such an a priori knowledge is not possible.[253] Just as Hume does not see a logical necessity between cause and effect, he also rejects the existence of physical necessity. He associates the delusion of physical necessity with psychological factors and calls it 'subjective'. Due to this immanent relationship between regularity and Hume's ideas, this approach is often called 'Humean theory'. In its simplest sense, the regularity approach deems the 'laws of nature' as mere generalizations.[254]

Ironically, this approach, which has become synonymous with Hume, is in conflict with Hume's description of miracles as violations of the laws of nature.[255] This is because regularity approach gives observed phenomena the top priority; the laws should follow the observed phenomena, in a way which encompasses all occurrences. Since occurrences precede laws, if there is an exceptional occurrence, the corresponding law has to be revised to encompass it. If, for example, the fire did not harm Prophet Abraham, we should revise our generalization about fire to include the possibility that

253 Alfred Ayer, "*What Is a Law of Nature?*", (ed: Baruch A. Brody, Readings in the Philosophy of Science), Prentice-Hall, New Jersey (1970), p. 42-46.

254 Martin Curd and J. A. Cover, p. 879-880.

255 Norman Swartz, *The Concept of Physical Law*, Cambridge University Press, Cambridge (1998), p. 109.

'fire may not always burn'. Obviously, this does not mean that every claim of 'extraordinary' observation has to be accepted. However, if this approach is adopted, it would no longer be possible to reject miracles based on their violation of the laws of nature. Within this perspective, miracles cannot be rejected in the name of atheism, deism, agnosticism and theism (based on the argument that God does not break His own rules). If we cannot learn the exact rules set by God Himself, how can we say that He breaks them? The outcomes of natural sciences are only generalizations. As a result, it would be meaningless to talk about the 'violation of laws', since there are no absolute laws but 'law-like' generalizations.

On the other hand, regularity can also become problematic for those, like Mersenne, who associate a positive meaning to the violation of the laws of nature. When there is no absolute law, no positive meaning can be ascribed to it.

2. Instrumentalism: The regularity approach reduces the ontological status of the 'laws of nature' from being absolute truths to generalized descriptions of regularly observed phenomena.[256] In this respect,

256 Ernest Nagel, "*Issues in The Logic of Reductive Explanations*", (ed: Martin Curd and J. A. Cover, Philosophy of Science), W. W. Norton and Company, New York (1998), p. 911.

instrumentalism reduces their ontological status even further: the relationship of the laws as we know them with the absolute truths about nature is totally irrelevant; it is the human mind that attaches the status of 'law' to certain occurrences. According to instrumentalism, the best scientific theory is not the one that describes the ontological reality the best; it is rather the one that most successfully facilitates technological advances, and most precisely makes predictions about the outcomes of experiments.[257] The approach of Thomas Kuhn is aligned with instrumentalism (as held by Ernan McMullin, for example). Kuhn thought that we could totally leave aside the debates about the independent reality of scientific theories.[258] He considered the success of a theory to be analogous to its puzzle solving ability, thereby rejecting the 'objective reality' of the laws of nature.[259]

257 Jarrett Leplin, "*Realism and Instrumentalism*", p. 394.

258 Ernan McMullin, "*Rationality and Paradigm Change in Science*", (ed: Martin Curd and J. A. Cover, Philosophy of Science), W. W. Norton and Company, New York (1998), p. 119-136. In this article, McMullin presents his critique of Kuhn. He argues that the theory of Copernicus is superior to that of Ptolemy, due to the former's ability to explain observed phenomena and make new predictions. In other words, McMullin argues that two theories can be compared on the grounds of 'objective criteria'; they are not merely tools for 'saving the phenomena', as Kuhn argues.

259 Thomas S. Kuhn, *The Structure of Scientific Revolutions*, The University of Chicago Press, Chicago (1970).

When one evaluates the quantum theory from the instrumentalist perspective, he would focus on its glories in the development of technologies like transistors, superconductors, lasers, nuclear plants etc. and ignore the question of how successfully the theory matches the ontological reality of the micro world. Likewise, one would evaluate Newtonian determinism and Einstein's theory of relativity based on the roles they play in developing practical advances. In this approach, the term 'scientific laws' is more appropriate than 'natural laws', as the roots of these laws are sought in the human mind, rather than in nature. Finally, according to instrumentalism, scientific developments are not 'discoveries' but 'inventions'.

Regarding the question of miracles, since instrumentalism mandates no ontological claim about 'thing-in-itself', it should stay indifferent to whether or not miracles violate the laws of nature. How can one claim violation of 'natural laws' based on a philosophy that ontologically makes no prediction on the existence of natural laws? If scientific theories are merely products of the human mind, they are no longer the 'rules placed by God', and hence there would be no further theological argument as to God's breaking of his own rules; it

would no longer be possible to reject miracles based on this kind of theological argument.

On the other side, for those like Boyle, who observe a 'positive' meaning of the violation of the laws of nature by miracles, instrumentalism is not an appealing approach towards the scientific theories.

3. Necessitarianism: In this perspective, the relationship between cause and effect is a necessity: the laws of nature are ontological realities, and they exist irrespective of the human mind. The laws of nature not only determine what must happen, they also exclude what cannot happen. If the cause 'A' creates the effect 'B', the phenomena A and B must always follow each other.[260] The laws are also not bounded by time and space. B follows A now, as it did a billion years ago, and will do still in a billion years.[261]

As opposed to ascribing priority to phenomena over laws in regularity approach, necessitarianism defends the ontological priority of the laws over natural phenomena. Among the four categories of philosophical approaches to the scientific theories, only within

260 Paul Humphreys, "*Causation*", (ed: W. H. Newton-Smith, A Companion to the Philosophy of Science), Blackwell Publishers, Massachusetts (2001), p. 34-35.

261 R. B. Braithwaite, "*Laws of Nature and Causality*", (ed: Baruch A. Brody, Readings in the Philosophy of Science), Prentice-Hall, New Jersey (1970), p. 55.

necessitarianism it is possible to talk about miracles' violation of the laws of nature. In other words, those who feel discomforted by the idea of violative miracles - such as Schleiermacher - should be tacitly assuming necessitarianism. In order to refute necessitarian objections to miracles, it is vital to assess whether or not quantum mechanics can explain how miracles could occur in the framework of physical laws. Regarding regularity, on the other hand, since there is essentially no such difficulty with the existence of miracles, what the quantum theory has to say on this issue would not be of comparable importance.

Recall that the violative description of miracles in necessitarianism is something many philosophers and theologians do not feel uncomfortable about - some even prefer such a description of miracles. William Lane Craig, for example, has said that the necessitarian approach to the laws of nature may indicate that miracles are 'physically impossible'; however, religions claim that miracles happen not within the natural chain of events, but with the intervention of a supernatural Power.[262] He has further held that if we accept the existence of a theistic God, we should automatically accept the possibility of miracles. To the contrary, one might advocate

262 William Lane Craig, "*Creation, Providence and Miracle*", p. 152-153.

the impossibility of miracles if and only if the verity of atheism were established on rational grounds. As a result, according to Craig, rejecting miracles based on their violation of the laws of nature, within the necessitarian approach, is not a valid form of argument. [263]

4. Probabilistic Approach: The probability theory and its relative, statistics, have established significant roles in many areas of modern science.[264] For example, results of medical research would be quite elusive without statistical presentation (think about the following representative statement: "in *A* percent of smokers, lung cancer is observed *B* percent more likely as compared to non-smokers"). In general, if the occurrence of A makes the occurrence of B more likely than not, we can talk about 'probabilistic causation'.[265] In necessitarianism, B is said to be a necessary result of A, whereas in the probabilistic approach, B might as well have been caused by C, or something else. For example, lung cancer might be caused by smoking, or weather pollution, and a person who never smokes and lives in clean air might also get lung cancer.

263 William Lane Craig, p. 154.

264 Philip Percival, "*Probability*", (ed: W. H. Newton-Smith, A Companion to the Philosophy of Science), Blackwell Publishers, Massachusetts (2001), p. 363.

265 Paul Humphreys, p. 35-36.

In situations where probabilistic causation prevails, it is often hard to determine the connection between a certain effect and its potential causes. Carl Hempel defines this situation as 'the problem of explanatory ambiguity', and also associates Divine action to such occasions. As a result of this ambiguity, one could claim that an illness is cured by a specific drug, or that healing occurred through the Divine.[266] In Hempel's approach, the result (e.g. healing) does not prove Divine intervention; however, the underlying ambiguity makes it impossible to falsify this belief.

The law of entropy, discovered in the second half of the 19th century, has demonstrated that even the most fundamental laws of physics have a probabilistic aspect. In fact, the law of entropy (also known as the second law of thermodynamics) is so fundamental that, as Arthur Eddington stated: a new theory holds a chance to still be true even if it conflicts with Maxwell's Equations or some previous experimental results, whereas it will have no chance if it contradicts the entropy law.[267] It should be noticed, however, that neither in the examples above about lung cancer, nor in the law of entropy,

266 Carl Hempel, *Aspects of Scientific Explanation and Other Essays in the Philosophy of Science*, Free Press, New York (1965), p. 394-397.

267 Arthur Eddington, *The Nature of the Physical World*, Macmillan, New York (1929), p. 74.

do we surpass the borders of determinism. In fact, according to Einstein, the biggest success of Newtonian mechanics is in its applicability to statistical mechanics (i.e. the study of macroscopic systems based on statistical behavior over a large number of microscopic particles; the entropy law and kinetic theory of gases are results of statistical mechanics).[268] In summary, 'subjective probability' in lung cancer and entropy law stems from our epistemological shortcomings. As in Polkinghorne's interpretation of the chaos theory, one may observe an appeal in making a transition from these epistemological probabilities to ontological ones.[269] In that case, ontological reality of determinist laws should be rejected, and instead, these so-called laws will be regarded as the most probable approximations to ontological realities.[270] Viewed from this angle, Hempel's 'problem of explanatory ambiguity' is actually an advantage. In my opinion, however, instead of jumping from epistemological uncertainties to ontological

268 Albert Einstein, *The Theory of Relativity and Other Essays*, MJF Books, New York (1997), p. 30.

269 John Polkinghorne, "*The Laws of Nature and the Laws of Physics*", (ed: Robert John Russell, Nancey Murphy and C. J. Isham, Quantum Cosmology and the Laws of Nature), The Center for Theology and the Natural Sciences, Berkeley (1999), p. 433.

270 This view can be reconciled with critical realism (which I also advocate). However, if one moves too far away from realism, the ontological reality of laws loses their importance and instead, the laws turn into products of the human mind, as in instrumentalism.

indeterminism (i.e. Polkinghorne's approach), it is a better alternative to defend ontological indeterminism based on the quantum theory, which scientifically advocates for 'ontological chance' (i.e. the approach of Murphy, Clayton and Tracy). [271]

On the other hand, for those who assume that probabilistic laws are related only to our epistemological shortcomings (unrelated to indeterminism), probabilistic and necessitarian approaches have the same ontological meaning. When the view of 'subjective probabilities' is adopted, God's creation of miracles would appear to conflict with the laws of nature. At this point, in order to save miracles from suspending natural laws, the Copenhagen interpretation of quantum mechanics comes to the rescue. Among all modern theories about the description of nature, 'ontological probability' occurs only in quantum mechanics. This aspect of quantum mechanics opens up an opportunity for the idea of God's determination of uncertainties, thereby creating miracles without breaking any laws. We should be aware that not every probabilistic approach has this kind of a gap; the quantum theory presents the best opportunity, as it is the sole scientific theory that fundamentally yields 'ontological indeterminism'.

271 It is possible to harmonize 'ontological indeterminism' as a philosophical and theological position, with Polkinghorne's approach.

In conclusion, philosophical approaches towards scientific theories have critical importance in the evaluation of whether miracles violate the laws of nature or not. Since regularity and instrumentalism make no strong statements about the ontological nature of laws, in these approaches the 'violation of laws' loses its significance, whereas in necessitarianism, such a violation becomes a very crucial matter, because this approach is constructed upon relying on theories as real descriptions of ontological status in nature. However, with the onset of quantum mechanics and correspondingly, objective indeterminism, it has become evident that if we were to believe in the ontological reality of scientific laws, we should also accept that 'ontological chance' (indeterminism) is a fact of the universe. The models in which God is assumed to fill the gaps (i.e. uncertainties) in the quantum world to create miracles come into play in 'ontological probabilistic' approaches. In other words, miracles can be accused of breaking the laws of nature only within necessitarianism. Many prominent thinkers, including Boyle and Mersenne, observed no problem in such a description of miracles, and even considered this violation to be consistent with their expectations from the Divine. On the other hand, for those who believe in the virtue of miracles in harmony with the reign of scientific laws;

regularity, instrumentalism, and 'ontological probability' of the quantum theory are compelling alternatives.

Miracles as Divine Action on Initial Conditions

It is generally accepted that in a deterministic universe, God would have to violate some laws in order to create miracles. This widespread assumption, often defended by necessitarians, in its essence misses a very important alternative that would allow miracles without such a violation. Despite his extensive work on miracles - often quoted in related debates - this alternative never occurs in Hume's works.[272] Here is the idea: the theistic God is 'omniscient' so that He can calculate all future consequences, of even the smallest act; therefore, he can essentially design all the future events He desires, by correspondingly setting up the required conditions at the initial creation of the universe. Even if the universe is of a determinist structure with no ontological gaps, for those who believe in the theistic doctrine of creation out of nothing, Divine intervention can take place at the very beginning, which is the starting point of existence not only of the universe, but also of the laws that govern it. Hence, Divine intervention in

272 David Hume, *An Enquiry Concerning Human Understanding*, Chapter 10.

setting up the initial conditions does not violate any laws (since they did not yet exist).

If someone rejects the idea of miracles as violation of natural laws, based on a theological motive that God does not break His own rules, he should be presupposing the following:

1- Philosophically, laws of nature are necessities.
2- The laws of nature are ontologically deterministic.
3- God does not break His own laws.

We have already seen that various objections can be brought against each one of these statements. For example, regularity is a response to the first; quantum theory to the second; and Boyle's and Swinburne's arguments[273] are responses to the third statement. More importantly, however, the idea of 'Divine action on initial conditions' constitutes a model that allows miracles as extraordinary events, even if all three presuppositions are assumed correct. Many prominent thinkers have overlooked this alternative; yet, there are some relevant discussions in the literature.[274]

273 Peter Harrison, "*Newtonian Science, Miracles, and the Laws of Nature*", Journal of the History of Ideas, no: 56-4 (1995), p. 535.

274 Michael Peterson et al. *Reason & Religious Belief*, Oxford University Press, Oxford (2012).

Now let us reconsider the stories of ancient societies, who belied their prophets and consequently were destroyed by natural calamities, as described in scriptures. According to the perspective above, God knew from the very beginning of the universe that those people would belie God's message; for this reason, He tuned the initial conditions at the Big Bang so precisely that about 13,8 billion years later, at the exact time and location, there would be natural disasters such as earthquakes and the eruption of volcanoes (which are accepted as 'miraculous' by theists).[275]

The parting of the sea for Moses can also be explained in a similar manner. Water is made of billions of billions of molecules, each moving in a random direction. Now consider an imaginary line dividing the sea across. It is possible (albeit with an extremely low probability) that all molecules on one side of this fictitious

275 There is no indication of miracles' violation of the laws of nature in any one of the Holy Texts of monotheistic religions. In the Quran, for example, the Arabic word 'ayah' denotes the miracles. The literal meaning of this word includes 'sign', 'evidence' and 'document'. The same word is used for natural and supernatural phenomena, from which one is to draw relevant conclusions. In the Quran, natural phenomena such as the blowing of the wind, the occurrence of day and night, the floating of ships on the sea etc. are described by the word 'ayah' (e.g. Surah al-Baqarah, 2:164). On the other side, extraordinary events which occurred to prophets are also described by the exact same word (e.g. Surah al-Isra, 17:101). As a result, even if the miracles are assumed to be violations of natural laws, such a conclusion cannot be derived from the Quran.

line move toward the right, and all on the other side move to the left. This kind of a motion would split up the sea, without violating any laws of physics. The reason why we do not see such events very often is not that they are forbidden by physics, but because they are extremely unlikely to happen. Someone who believes in an omnipotent God who can make any choice among many possibilities, would agree that an 'extremely low probability' does not pose a problem for the Divine. If also a believer of determinism, this person would explain the miracle as follows: God knew right from the beginning that Moses would incur the wrath of Pharaoh and his army and be cornered in front of the sea. In order to save Moses, God tuned the initial conditions at the Big Bang in such a way that at that precise moment the water is divided (e.g. via the motion of molecules as mentioned above).

This perspective of miracles is not against any physical laws, while it still confers the extraordinariness of the event (as needed for the theological interpretation). The occurrence of extremely low probabilities are, by definition, 'extraordinary'. Furthermore, as we have seen above, what distinguishes a miracle from a 'regular' extraordinary event is the fact that the former happens in a special theological-historical context. In the

example above, the miracle happened in the framework of Moses' religious mission. As a result, even though no law is violated, the extraordinariness of the event, evaluated in its historical-theological context, suffices to deem it a miracle.[276]

The picture of miracles we have just seen has some similarities with Leibniz's philosophical system.[277] These and similar ideas, however, are often confused with deism. As mentioned by Phil Dowe, this kind of identification with deism is erroneous.[278] A deist usually describes a God who creates the universe at the beginning, and never intervenes (nor has any intention of doing so) with anything that happens later. Contrary to this belief, in the picture drawn above, God intervenes in every single event of the future by deliberately adjusting the initial conditions precisely to serve His goals. Considering God's transcendence to space and time, it is not difficult for Him to make interventions at any given time, at any point in the universe. This perspective does not contradict fundamental theist doctrines.

276 In theist traditions, splitting the water by Moses is often understood literally. However, some people interpret this kind of phenomenon allegorically.

277 Leibniz, *Monadologie*, Akademia Verlag, Baden (2008).

278 Phil Dowe, "*Chance and Providence*", Science and Christian Belief, vol: 9/1 (April 1997), p. 9.

The time difference between setting up the initial conditions and continuous intervention is about 13,8 billion years (according to modern cosmology). For God, however, there is no restriction of time: since He is transcendental to time, 13,8 billion years is no different than an instant to Him. When the length of time from the beginning of the universe to our present day loses its importance, Divine action on 'initial conditions' becomes identical to Divine action as 'continuous intervention'.

Creation of Miracles by Determination of Quantum Uncertainties

Via the 'ontological indeterminism' it advocates, the Copenhagen interpretation, the most common philosophical understanding of the quantum theory, makes it possible to interpret miracles within the laws of nature, without attracting attention to an initial Divine fine tuning. According to this alternative, the determination of ontological uncertainties (gaps) in the quantum world can yield observable modifications in the macroscopic world, including the extraordinary events we call miracles. One may inquire whether molding the results of quantum mechanics with Divine action might yield the bottom-up intervention that would explain macroscopic occurrences, including miracles. First of

all, every piece of matter in the universe is made of atoms, and atoms in turn are made of electrons, protons and neutrons. As a result, an intervention on the atom is reflected on matter. Furthermore, we should recall the main tenet of chaos theory: very minute changes on the input might yield major changes on the output. Lorenz's seminal article that described the phenomenon of 'sensitive dependence on initial conditions' has also sprouted the notion of the 'butterfly effect', due to his question: *"Does the flap of a butterfly's wings in Brazil set off a tornado in Texas?"* As a result, when Divine action is molded with God's omniscience, one can interpret a major natural disaster described in the Holy Texts as a result of God's determinations at the microscopic level. Actually, prior to the formal development of the chaos theory, there had been intuitive thoughts, quite reminiscent of the idea. Consider, for example, Franklin's quote:

> *"For the want of a nail the shoe was lost,*
> *For the want of a shoe the horse was lost,*
> *For the want of a horse the rider was lost,*
> *For the want of a rider the battle was lost,*
> *For the want of a battle the kingdom was lost,*
> *And all for the want of a horseshoe-nail."*[279]

279 James Gleick, *Chaos*, p. 18.

It is important to realize that the butterfly effect as described by the chaos theory occurs in the framework of determinist laws. When the chaos theory is evaluated under the light of the indeterminism of quantum mechanics,[280] some major macroscopic events might be attributed to God's determination of uncertainties. For our purposes in this book, what matters most is the realization that a 'bottom-up' intervention can indeed make observable macroscopic modifications. The tiny building blocks of matter are in constant interactions with each other, via 'collisions'. Even in air, molecules undergo billions of collisions per second. These collisions essentially 'spread out' the modification done on one molecule. Consider a satellite orbiting around the earth, steadily performing its revolution. If its orbit deviates by one trillionth of a degree per revolution, the effect would be totally negligible on a single tour. After 180 trillion revolutions, however, the deviation would add up to such an extent that the satellite would be orbiting in exactly the opposite direction. When conscious determinations on probabilities are repeated over a very large number of times, major changes might occur in the macroscopic world. This presents a model

280 Thomas Tracy, "*Creation, Providence and Quantum Chance*", p. 257; Michael Berry, "*Chaos and the Semiclassical Limit of Quantum Mechanics*", (ed: Robert John Russell et al., Quantum Mechanics), Center for Theology and the Natural Sciences, Berkeley, (2001), p. 41-54.

to explain Divine action as conscious determination of quantum uncertainties, in order to create certain events we know as 'miracles', without trespassing beyond the borders of the laws of nature.[281]

In making the transition from the microscopic (i.e. quantum mechanical) realm to the macroscopic world, the prominent utility of physics is 'statistical mechanics'; one of the most dramatic results of this field is the law of entropy. Consider a room, filled with air. For any given molecule of air, the probability to be on a chosen half of the room is simply 1/2; for two such molecules to be on the same half, it is 1/4 and so on. If we carry on the calculation, the probability for all molecules of air to concentrate in one-half of the room becomes extremely small. Using the typical molecular speed at room temperature, it is possible to estimate that the time needed to 'expect' such a division to be 'likely' is about $10^{299,999,999,999,999,999,999,999,998}$ seconds! Add to this the fact that the estimated age of the universe is only 10^{17} seconds, one may stop worrying about suffocation as a result of such a congregation of molecules.[282] These figures also explain why we almost never observe such

281 Caner Taslaman, "*Tanri-Evren Iliskisi ve Mucize Sorunu Acisindan Determinizm, Indeterminizm ve Kuantum Teorisi*", Marmara Universitesi Ilahiyat Fakultesi Dergisi, no: 31 (2006), p. 180.

282 George Gamow, '*One, Two, Three... Infinity*', Dover Publications, Mineola (1988).

unlikely surprises (like miracles). On the other hand, if we include Divine action in the picture, as determination of quantum uncertainties to guide the directions of molecules (in other words, if we defend that the 'epistemological probabilities' in the entropy law are actually 'ontological' in nature, and God can act upon them), we can interpret many miraculous events within the laws of nature. In this interpretation, since the model system is indeterministic, there is no need to assume finely tuned initial conditions. There is ample space for intervention, not only at the very beginning of the universe, but at all times after its creation. Imagine, for example, a group of people gather to kill a prophet. If all air molecules, all of a sudden, move away from these intended killers, they would 'miraculously' suffocate to death. This event, happening via the occurrence of extremely low probabilities would certainly be deemed a miracle, while it does not violate any physical law.[283]

Now let us reconsider the miracle of Moses. Quite analogous to the imaginary example above, one might assert that God could have made all water molecules to move in such directions as to in effect split the sea. As we have previously seen, if the probabilistic motion of

283 Caner Taslaman, p. 181

molecules is assumed to be epistemological, one may associate the splitting to precisely set up initial conditions. Alternatively, if these probabilities are considered 'ontological', determination of quantum uncertainties explains 'momentary' intervention. In either picture, everything happens within the borders drawn by the laws of the nature.

Divine revelation (to prophets) is a critical element in monotheistic doctrines. There have been attempts to explain 'revelation' as 'extraordinary' events, related to the determination of quantum uncertainties. For example. George Ellis has mentioned that through interventions in quantum uncertainties, God can send revelations to any person, without breaking any natural law.[284] Likewise, God can make similar interventions in the human mind, thereby propagating His will to the human body and its surroundings.[285] Ellis grants that most people would find discomfort in this idea about revelation; nevertheless, this option cannot be falsified and completely left out, as it does not violate any physical law. Ellis uses this example to advocate that belief in

284 George Ellis, "*The Theology of the Anthropic Principle*", (ed: Robert John Russell, Nancey Murphy and C. J. Isham, Quantum Cosmology and the Laws of Nature), The Center for Theology and the Natural Sciences, Berkeley (1999), p. 390-391.

285 George Ellis, "*Ordinary and Extraordinary Divine Action: The Nexus of Interaction*", p. 389-395.

Divine revelation does not necessarily contradict 'scientific laws'.[286] He does not attempt to 'prove' the existence of Divine revelation. Instead, his goal is to show that one can be steadfast on the scientific method and results, and in the meantime, remain faithful to theological elements such as miracles and revelation.

It is worthwhile to reemphasize that our discussions above are intended to show a 'possibility'. Nowhere in the discussion is a claim that miracles do in fact occur in any particular way. A vigilant inquiry on the outcomes of natural sciences reveal these possibilities. These arguments, however, do not forbid one to adopt one of the alternative approaches (some described above) to the laws of nature and Divine action. As noticed by Philip Clayton, if we are willing to understand how Divine action and miracles can occur without violating the laws of nature, we live in the luckiest epoch since the time of Newton.[287]

Theological Agnosticism, and Deriving Ontology from Methodology

As should be clear from our discussions so far, while I greatly value the contribution quantum mechanics

286 George Ellis, "*The Theology of the Anthropic Principle*", p. 392.

287 Philip Clayton, *God and Contemporary Science*, Edinburgh University Press, Edinburgh (1997), p. 173-174.

makes to the debates on miracles; I refrain from making any assertion that would imply that a non-violative description of miracles via quantum mechanics is their mandatory explanation. Instead, I prefer to hold a stance about miracles that I call 'theological agnosticism'. My main motivation for this stance is that there is no mandatory reason to make a definite choice among existing alternatives on this matter. Moreover, the reason why I also add the term 'theological' is to specifically imply that no theological principle dictates any one of the alternatives. I advocate 'theological agnosticism'[288] as the most appropriate position, not only regarding the problem of miracles, but also about any other issue where we cannot comprehend what is meant by the Divine wisdom, and none of the alternative explanations contradict main theistic doctrines about the notion of God or tenets of religion as described in the Holy Texts.[289]

In my other studies, I have defended 'theological agnosticism' about the questions of 'dualism' (whether or

288 Please note that my use of the term 'theological agnosticism' is limited to the definition given here.

289 In order for a 'Holy Text' to gain sufficient authority, it must simultaneously be of undeniable authenticity and be a revelation of God. The question of how reliable are the authenticities of different scriptures is out of the scope of this book. However, regarding our current focus, all Holy Texts of monotheistic religions describe the occurrence of miracles as extraordinary events, whereas none of them make a clear statement about whether or not they violate the laws of nature.

not human beings are created of two 'substances');[290] as well as about the theory of evolution (whether or not God has used evolution as a method to create living species).[291] In both works, I have first scrutinized the potential rational explanations of the creation of man out of a single or double 'substance', and the creation of species separately or out of evolution. I conclude that my theological belief does not force me to choose between the two alternatives.

According to philosophical naturalism (also known as ontological naturalism, and metaphysical naturalism), there is no entity outside nature (which makes this perspective almost identical to materialism and atheism).[292] On the other hand, methodological naturalism and scientific naturalism investigates the proper methodology of science. According to this, nature should not be explained via supernatural causes - even if such causes, like the Divine, do exist. It is sometimes argued that since methodological naturalism makes no judgment about the existence of God, it is neutral to religion. However,

290 Caner Taslaman, "*Bedenin ve Ruhun Iki Ayri Cevher Olup Olmadigi Sorununa Karsi Teolojik Agnostik Tavir*", Marmara Universitesi Ilahiyat Fakultesi Dergisi, no: 33 (2007), p. 42-68.

291 Caner Taslaman, *Can a Muslim Be an Evolutionist?,* Istanbul Publishing, Istanbul, (2020); Caner Taslaman, *Evrim Teorisi Felsefe ve Tanri*, Istanbul Publishing, Istanbul (2007), Chapter 3.

292 Alvin Plantinga, "Methodological Naturalism", (ed: Jitse Van Der Meer, Facets of Faith and Science), University Press of America, Lanham (1996).

as criticized by Alvin Plantinga, this argument is not entirely correct. When methodological naturalism is a priori adopted as the proper scientific approach, the possibility of miracles is rejected without any further scrutiny. 'Divine action' by its very definition is a 'supernatural cause', so how can it be coherent with a system that includes no cause but 'natural' ones?[293] Actually, it is not difficult to comprehend that a significant portion of thinkers who reject miracles are influenced by methodological naturalism.

It is possible to generalize the above argument even further: many of the apparent conflicts between science and religion actually stem from tacit acceptance of methodological naturalism. "Scientific research must be limited to natural causes" is a methodological choice, whereas the claim "everything in nature happens by natural causes, and they are totally unrelated to anything supernatural" is an ontological one. Many people reject the existence of miracles due to the conflict with their 'naturalist' methodologies. The line of reasoning behind this can be verbalized as follows: "Supernatural phenomena cannot be included in scientific methods; therefore, miracles cannot exist as they are defined to be caused by a 'supernatural' entity." I call this fallacy 'derivation of ontology from methodology'. Ontology is

293 J. A. Cover, Miracles and (Christian) Theism, p. 344.

about what exists (along with its properties) and what doesn't exist, while methodology is about 'how to understand' existence and its properties. If our methodology does not suffice for gathering satisfactory information about something, the most appropriate stance on that particular issue would be to stay agnostic. We should keep in mind that methodology is a means to understand beings; there is no mandatory reason to reject something that we cannot discover via our methodology. The fallacy of deriving ontology from methodology is similar to using a meter stick as a method of measuring distances (a certain methodology), and when this method fails to be applicable on measuring distances to stars, claiming that such distances 'do not exist' (an ontological deduction).

One of the primary reasons behind the rejection of miracles - particularly violative ones - is the dominant paradigm[294] of our age and the methodology that is attached to this paradigm. Since there is no mandate on acceptance of this methodology, there is no corresponding ground on which to reject violative miracles. The approach of Mersenne, Boyle and Swinburne is certainly an undeniable 'possibility'; for this reason, I refrain from dictating an approach where miracles do

294 The term 'paradigm' refers to the framework of all scientific studies, corresponding premises and sociological background. For more on this concept, refer to: Thomas Kuhn, *The Structure of Scientific Revolutions*.

not violate the laws of nature. That is why I remain agnostic on the issue of 'miracles as violation of natural laws', and do not make any absolute claim about the need to use quantum mechanics to explain miracles.

On the other hand, I see no obvious reason to insist that God intervenes in the laws of nature in order to create miracles. Let's reuse the example of the sea parting for Moses: God might have created this miracle by suspending some natural laws, or without doing so (in one of the manners discussed above); whichever is the case, as far as a monotheistic believer is concerned, the event is a miracle. Consider a theist who believes that God intervenes in the laws of nature during miracles; if you ask this person: "Can God create the same miracles without suspending any law?", his response would be "Of course!", since God is omnipotent. As a result, "God can intervene in his own laws, if He wills" (as stressed by Newton and Boyle), does not mean that He actually does suspend these laws. We do not know which manner suits the Divine wisdom (while some may claim to know it, I would disagree.). This is another reason why I favor 'theological agnosticism'.[295]

295 It is noticeable that defenders of quantum uncertainties as the source of Divine action are rather prudent in their arguments. For example, Clayton specifically mentions that theological claims about the work of God needs to be in the form of 'could' not 'must'. Philip Clayton, "*Tracing The Lines: Constraint and Freedom in The Movement from Physics to Theology*", p. 234. I am much sympathetic to Clayton's suggestion here. In addition, however, I also

Let me now summarize my motivation in adopting theological agnosticism on the question of whether or not God intervenes the laws of nature when He creates miracles:

1. Under certain philosophical approaches (such as regularity) to the laws of nature, there is no such thing as 'violation of the laws of nature'.
2. Even if we assume that the universe is a closed system governed by deterministic laws, there is still a place for the creation of miracles, via God's determination of initial conditions at the very beginning. Alternatively, if one feels more comfortable with the idea of Divine intervention (suspending laws during miracles), there is no further reason to search for a model like initially determined conditions or quantum gaps.
3. One may follow scientific realism and assume that scientific laws describe the real ontological structure of the universe. In this case quantum mechanics, one of the most fundamental theories of modern science, provides opportunities for the creation of miracles without suspending the laws. The ontological indeterminism and corresponding objective probabilities described in quantum mechanics

recommend 'theological agnosticism' as the most appropriate philosophical position in the corresponding discussions.

can be filled with God, without breaking any natural laws.

4. From a theological standpoint, it can be argued that if He wishes, God can overrule the laws of nature; this, however, does not mean that He does overrule them. Likewise, God can create miracles within the laws of nature; but this does not mean that He creates them this way. Neither of these two alternatives contradict the tenets of monotheism, such as the omnipotence and omniscience of God.
5. The Holy Texts of monotheistic religions, the Old Testament, the New Testament and the Quran, unanimously describe occurrences of miracles. On the other hand, nowhere in these resources there is an indication of whether or not God suspends the laws of nature. This further supports my argument that there is no mandate on any one of the stances about the way miracles are created.

Philosophically, just as the determination of things we can know, it is equally valuable to determine things we cannot know. Furthermore, from the perspective of philosophy of religion, there is no mandate for theist believers to adopt a certain approach to the way miracles are created; the Divine wisdom behind miracles is unknowable. The agnostic stance about this matter can be formed in two different manners. In the first,

one can argue that our current level of knowledge does not allow us to make a definite judgment. According to the second, it is plainly impossible to make a definite judgment, irrespective of our level of scientific knowledge. The latter, the one I prefer, is the 'strong agnostic' stance. One can assume - as Einstein did - that further scientific developments will turn the quantum theory into a deterministic model.[296] However, as discussed above, even a most rigidly deterministic system has a place for miracles, in the form of 'initial determination' (for the non-violative model of miracles) or philosophical alternatives where there is no such thing as a 'violation of a natural law'. In other words, for someone who has faith in an omnipotent God, there will always be room for either one of the two alternatives, regardless of what new scientific developments will bring. The most fundamental divide between theism and naturalism/deism is the existence of an omnipotent God. For a theist, whether or not miracles violate the laws of nature is of relatively minor importance.

296 This is also the main reason why Polkinghorne is prudent to link Divine action and miracles to quantum uncertainties: John Polkinghorne, *Reason and Reality: The Relationship between Science and Religion*, Trinity Press International, Philadelphia (1991), p. 40-42.

CHAPTER V

THE PROBLEMS OF EVIL AND FREE WILL, AND THE QUANTUM THEORY

Description of the Chapter

The problem of evil, together with that of free will, has occupied philosophical minds for millennia. In this chapter, I will first describe the problem of evil and its relation to free will. I will then investigate the problem of free will and its relation to the quantum theory. I will investigate potential implications of quantum mechanics on these two problems, and in doing so, we shall avoid demeaning or exaggerating projections of scientific outputs. In addition to the quantum theory, I will also mention other approaches pertinent to our discussions.

In this chapter, you will find answers to the following questions: How is the problem of evil related to the problem of free will? What are the different perspectives proposed to resolve the problem of free will? Would it

be appropriate to use the problem of evil as an argument in favor of atheism? What is the most appropriate stance on the problem of evil? How can free will be reconciled with determinism? Why do the implications of the quantum theory on free will become unimportant for those who believe in soft determinism? Is it possible to reconcile a libertarian notion of free will with dualism and emergence? What is the significance of the quantum theory for the libertarian description of free will? Does free will contradict with God's omniscience? What are the significances of the Molinism and the theory of relativity on the problem of free will? Can the New Berkeleyan interpretation of the quantum theory make any contribution to the problem of free will? How is the principle of complementarity applied to the problem of evil?

How are the Problems of Evil and Free Will Related?

In the known course of history, debates about the problem of evil date back to Epicurus of ancient Greece.[297] One of the most detailed and influential discussions of

297 Timothy O'Connor, "*The Problem of Evil: Introduction*", (ed: William Lane Craig, Philosophy of Religion), Rutgers University Press, New Jersey (2002), p. 305.

the issue argued by David Hume in the 18th century.[298] Hume questioned the existence of evil on earth, despite God's omniscience, omnipotence and absolute goodness. In doing so, Hume also intended to argue that the existence of evil is incompatible with the existence of God, thereby deriving ontological conclusions to support his agnostic philosophy. A few centuries before Hume, al-Maarri and Ibnur Rawandi published their similar thoughts.[299] In the 20th century, Paul Draper and John Mackie were among prominent thinkers who handled the problem of evil in conjunction with atheism.[300] It would not be wrong to claim that the problem of evil is one of the foremost criticisms atheists and agnostics bring up against theism.

From the theist side, substantial deliberations have been targeted against these critics. Al-Farabi, for example, has argued that evil is relative and emerges as a necessary result of changes in the world; yet these changes also bring a lot of good. It would not be appropriate to abandon major goodness to avoid minor evil. Granted: rain sometimes causes floods, but the

298 David Hume, *Dialogues Concerning Natural Religion*, Penguin Classics, London (1990), p. 103-112.

299 Mehmet Aydin, Din Felsefesi, p. 156.

300 Paul Draper, "*Pain and Pleasure: An Evidential Problem for Theists*", (ed: William Lane Craig, Philosophy of Religion), Rutgers University Press, New Jersey (2002); John Mackie, "Evil and Omnipotence", Mind, no: 64 (1995).

benefit of rain well surpasses the harm it does.[301] Avicenna's perspective on evil is quite similar. He uses the example of fire: in most cases fire has great benefits for human beings, but in a few cases it leads to some evil. He also defends the general principle: "minor evil is necessary for the major good".[302]

John Hick has explained evil as a means to set up a medium in which moral advancement of mankind is possible. This medium needs to be governed by natural laws, and should allow imposing or appeasing evil. Moral advancement requires the ability to make moral choices, which in turn requires the co-existence of good and evil.[303]

To resolve the problem of evil, Muslim scholar al-Ghazali has used the idea that the universe in which we live is the most perfect one among all possible universes.[304] This argument was later adopted by Leibniz (and often identified with him). Leibniz held that God

301 Mohammad Saeedimehr, "*Islamic Philosophy and the Problem of Evil; a Philosophical Theodicy*", Intl. J. Humanities (2010) Vol. 17 (1): (127-148).

302 Jon McGinnis, *Avicenna (Great Medieval Thinkers)*, Oxford University Press, Oxford (2010).

303 John Hick, "*An Irenaean Theodicy*", (ed: Eleonore Stump and Michael J. Murray, Philosophy of Religion: Big Questions), Blackwell Publishing, Malden (1999), p. 222-227.

304 Abu Hamid Muhammad al-Ghazali (Author), Michael E. Marmura (Translator), *The Incoherence of the Philosophers,* Brigham Young University, Provo (2002).

is perfect, and He has created the universe most perfectly. However, since no universe can be as perfect as God himself, it is unavoidable to not have some evil. He has further argued that God has established an ideal balance between good and evil, and created the universe in accordance with this balance.[305]

There have been numerous other treatises on the problem of evil. The most outstanding aspect of all different perspectives is their emphasis on free will. For example, St. Augustine's discussion on this topic is known as 'free will defense'. According to this, free will is a gift from God; however, by its definition, free will can be used towards both good and evil.[306]

Even though the element of free will is common in the majority of the discussions about the problem of evil, the way it is applied to the matter varies. For example, Michael Murray emphasizes the necessity of God's hiddenness, together with the existence of free will. Had God been manifest out in the open, human beings would not have had the freedom to make willful

305 Leibniz, *Theodicy: Essays on the Goodness of God the Freedom of Men and the Origin of Evil*, Open Court, Chicago (1990).

306 Saint Augustine (Author), Thomas Williams (Translator), *On Free Choice of the Will*, Hackett Publishing, Indiana (1993).

choices. Hence, the problem of evil stems from God's hiddenness.[307]

Eleonore Stump considers God's permission on evil to be linked to the necessity of evil for human beings' realization of its destructive power. No human being alone can repair the destructiveness of free will. The only solution is seeking refuge in God. As a result, natural and moral evil have the mission of guiding us towards God, and training us to piously use our will - with the help of God.[308]

In his treatise on the problem of evil and free will, Richard Swinburne draws attention to the fact that, in order to be morally responsible, man should know the outcomes of moral actions. This knowledge is possible only in a medium reigned by law and order.[309] (The actual structure of the universe is linked to the evil in nature.) Allowing the possibility of evil in the observable world is morally acceptable, as it is needed for human

307 Michael J. Murray, "*Coercion and the Hiddenness of God*", (ed: Eleonore Stump and Michael J. Murray, Philosophy of Religion: Big Questions), Blackwell Publishing, Malden (1999), p. 241-249.

308 Eleonore Stump, "*The Problem of Evil*", Faith and Philosophy, no: 2 (October-1985), p. 392-423.

309 Nancey Murphy also maintains that an ordered and lawful structure of the universe is prerequisite for moral responsibility of man: Nancey Murphy, "*Divine Action in the Natural Order: Buridan's Ass and Schrödinger's Cat*", p. 347-348.

beings' possession of free will, as well as for other kinds of major goodness.[310]

Alvin Plantinga criticizes the exploitation of the problem of evil as a motivation for atheist ontologies. In my opinion, Plantinga's following perspective is clear: in order to refute atheist arguments on evil, there is no need to prove that the existence of God 'must' accompany the existence of evil; instead, suffice it to show that it is 'possible' for the two to coexist. Logically, if we prove that the existence of God is 'possible' together with evil, it will no longer be possible to exploit the problem of evil as grounds on which materialist-naturalist ontologies are established. A defensive approach is not only sufficient, but also more appropriate.[311] Plantinga's treatise has been quite influential and is very often quoted in contemporary debates on the problem of evil.[312]

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310 Richard Swinburne, *Providence and the Problem of Evil*, Clarendon Press, Oxford (1998), Chapter 10. For further reading on Swinburne's ideas about free will, see: Richard Swinburne, *The Evolution of the Soul*, Clarendon Press, Oxford (1997), Chapter 3.

311 Alvin Plantinga, *The Nature of Necessity*, Oxford University Press, Oxford (1979), p. 49-55, 165-168, 189-196; Alvin Plantinga, "The Probabilistic Argument from Evil", Philosophical Studies, no: 35 (1979), p. 1-53.

312 For critique of this approach, see: M. Tooley, "*Alvin Plantinga and the Argument of Evil*", Australasian Journal of Philosophy, no: 58 (1980); For Plantinga's response to Tooley, see: Alvin Plantinga, "*Tooley and Evil: A Reply*", Australasian Journal of Philosophy, no: 60 (1982).

The Problem of Evil and Ontology

So far in this chapter, we have seen an overview of different viewpoints about the problem of evil, and we have identified the place of free will in these arguments. As noted, there have been many distinct approaches to this problem. These facts are quite essential to our discussions, since we will relate the implications of the quantum theory both to the problem of evil and the problem of free will. I should emphasize that the further we move away from the concept of free will, the less will be the contribution of quantum mechanics on the problem of evil. In fact, if one considers free will entirely indifferent to the problem of evil, he would most probably see no link between the quantum theory and the problem of evil.

Moreover, evil is often categorized under 'moral evil' and 'natural evil'. Moral evil describes willful human behavior like theft, murder, dishonesty and stinginess. Natural evil, as its name implies, describes natural phenomena such as floods, fires, diseases, blindness etc.[313] The relation of moral evil to free will is evident. Though some philosophers have attempted to find one, there is no obvious connection between free will and

313 Michael Peterson et al. *Reason & Religious Belief*, Oxford University Press, Oxford (2012).

natural evil.[314] Therefore, our discussions henceforth will be concentrated on the implications of the quantum theory about moral evil.

You should also keep in mind that, while the implications of the quantum theory on the problem of evil are definitely noteworthy, they do not suffice to draw a complete picture about this matter. Such a detailed study would take a much larger volume than the book you are holding. Without going into details, I emphasize that we cannot know the motivation of Divine wisdom for the creation of evil. Avicenna's tenet "minor evil is necessary for the major good", or Saint Augustine's doctrines centered on free will might give us clues about this motivation. Notwithstanding, no humanly endeavor can precisely determine God's intentions. As a result, in my opinion, no matter what solution is adopted for the problem of evil, this limitation should never be forgotten. In fact, some thinkers, including Stephen Wykstra, prefer to construct an independent argument based on a strategy: 'remaining agnostic about the reason for evil', thereby claiming that the impossibility to understand the reason behind evil cannot be a reason to reject the existence of God.[315] Wyk-

314 Robert A. Oakes, "*God, Evil and Professor Ross*", Philosophy and Phenomenological Research, vol: 35, no: 2 (December 1974), p. 261.

315 Timothy O' Connor, "*The Problem of Evil: Introduction*", p. 314.

stra's corresponding approach is known as 'CORNEA: Condition of ReasoNable Epistemic Access'. Just because we cannot determine why there is evil, does not mean that there is no reason behind it.[316] To strengthen his argument, Wykstra draws attention to the gap between the boundless reason of God and limited human reason. In my opinion, instead of using this perspective as an independent argument, it would be best to combine it with others and establish a defensive methodology. Plantinga's viewpoint described above is an elegant example of this. In his works, when presenting defensive arguments, Plantinga often emphasizes that we cannot perfectly understand Divine intentions, and this may limit our comprehension about why there is evil.[317]

If the arguments for the existence of God are constructed independently from the problem of evil, the problem may be evaluated with a God-centered ontology, thereby the existence of 'evil' cannot be used in the name of a materialist ontology. In my opinion, from among the results of modern scientific studies, the fine tuning of the universe supports the design argument, and the Big Bang theory and the law of entropy support

316 Stephen Wykstra, "*The Humean Obstacle to Evidential Arguments from Suffering: On Avoiding the Evils of 'Appearance*", International Journal for Philosophy of Religion, no: 16 (1984).

317 Michael Peterson et al. *Reason & Religious Belief,* Oxford University Press, Oxford (2012).

the cosmological argument.[318] In addition, many people adopt a God-centered ontology via fideism. As a result, deliberations about the problem of evil boil down to whether our belief in God is epistemologically viable. The problem of evil is thus related to our entire epistemological and ontological system of thought, and it should not be discussed in isolation from this system.

The defensive approaches briefly described above, when combined with an 'offensive' against atheism, would strengthen the theistic point of view. Here, what I mean by 'offensive' is the following: while atheistic claims argue that the problem of evil is incompatible with the existence of God, it is actually atheism itself that is faced against 'the problem of good'; atheism does not provide a convincing explanation for the existence of 'goodness' in nature, whereas theism can comfortably explain this fact via God's own goodness and mercy. In the realm of living beings, we can observe countless examples of altruistic behavior. Many species of bird feed other's chicks; ants and bees sacrifice themselves for their 'communities' etc. Materialistic and atheistic philosophies face a great challenge to

318 I readily agree that this claim could cause lengthy debates. I will not further delve into such discussions in this book. However, you can refer to my other works. See for example: Caner Taslaman, *Twelve Arguments for the Existence of God*, Istanbul Publishing, Istanbul (2020).

explain how matter and natural selection (an unconscious mechanism) can give rise to altruism and similar selfless acts. In the 1960s, William Hamilton carried out extensive studies in order to explain altruism by 'kin selection', where selfless acts are assumed to augment the probability of the transfer of genes to the offspring.[319] In other words, it is argued that what we virtually perceive as 'good' and 'selfless' is nothing but a way of obtaining an advantage in the struggle for life and reproduction; as a result, in reality, these are 'selfish' acts. Richard Dawkins, one of the most renowned atheists of our time, named one of his books ('The Selfish Gene') after this idea.[320]

The interdisciplinary field of sociobiology aims to explain all sorts of behaviors in the realm of living beings (including humans) entirely in terms of biological descriptions.[321] Indeed, atheist arguments under titles like 'the selfish gene' and 'sociobiology' are mainly targeted against the design argument.[322] In addition,

319 William Hamilton, "*The Genetical Evolution of Social Behavior*", Journal of Theoretical Biology, vol: 7 (1964), p. 1-52.

320 Richard Dawkins, *The Selfish Gene*, Oxford University Press, Oxford (1989).

321 Edward O. Wilson, *In Search of Nature*, Island Press, Washington (1997). Stephen Gould argues that such approaches do not qualify to be scientific, and are rather 'just-so stories': Stephen Jay Gould, "*Sociobiology and the Theory of Natural Selection*", (ed: G. W. Barlow and J. Silverberg, Sociobiology: Beyond Nature/Nurture?), Westview Press, Colorado (1980), p. 257-269.

322 For a critique of these arguments, see: Caner Taslaman, *Evrim Teorisi, Felsefe ve Tanri*, p. 291-295, 397-401.

however, some atheists also use similar arguments as a response to 'the problem of good', where the existence of 'goodness' in nature is explained in the framework of biological laws and coincidental processes. After careful scrutiny, one would realize the failure of mechanisms like 'kin selection' to explain altruistic behavior. For example, dolphins and whales often help diseased members of their groups, a behavior that has no positive contribution to the genetic pool. When we include human beings in the picture, the examples become much more numerous. Even further, if we assume for a moment that altruistic behavior is explained by biological laws, the 'problem of good' is not resolved from the atheistic angle. As noticed by Swinburne, the remaining question is: "Why do the laws of nature exist in a way to bring about 'goodness'?"[323] Put in another statement: "How does it happen that when lifeless materials come together in certain compositions, altruistic behavior emerges in so many different life forms?" This question is not something one can easily overlook.

Our main objective here is not to use altruistic behavior as an argument to support theistic ontology. I do not put forward a statement such as: "The goodness in nature proves the existence of God". Instead, I draw

323 Richard Swinburne, *Is There a God?*, Oxford University Press, Oxford (2010).

attention to the fact that while atheist thinkers attribute the problem of evil to theism, it is actually atheism itself that encounters the problem of good. The moral of the story here should be to avoid making strong ontological judgments based on the existence of good or evil in the universe.

To wrap up our discussions so far, I argue that a proper theological or philosophical resolution to the problem of evil should include the following elements:

1. Firstly, attention should be drawn to the limits of the human mind (Wykstra's discussions follow this strategy).
2. Different approaches to free will should be included in the picture. (This is where the quantum theory would come into play.) In doing so, as exemplified by Plantinga, one should be satisfied with showing that the existence of God is not contradictory to the existence of evil in a universe created by God; there is no further need to prove that God and evil 'must' coexist.
3. When scrutinizing the problem of evil, alternative perspectives to the problem should be taken into account (e.g. Hick's emphasis on moral advancement). As mentioned above, I believe that there is no way for a human being to completely comprehend

Divine motivation; we can only conjecture. Hence, it would be of much benefit to consider as many alternatives as possible.

4. Encounter of theism with the problem of evil should be handled together with the encounter of atheism with the problem of good. This way, one would avoid ontological conclusions about the universe from good or evil.

Determinism and Free Will

After the reign of determinism dominated scientific quarters in the 17th century onward, the existence of free will has taken its part among the most heated philosophical and theological debates. The onset of quantum mechanics in the 20th century, and its indeterministic interpretation, brought about a dramatic paradigm shift, with profound consequences on these debates. Most importantly, it is no longer possible to reject free will on the grounds of scientific determinism. Understanding the relationship between determinism and free will has important implications for the problem of evil, morality, existentialism and other topics. We can investigate the relationship between determinism and free will under three categories:

1. Hard Determinism: Kant's third antinomy touches upon the conflict of free will with determinism:

Thesis: There is freedom in the world.

Proof:

1. *If there were no freedom in the world, then each state would presuppose a previous state upon which it follows according to the laws of nature.*
2. *If each state presupposes a previous state, then there is no absolute, but only a relative, beginning.*
3. *If there is only a relative beginning, then there is no sufficient cause for any event.*
4. *Nothing happens without a sufficient cause.*
5. *There is freedom in the world.*

Antithesis: There is no freedom in the world.[324]

Kant believed that 'pure reason' cannot prove freedom (or cannot resolve the antinomy above); however, his theory of morals necessitates freedom.[325] In order to resolve this dilemma, Kant distinguishes between the

324 Immanuel Kant (Author), J. M. D. Meiklejohn (Translator), *The Critique of Pure Reason*, William Benton, Chicago (1971), p. 129-159.

325 Immanuel Kant (Author), Thomas Kingsmill Abbott (Translator), *Fundamental Principles of the Metaphysics of Morals*, William Benton, Chicago (1971), p. 279-280.

distinct realms of phenomena and 'noumena':[326] Determinism is about the realm of phenomena, while 'freedom' is about the 'noumena'. For most people, however, it is not sensible to accept independent realities for these two realms. Unsatisfied with this distinction, most thinkers have chosen to resolve the incompatibility of free will with determinism by rejecting one or the other. Proponents of 'hard determinism' favor the rejection of free will.[327]

The rejection of free will has dire consequences on the problem of evil. In broader terms, it is extremely difficult to handle morality without free will (atheists and theists are faced with the same hardship on this point). Responsibility is interwoven with freedom; in order to be morally responsible, man should have the 'choice' to break moral law. Monotheistic religions equivocally teach about the world being an arena of trial, as well as about the existence of life after death; we can speak of 'trial' only if one has freedom. Despite these difficulties, certain theist denominations do reject free will.[328]

326 Kant has called the essence that constitutes the causes of observed phenomena the 'noumena': Immanuel Kant, *The Critique of Pure Reason*, p. 93-98

327 Theodore Sider, *Riddles of Existence*, (ed: Earl Conee and Theodore Sider), Oxford University Press, Oxford (2005), p. 117.

328 The Jabriyyah School in Islam is an example (we will touch upon this view later on): Majd Fakhry, *Ethical Theories in Islam*, E.J. Brill, Leiden (1990).

The earliest formal description of 'scientific determination' was done by Laplace.[329] According to Laplace, if a supreme intelligence (known as 'Laplace's daemon') knows the position and velocity of every particle in the universe at a certain time, he can calculate everything about the future and the past of the universe. Laplace advocated determinism as a scientific, not theistic, fact.[330] When the naturalist philosophy (rejection of any entity outside the universe), materialist philosophy (rejection of any substance other than matter) and Laplace's determinism are amalgamated, 'materialist destiny' comes about unavoidably, according to which the entire history of the universe is essentially determined at its very beginning. Many atheists and agnostics feel utterly uncomfortable with this kind of a determinism, as it leaves no space for free will. If every single event in the universe is predetermined and there is no escape for human beings from following the determined material destiny, what would be the justification for punishing a person who is 'predetermined' to steal?

Hard determinism is also problematic for existentialists.[331] Sartre, for example, regarded freedom as a necessary aspect of being human, and claimed that 'man

329 Stephen Hawking, *The Universe in a Nutshel*l, Bantam, New York (2001).
330 Karl R. Popper, *The Open Universe; An Argument for Indeterminism*, p. 30.
331 Ian Barbour, *Issues in Science and Religion*, p. 310.

makes himself';[332] in exact opposition to 'determinism making man'.

2. Soft Determinism: Hard determinism and the consequent rejection of free will have been vehemently attacked from various angles, including the 'substance' hypothesis where the human soul is regarded above determinism, and indeterministic interpretations of the quantum theory (we will detail this latter approach in the next section). More interestingly, however, many people reconcile free will with the idea of determinism (such methods are collectively called 'compatibilism'). In that case, the implications of quantum mechanics on the existence of free will become immaterial.

According to a 'compatibilist', in order to deem an act 'free', it is sufficient to be caused by the person's own volition; whether or not the person could have 'willed' differently does not oppose free will.[333] According to this view, the act of a prisoner forced to wash dishes is not 'free', whereas the same act done at home by someone, without being forced, is 'free'. Even if the latter had no other option due to determinism. When one says 'I have done so by my own free will', he or she means to

332 Jean Paul Sartre (Author), Hazel E. Barnes (Translator), *Being and Nothingness*, Washington Square Press, New York (1993).

333 Philip Clayton, "*Tracing the Lines: Constraint and Freedom in the Movement from Quantum Physics to Theology*", p. 221.

say that there was no external pressure on the act, not that there was no internal motivation.[334]

Theodore Sider prefers 'soft determinism' over hard determinism and libertarianism - despite certain difficulties he observes in the former. He argues in favor of his approach, and against the non-compatibility of the other two, using the following example:

"Imagine a very young boy with a serious misunderstanding of the concept of a man. This boy thinks it is part of the definition of the word 'man' that men never cry. As far as he knows, the men in his family never cry, the men on television never cry, and so on. He believes that his father is a man, of course, but one day he sees his father crying. The boy becomes very confused. Two of his beliefs now contradict: his belief that his father is a man and his belief that his father is crying. Which should he give up? Should he decide that his father is not a man after all? Or should he decide that his father was not really crying—that he was only cutting up onions, say? Obviously, he should do neither. Instead, he should clear up his conceptual confusion about the nature of manhood. Then he will see that his beliefs about his father's manhood and about his father's crying are compatible after all."[335]

334 Ian Barbour, p. 307.

335 Theodore Sider, *Riddles of Existence*, p. 126.

With this example, Sider argues that one would reach compatibilism by 'clearing up' mental misconceptions of free will.[336]

The idea of soft determinism received support from numerous renowned thinkers, including most Stoics (who regard freedom synonymous to autonomy), Thomas Hobbes and John Locke.[337] Daniel Dennett[338] and Donald Davidson[339] are famous contemporary soft determinists. Among theists and atheists, it is possible to find supporters of soft determinism, as well as hard determinism and libertarianism; the problem of free will never formed a divide between those two ontological camps (despite nuances in their interpretations).

3. Libertarianism: According to libertarianism, free will is not compatible with determinism. On the other hand, as opposed to hard determinists who reject free will, libertarians reject the idea of complete predetermination of the universe.[340] According to Descartes, determinism does not pose a threat to free will since the

336 Theodore Sider, *Riddles of Existence*, p. 127-131.

337 The Cambridge Dictionary of Philosophy, *'Free will problem'*, ed: Robert Audi, Cambridge University Press, Cambridge (1985), p. 281.

338 Daniel Dennett, *Elbow Room: The Varieties of Free Will Worth Wanting*, MIT Press, Massachusetts (1984).

339 Donald Davidson, *Essays on Actions and Events*, Clarendon Press, Oxford (1980).

340 Theodore Sider, p. 118-119.

human soul is a non-material substance, above material determinism.[341] The idea of the soul being a different substance and free will being a phenomenon 'emergent' in the human mind are alternative approaches to save free will from the chains of determinism (we will revisit this issue in the following pages).

Another way to save free will is to abandon determinism; this is where quantum mechanics comes into play as the strongest scientific grounds of 'objective indeterminism'. Libertarians deem an act 'free' if it is not determined by the conditions prior to it. If a person has a chance to act differently (under the same conditions), we can talk about freedom. Since determinism leaves no chance at all, libertarians regard indeterminism a prerequisite to free will. According to Tracy, indeterminism is necessary but not a sufficient condition of free will; one must possess, in addition, 'the capacity of self determination'.[342]

The acceptance of quantum indeterminism does not enforce a libertarian approach to free will. John Searle, for example, argues that the indeterminism of the atomic realm has no consequence on macroscopic human activities. In his arguments, Searle makes reference

341 Descartes, *Meditations*, p. 150-169.

342 Thomas Tracy, "*Creation, Providence and Quantum Chance*", p. 245-246.

to 'the law of large numbers': probabilistic behavior is smoothed out for a macroscopic system consisting of a very large number of atoms.[343] On the other hand, there is a loophole in Searle's analogy:[344] the structure of the human body is quite different from, say, a billiard ball, as the former has 'consciousness' and the ability of self-determination. Furthermore, one does not need to claim that indeterminism in the atomic realm 'magically' brings about freedom in the macro world; instead, one may conjecture that the human mind may play a role in the determination of quantum uncertainties, thereby causing a certain output among a range of possibilities.[345]

The significance of the quantum uncertainties (ontological probabilities) in the microscopic world is their potential to be determined by a mechanism related to free will. Just as God may fill quantum gaps to create miracles, the human mind can make willful choices in the same way.[346]

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343 David Ray Griffin, *Religion and Scientific Naturalism*, p. 154.

344 Our previous discussions on the combination of the chaos theory with the quantum theory refute Searle's claim. The former theory shows that a minute chance on the initial conditions can induce major changes on the output. The 'objective probabilities' of the latter theory might play the role of these 'minute changes'. Despite this conceptual agreement, however, much research is still to be done in order to figure out the details of this merger.

345 David Ray Griffin, p. 155.

346 Donald MacKay, *Science, Chance and Providence,* Oxford University Press, Oxford (1978).

Our objective here is to determine, without exaggerating or demeaning, what implications the quantum theory can have on the problems of evil and free will. The more that free will is valued in relation to the problem of evil, the more significant is the potential contribution of the quantum theory. In fact, in a deterministic approach to the universe (for example, according to Einstein's deterministic interpretation of quantum mechanics), no role is left for quantum mechanics to play on free will. This would also be the case for soft determinism and compatibility approaches to determinism and free will. On the other hand, in libertarianism, what quantum theory has to say on free will would be highly valuable. However, recall that libertarians also have other options like dualism and emergence (we will discuss these shortly). Furthermore, one should also keep in mind that references to free will occupy a significant portion of the discussions about the problem of evil; the quantum theory is the most important modern scientific result to support indeterminism against determinism, and the view on the determinism/indeterminism of the universe has paramount implications on free will. These remarks form the backbone of our consecutive discussions, in order to properly investigate the role of quantum mechanics without exaggeration.

Free Will by Dualism and Emergence

According to dualism, the human mind contains a 'substance' distinct from matter, and as a consequence, it is not bound by the laws of the physical world. Throughout the history of philosophy, there have been many supporters of dualism. Plato was a dualist and he utilized dualism in order to describe the process of learning as "nothing other than remembering what we have previously known".[347] Avicenna[348] used the 'floating man' example to illustrate dualism:

"We say anyone among us must make himself believe that it is as if he is created all at once and

as a whole , but his eyes are prevented from seeing anything external, and he is created floating in the air or a vacuum in such a way that the substance of the air does not collide with him so as to allow him to perceive; and his limbs are separate and do not meet or touch each other. He then reflects on whether he affirms the existence of his self. For he will not have a doubt in affirming the existence for his essence, yet he will not along with this affirm extremities of his limbs, nor his innards, his heart, or anything external to him..."

347 Plato (Author), David Gallop (Translator), *Phaedo*, Oxford University Press, Oxford (2009).

348 Jon McGinnis, *Avicenna (Great Medieval Thinkers)*, Oxford University Press, Oxford (2010).

Descartes' dualism is perhaps the most widely known throughout the world. When he proves his own existence by "I think so I am", he is referring to the certainty of his 'soul' (mind) as a substance distinct from his body.[349] In modern times, dualism is certainly not nearly as popular as it has once been. Nevertheless some contemporary philosophers, including Swinburne, are dualists; they argue that science falls short of explaining the properties of the mind, which is due to it being connected to a non-material substance, and that substance is also the source of consciousness and free will.[350]

For thousands of years, the overwhelming majority of theist thinkers believed in dualism. However, this fact should not be interpreted as dualism being a theological tenet, since there is no direct mention of it in any one of the Holy Texts. Joel Green has carried out a detailed etymological scrutiny of words like 'soul' in the Old and New Testaments, and concluded that no occurrence can be used as solid evidence for the existence of a distinct substance.[351] Likewise, there is no

349 Descartes, *Meditations,* p. 102-112.

350 Richard Swinburne, *The Evolution of the Soul,* Clarendon Press, Oxford (1997), p. 231-261.

351 Joel B. Green, "*Restoring the Human Person: New Testament Voices for a Wholistic and Social Anthropology*", (ed: Robert John Russell et al., Neuroscience and the Person, Vatican Observatory Publications), Vatican (2002), p. 4-5.

mention or implication of dualism in the Quran.[352] Indeed, the word 'substance' never occurs in these scriptures; the terminology entered into the Jewish, Christian and Muslim schools via the influence of ancient Greek philosophers.[353] As a result, there is no mandate on belief in dualism in any of the monotheistic religions.

At this point, it would be worthwhile to make some remarks on 'scientism', a naive application of science in unwarranted situations, supposedly to explain everything about objects and reality. 'Reductionism' is one of 'scientism's' primary methods.[354] The climax of materialist-scientism would be to explain all known phenomena via reduction to the smallest building blocks of matter.[355] Our mental experiences can be reduced to the interactions of neurons, neurons to cellular reactions and eventually cells to atoms and molecules. Recall that dualism is often motivated by the irreducibility of human mind and consciousness to material processes. On the other hand, dualism is not the only

352 Turan Koc, *Olumsuzluk Dusuncesi*, Iz, Istanbul (2005), p. 42.

353 Ian Barbour, *Nature*, Human Nature and God, SPCK, London (2002).

354 The term 'scientism' refers to the application of science (most commonly physical sciences) as the sole means to obtain knowledge, even in unwarranted situations not covered by scientific methods. 'Reductionism' is one of the most common approaches of scientism; it has been heavily criticized by scientists from many disciplines including anthropology and sociology, where reductionism is deemed unacceptable.

355 Francis Crick, *Astonishing Hypothesis: The Scientific Search for the Soul*, Scribner (1995).

option for those who believe in the irreducibility of the mind: alternatively, one can argue that the human mind is 'emergent'.[356] The main assumption behind emergence is that the whole is more than its pieces, and hence cannot be explained by its constituents.[357] According to emergence, the mind is not a blend of two substances (i.e. dualism); nor it can be reduced to material processes (i.e. reductionism). As we have seen earlier, quantum mechanics poses a serious threat to reductionism and its aim to explain everything by the building blocks of matter.[358] The Pauli Exclusion Principle, one of the most striking components of the quantum theory, dictates that when two electrons come together, they are 'more' than two independent electrons. This principle, together with quantum phenomena such as entanglement and non-locality, are supportive of holistic epidemiologies, as opposed to reductionism. This is another critical aspect of quantum mechanics, regarding the problem of free will. The role of quantum mechanics here is rather indirect; its results negate reductionism and support holism, and holism supports the idea of

356 Warren S. Brown, "*Conclusion: Reconciling Scientific and Biblical Portraits of Human Nature*", (ed: Warren S. Brown, Nancey Murphy and H. Newton Malony, Whatever Happened to the Soul?), Fortress Press, Minneapolis (1998), p. 216.

357 Ian Barbour, *Issues in Science and Religion*, p. 326.

358 Ian Barbour, *Religion in an Age of Science,* p. 104-106.

emergence as a mechanism to explain how the human mind supports free will, independent of determinism.

In addition to its failure at the quantum level, reductionism also faces hardship in its very first step: reducing mental processes to the interactions of neurons.[359] Emergentists argue that the human mind contains certain elements not contained in its constituents. According to a similar perspective called 'non-reductive physicalism', the human mind cannot be reduced to material processes and laws, and while it is not made of two distinct substances, it has two distinct appearances.[360] In either case, there is ample space for free will without dualism, even if the universe is assumed to be of deterministic structure: the human mind cannot be reduced to material laws, hence it contains certain aspects those laws cannot describe. [361]

As we have seen, some proponents of libertarianism advocate the independence of the human mind from

359 I present my detailed views on this in the following article: Caner Taslaman, "*Bedenin ve Ruhun Iki Ayri Cevher Olup Olmadigi Sorununa Karsi Teolojik Agnostik Tavir*", p. 48-53.

360 Malcolm Jeeves, "*Brain, Mind and Behavior*", (Warren S. Brown, Nancey Murphy and H. Newton Malony, Whatever Happened to the Soul?), Fortress Press, Minneapolis (1998), p. 89; Nancey Murphy, "*Human Nature: Historical, Scientific and Religious Issues*", (Warren S. Brown, Nancey Murphy and H. Newton Malony, *Whatever Happened to the Soul?*, Fortress Press, Minneapolis (1998), p. 1-2.

361 Warren S. Brown, p. 215.

deterministic laws, via dualism or emergence, thereby opening up room for free will. As a result, these perspectives do not need much contribution from the indeterminist interpretation of quantum mechanics. In other words, dualism and emergence are further options for libertarian defenders of free will, who do not feel comfortable with quantum mechanical evaluations. Today, many libertarian theologians and philosophers follow one of these alternative approaches to free will.

Ideas on Quantum Mechanics and Free Will

So far in this book, on numerous occasions we have seen that many alternative views exist for scientific interpretations of quantum mechanics, as well for to its implications on Divine action. These alternatives are also critical for the evaluations on the problem of free will. Einstein's deterministic interpretation of quantum mechanics will have no further contribution to free will, other than what is already told by classical determinists. This would also be the case for those (e.g. Searle) who consider quantum indeterminism to be constrained to the microscopic realm, with no observable consequences on the macroscopic world, including the human brain.[362] Regarding the problem of free

362 David Ray Griffin, *Religion and Scientific Naturalism*, p. 154-155.

will, classical determinism and quantum indeterminism constrained to the micro world would yield essentially the same options. If we recall from previous pages, these options are: hard determinism and the rejection of free will; soft determinism and its compatibility with free will; assuming independence of the human mind from deterministic laws (dualism or emergence); and finally, staying agnostic on the matter.

We have seen similar interpretations when we have discussed Divine action in relation to quantum indeterminism. Pollard, for example, holds that God determines all quantum uncertainties.[363] These approaches replace 'theological determinism' with 'scientific determinism'; they can be useful in the reconciliation of Divine action with the laws of nature, while they do not resolve the problem of free will. As opposed to Pollard's views, Robert John Russell argues that God determines all uncertainties, up to the emergence of consciousness,[364] and afterwards, leaves the uncertainties to be filled by human volition.[365] God imposes some kind of 'self-limitation' on Himself, in order to

363 William Pollard, *Chance and Providence: God's Action in a World Governed by Scientific Law,* p. 114.

364 Robert John Russell, "*Special Providence and Genetic Mutation: A New Defense of Theistic Evolution*", p. 258.

365 Robert John Russell, "*Divine Action and Quantum Mechanics: A Fresh Assessment*", p. 318.

allow human beings make willful choices among different options. The idea of self-limitation appears quite often in the philosophical discussions about the problem of evil; many renowned thinkers including Keith Ward, Hick, Murphy, Ellis and Barbour emphasize the importance of this idea.[366] From these perspectives, in order to retain the omniscience of God, it is stressed that the limitation is voluntarily self-imposed by God on Himself. Human free will and moral responsibility are explained via this assumption.

According to Tracy[367] and Clayton,[368] God only determines a small portion of quantum uncertainties, while the rest might form the playground for free will. The importance of quantum mechanics in this case is its theoretical support for 'objective probabilities'. Tracy also focuses on difficulties brought about by 'theological determinism' regarding the problem of evil.[369] (While this is the case for libertarianism, compatibilism would be immune to attacks from theological or scientific determinism.) Like Tracy, Clayton also realizes the significance of the quantum theory for the problem of evil, whereas he also points out that the

366 Ian Barbour, *When Science Meets Religion*, p. 168-169.

367 Thomas F. Tracy, "*Particular Providence and the God of the Gaps*", p. 292-294.

368 Philip Clayton, "*Tracing the Lines: Constraint and Freedom in the Movement from Physics to Theology*", p. 212-215.

369 Thomas Tracy, "*Creation, Providence and Quantum Chance*", p. 247.

existence of indeterminism is not sufficient: its corresponding influence on the level of the brain is the key to resolving the dilemma.[370]

Roger Penrose, one of the most influential physicists alive, agrees that quantum mechanics can have strong implications on understanding certain aspects of the human mind (such as consciousness), and shed light on the problem of free will.[371] George Ellis is the lead philosopher who amalgamated the issues of the human mind, Divine action and the quantum theory. Ellis defends that God may act upon the human mind via the determination of quantum uncertainties, thereby explaining the way in which revelations and miracles occur, without violating any physical laws.[372] Ellis attributes a special importance to a 'top-down' action of the human mind on the body, in understanding the aspects of the mind.[373] As opposed to Searle, Ellis believes in the importance of quantum uncertainties on

370 Philip Clayton, "*Tracing the Lines: Constraint and Freedom in the Movement from Quantum Physics to Theology*", p. 222-223.

371 Roger Penrose, *The Large, the Small and the Human Mind*, Cambridge University Press, Cambridge (2000). Penrose is a long-time advocate of the quantum theory being incomplete, and argues for the need for revolutionary new theories.

372 George Ellis, "*The Theology of the Anthropic Principle*", p. 390-391.

373 George Ellis, "*Quantum Theory and the Macroscopic World*", (ed: Robert John Russell et al, Quantum Mechanics), Center for Theology and the Natural Sciences, Berkeley (2001), p. 264-269; George Ellis, "*Ordinary and Extraordinary Divine Action: The Nexus of Interaction*", p. 374-375.

the level of the brain, and argues that the brain further augments the effects of uncertainties. Furthermore, God communicates with people through these gaps.[374]

Perspectives like Penrose's and Ellis' on the importance of quantum uncertainties on the level of the brain/mind have crucial implications on the problem of free will. According to libertarianism, uncertainties must not be constrained to the subatomic world, so that under the same conditions, people can make different choices via mental reasoning.[375] In order to support libertarianism with the quantum theory, one should make a transition from objective probabilities in the microscopic world to those inside the human mind. While Ellis' angle has some appeal in explanation of theological concepts like revelation, it bears difficulties related to 'theological determinism'.[376] This is another place where quantum uncertainties come to the rescue: these gaps can be filled by God when He communicates with mankind via revelations or similar

374 George Ellis, "*Ordinary and Extraordinary Divine Action: The Nexus of Interaction*", p. 389-390.

375 It is possible to unite 'quantum indeterminism' as a mechanism that governs irreducible aspects of the mind (such as free will and consciousness), with the 'emergence' picture. Such a unification also facilitates the libertarian approach to free will. Indeed, some philosophers follow a similar route and in addition to the scientific indeterminism and quantum theory, they also stress the irreducible aspects of the human brain.

376 Robert Russell, "*Divine Action and Quantum Mechanics: A Fresh Assessment*", p. 318.

kinds of religious experience, as well as by man himself in making decisions by volition.

In summary, the problem of free will boils down to three determinations: by the Divine, by the laws of nature and by human free will. Objective probabilities within the laws of nature, as revealed by quantum mechanics, present opportunities to understand Divine action without any violation of those laws. Likewise, in the same manner, space is opened up for the action of human free will, without constriction by determinism. On the other hand, the line between Divine action and human free will cannot be drawn by the quantum theory; this is rather a theological matter, indeed a crucial one. Philosophical scrutiny of this matter extends to everlasting theist debates on whether the omniscience of God conflicts with human free will.

The Omniscience of God and Free Will

Belief in a 'perfect' God is a fundamental tenet of theism. The perfectness of God necessitates His omniscience. His knowledge encompasses the future, as well as the past, the former bearing most of the debates about free will. How can God's knowledge of the future be reconciled with free will? If God knew in advance

everything we are going to do, why are we responsible for our actions?[377]

Most theist doctrines reconcile God's knowledge of the future with free will, through a variety of interpretations. In the Muslim world, for example, the 'Jabriyyah' (compulsionism) school finds resolution of the dilemma in the rejection of free will. God's omniscience is synonymous to Him being the only actor behind every event, and hence, there is no such thing as free will.[378] On the other edge of the spectrum of thoughts is the rejection of God's knowledge of the future. Alfred North Whitehead maintains that God knows all probabilities about the future, but not the actual outcomes.[379] Whitefield's ideas have been influential on many philosophers and theologians. In a somewhat similar manner, 'open theism' attributes omnipotence to God, whereas it maintains that He does not know the future, though this is not a deficiency for God. The future is ontologically uncertain, and 'perfection' does not require knowing the uncertain.[380]

377 M. W. F. Stone, "*Philosophical Theology*", (ed: A. C. Grayling, Philosophy 2), Oxford University Press, Oxford (1998), p. 316.

378 One of the most eminent scholars of 'Jabriyyah' school was Jahm ibd Safwan. According to him, any human action is no different than the chute of a stone or the flow of water.

379 Mohammad Saeedimehr, "*Islamic Philosophy and the Problem of Evil; a Philosophical Theodicy*", Intl. J. Humanities (2010) Vol. 17 (1): (127-148).

380 Michael Peterson et al., p. 234-237.

Peacocke believes that while quantum uncertainties are fixed by God during Divine action, He deliberately leaves some of these gaps unfilled, in order to allow free will. God has chosen to constrict Himself and left the future undetermined and unknown.[381] The future has no ontological status, and therefore, God can only know the possibilities about the future. Peacocke harmonizes these ideas with the theist notion of an active and omnipotent God, by asserting that God voluntarily chooses to leave certain things to humans and logically the future cannot be known.[382] In order to create humans with the ability to make free choices, God created nature with a 'flexible' and open structure.[383] In the Muslim world, ideas akin to Peacocke's can be found in medieval thinkers Hisham ibn-al-Hakam and Hossain al-Basri. According to these thinkers, God knows the reality and essence of matter from eternity (similar to Peacocke's and Whitehead's assertions that God knows all future probabilities), whereas He knows the events only after they occur, since they were 'nothing'

381 Arthur R. Peacocke, "*God's Interaction with the World*", p. 279.

382 Arthur R. Peacocke, "*Biological Evolution - A Positive Theological Appraisal*", (ed: Robert John Russell, William R. Stoeger and Francisco J. Ayala, Evolutionary and Molecular Biology), Center for Theology and the Natural Sciences, Berkeley (1998), p. 368; Arthur R. Peacocke, "God's Interaction with the World", p. 280.

383 Arthur R. Peacocke, "*God's Interaction with the World*", p. 281.

beforehand, and it is absurd to 'know' something that does not yet exist.

The assertion of God's not knowing the future must be accompanied by some form of indeterminism, since determinism allows for complete knowledge of the future from the past. According to the chaos theory, inside a deterministic universe even a 'supreme intelligence' (e.g. "Laplace's demon') cannot predict the future. Recall, however, that this limitation is epistemological; it does not imply ontological unknowability of the future. If the future is ontologically determined, an omniscient God must know it. The Theistic notion of God is not that of a 'supreme intelligence' in the role of merely a passive observer. Instead, He is the creator of the universe, together with all phenomena in it. This theist doctrine contradicts God's inability to know a determined future due to epistemological shortcomings. On the other hand, for those who believe in dualism or emergence, or an indeterministic interpretation of quantum mechanics, 'ontological uncertainties' can exist in the universe. The only way to argue that God (of theism) does not know the future is to grant that the future is ontologically undetermined. Furthermore, in this kind of an uncertain future, God should not determine all possibilities, but leave freedom to human

volition. In other words, scientific determinism, as well as theological determinism, implies that the future must be known to God. The following point deserves particular attention: the rejection of scientific and theological determinism is necessary, but not a sufficient condition to also reject God's knowledge of the future. In fact, a very broad spectrum of theological opinions can be found in the literature about God's complete knowledge of the future being compatible with Him allowing humankind to make choices of their own will, in areas outside determinism (for example, by quantum uncertainties or dualism). Free will - independent of scientific and theological determinism - does not conflict with God's complete knowledge of the future. I am highly lenient towards this opinion.

Peacocke's libertarianism sacrifices God's knowledge of the future, in order to make room for free will. To the contrary, soft determinists reconcile free will with scientific determinism, and they would comfortably do so for theistic determinism. Those who blend compatibilism with theism tent to criticize libertarianism, as the latter interprets free will to take place via phenomena totally independent of God, which is incompatible with God's complete reign of the universe.[384]

384 John Byl, "*Indeterminacy, Divine Action and Human Freedom*", Science and Christian Belief, vol: 15/2 (October 2003), p. 114.

Moreover, the libertarian interpretation of free will via indeterminism randomizes our actions and negates human responsibility; this is another reason for compatibilist-theists to oppose libertarianism.[385] A compatibilist-theist feels no discomfort about simultaneously believing in God's knowledge of the future, theological determinism, and the existence of free will.

Many libertarian and soft determinist philosophers and theologians defend that God's complete knowledge of the future is compatible with human free will. In the Islamic terminology, God's eternal knowledge is reconciled with human freedom and moral responsibility via the motto: "knowledge is dependent on the thing known".[386] From this perspective, God knows things in the future because they will happen, whereas God's knowledge does not determine what will take place.[387] The majority of Muslim schools reconcile God's complete knowledge of the future with human free will and moral responsibility. On the other hand, it is rather difficult to determine whether the statement "knowledge is dependent on the thing known" is libertarian or soft determinist. A similar hardship is also appar-

385 John Byl, p. 112-113.

386 This concept is interpreted in many distinct ways, by different philosophers (we shall not delve into this issue here).

387 Keep in mind that there is no consensus on this interpretation.

ent for Thomas Aquinas' discussions (he believed in free will, together with God's knowledge of the future): in his writings on this matter, one can find traces of both libertarianism and soft determinism.[388] According to Kevin Staley, Aquinas defends both views, but at the same time evades the problems within them.[389] As with the Muslim world, the majority of Christian theologians simultaneously believe in free will and God's knowledge of the future, albeit with a wide spectrum of interpretations.[390]

This variance within the theist thoughts on the matter of free will and God's omniscience is something notable. For example, the views of Aquinas on this issue differ from those of William of Ockham. Without discussing these differences in depth, let us consider the following views of Jesuit priest Luis de Molina: the knowledge of God preceding His creation of the world and humans (with free will) is 'natural knowledge', which encompasses all future probabilities. God, in addition, possesses 'free knowledge', by which He knows what will happen when He creates beings with free will. Most importantly (and this is where the novelty

388 Kevin M. Staley, "*Aquinas: Compatibilist or Libertarian*", The Saint Anselm Journal, no: 2-2 (Spring 2005), p. 73-75.

389 Kevin M. Staley, p. 78.

390 William Lane Craig, *The Problem of Divine Foreknowledge and Future Contingents from Aristotle to Suarez*, Brill, Leiden (1988).

of de Molina's ideas lies), however, God also possesses 'middle knowledge',[391] through which He knows what choices will be made by every single willful being even if they were not created.[392] On the grounds of His middle knowledge, He chooses to create certain willful beings under certain conditions, among infinite possibilities.[393] He further knows all future events via His free knowledge. According to Molinism, God has granted free will to humans (in a libertarian sense) and in doing so, He has not taken any 'risk'.

Molinism reconciles the theist requirement of a 'perfect' and omniscient God with the libertarian interpretation of free will.[394] I also support the belief that God's supreme knowledge requires that He knows what anybody would do in any kind of circumstance. As a result, as rightly noted in Molinism, the notion of a 'perfect' God necessitates 'middle knowledge'. Any claim as to otherwise would conflict with the idea of 'perfectness'. In addition, Molinism quite successfully demonstrates that there is no need to reject the classical theistic belief

391 Luis de Molina (Author), Alfred J. Freddoso (Translator) *On Divine Foreknowledge,* Cornell University Press, Ithaca (2004).

392 This type of knowledge is sometimes referred to as 'counterfactual knowledge'.

393 William Lane Craig, "*The Coherence of Theism: Introduction*", (ed: William Lane Craig, Philosophy of Religion), Rutgers University Press, New Brunswick (2002), p. 204.

394 Since Molinism encompasses all these critical aspects, some thinkers consider it to be the most appropriate approach to the problem of free will.

that 'God knows the future' in order to make room for human free will.

On the other hand, no theist or atheist system of thought presents a completely satisfying description of what will is and how it works. As noticed by Searle, our states of mind are 'first-person ontologies', and hence, they are subjective. Our subjectivity cannot be the object of any external observation or scientific study.[395] Will is about the mind; with common sense, we do not doubt its existence; we feels its existence as 'first-person ontology'. Despite these feelings, we cannot make our will the subject of any scientific endeavor, nor can we make a complete description of what it is (this is similar to the perception of 'color'). Therefore, we should keep in mind that all discussions about free will are made without a satisfactory understanding of it. I believe that there is no way, from either atheistic or from theistic viewpoints, to reach a complete description of free will. In fact, no theist approach is able to explain how to draw the line between the will of God and human free will, or how much 'freedom' a human being can possess, considering that his or her whole existence is entirely determined by God. On the side of atheism, there is a profound difficulty in understanding how

395 John R. Searle, *Mind: A Brief Introduction*, Oxford University Press, Oxford (2005). We experience the states of our own mind; however, we cannot comprehend what it is to see 'red' or to 'wish' to raise a hand.

much freedom the will can exhibit, even though it is determined by materials and laws independent from itself. Regarding the theist approaches, I am inclined to favor 'defensive' methods, rather than 'explanations'. A theist should grant a priori that the problem of free will is unsolvable; in the meantime, the same problem also holds for atheism, and hence, it cannot be exploited against theism. In fact, hard deterministic, soft deterministic and libertarian approaches are advocated by many theists and atheists, through a myriad of interpretations. Had there been a clear distinction between definitions of free will in theism and atheism, there would have been more segregation. As Polkinghorne maintains, even though modern science has shaken the idea of a universe functioning like a mechanical watch, science alone cannot resolve the problem of free will, as it is primarily metaphysical and about metaphysical choices.[396]

Why is the Problem of Free Will Unsolvable?

Even though modern science is unable to answer many questions related to free will and God's omniscience, certain scientific findings present vital clues for understanding why the problem is an unsolvable

396 John Polkinghorne, *Science and Theology*, p. 58.

one. The concept of 'time' has a central role in understanding the relationship between God's omniscience and free will. In a more general sense, in order to properly understand the relationship between God and the universe, we should understand the relationship between God and the concept of time. We are faced with two alternatives here: in the first, God is the creator of time and thus transcendental to it; God does not perceive time like we do; concepts like 'past' and 'future' do not apply to Him. In the second, God's eternity is understood as His existence since negative infinity in time, and thus He is not transcendental to time.[397] Our choice between these two options would depend on our understanding of the nature of time. Scientific developments in the 20th century have dramatically shaken long-held presumptions about time. In particular, Einstein's theory of relativity has shown that time is not an absolute quantity, and depends on relative motion of observers, as well as on gravity.[398] These findings appear to be more compatible with the idea of a 'transcendental God', advocated by many thinkers including Plato, Plotinus, Boethius, Anselm and Aquinas.[399] According to St. Augustine, when one realizes that time itself is

397 M. W. F. Stone, "*Philosophical Theology*", p. 312-313.

398 Stephen Hawking, *A Brief History of Time*, Bantam, New York (1998).

399 William Lane Craig, *The Coherence of Theism: Introduction*, p. 206.

created by God, questions like "What was God doing before He created the universe?" would be resolved by themselves. Before the scientific discovery of the relativity of time, St. Augustine expressed his philosophical thoughts on why time must be relative. Similar philosophical arguments have also been laid out by Muslim thinkers al-Kindi[400] and al-Ghazali.[401] Since time is woven into the fabric of the universe, it would be rational to expect that a transcendental God should be above time, as well as space.[402]

Once God's transcendentality to time is accepted, one would realize the loophole in the interpretation of God's knowledge of the 'future' as something He possessed in the 'past'. Instead, God knows all components of time from above time itself, like a photographer looking at a sequence of frames on a film. Aquinas' example to show the compatibility of God's omniscience with human free will is somewhat analogous: a traveler in the middle of a caravan does not

400 Peter E. Pormann and Peter Adamson, *The Philosophical Works of al-Kindi*, Oxford University Press, Oxford (2012).

401 Abu Hamid Muhammad al-Ghazali (Author), Michael E. Marmura (Translator), T*he Incoherence of the Philosophers*, Brigham Young University, Provo (2002).

402 The theory of relativity does not terminate the debates on the transcendentality of God. Nevertheless, after the formulation of this theory, it has become more rational to argue that God should not be bound by such a time that depends on the state of observer.

see who is in the lead or at the back, whereas someone watching the caravan from above a hilltop would simultaneously see every traveler. Similarly, God knows the past, present and future, from outside time. Aquinas' approach is also applicable to the problems related to fatalism, as well as the perfectness and immutability of God.[403] Since the operation of our minds is bound to the concept of time, we are unable to comprehend what is it like being outside time, and how a timeless being can act upon a temporal universe and simultaneously 'know' the past and future. Even though Aquinas' approach does not resolve the problem of free will by itself, it yields important clues about the roots of certain misunderstandings, and explains why we are unable to perfectly understand how free will complies with God's omniscience. Molinism's notion of middle knowledge, combined with God's transcendentality, would yield the most appropriate approach to free will - although it does not resolve the problem entirely.

As with the problem of miracles, I prefer to remain agnostic on certain matters related to free will. First of all, a theist should remain steadfast on their fundamental belief in God's perfect knowledge of everything in the past and the future. Furthermore, as noted by de

403 Ian Barbour, *Issues in Science and Religion*, p. 427

Molina, this kind of knowledge encompasses not only what will happen, but also all probable events. God's knowledge of how people would act in alternative probabilities is compatible with the general theist notion of God. In addition, even though some theist thinkers and schools adopt hard determinism, in my opinion, it must be abandoned in any theist system which teaches moral responsibility. Regarding compatibilism and libertarianism, however, I am inclined to remain agnostic. Scientific determinism does not pose a threat to libertarianism; none of its options (quantum theory, dualism, emergentism, Molinism etc.) conflict with God's omniscience. These options, however, have no consequence about how to draw the line between theological determinism and human free will.[404] For this reason, the most appropriate choice between libertarianism and compatibilism is to remain agnostic, and confess that 'we do not know' the answer. A theist would readily agree with the statement "God is free to make anything via His volition, and He is also able to grant human beings a somewhat similar capacity of free will"; whereas since we cannot totally comprehend the aspect of free will and the Divine motivation behind it, it is best to remain agnostic on these matters.

404 M. W. F. Stone, p. 312-325; William Lane Craig, p. 205-214.

The Role of Observer, The Principle of Complementarity and Free Will

According to indeterminist interpretations of quantum mechanics, 'objective probabilities' are everywhere in the universe, including the human brain. In the libertarian approach, these probabilities make the perfect candidate for the main mechanism behind volition. As a result, this most fundamental theory of modern physics comes to the rescue of free will, against the threat of hard determinism. This is the most important implication of the quantum theory on the problem of free will; we have dedicated previous pages to related discussions. Likewise, we have seen that quantum mechanics supports holism against reductionism, and the former is in harmony with 'emergence' approaches to free will. In this last section of our discussion, we will briefly see two further points (even though I do not regard them to be of fundamental importance) in which quantum mechanics cross the problem of free will.

In the above discussions about the principle of complementarity, we have seen that this principle, together with quantum phenomena, like non-locality and collapse of wavefunction, is exploited to develop New-Berkeleyan approaches. According to these, the effect of the observer on the observed is not only due to

physical, but also 'mental action'.[405] In Schroedinger's formalism of quantum mechanics, the state of a particle is described as a superposition of wavefunctions related to different probabilities; when a measurement is performed on the particle, the wavefunction 'collapses' to a definite state among possible ones. In the New-Berkeleyan view, what causes the collapse of the wavefunction is not a 'physical touch' but a determining action of the mind.[406] If the mind is capable of affecting matter, hard determinism is no longer possible and there is room for free will in the libertarian sense.[407]

George Bishop is a prominent New-Berkeleyan. Bishop regards God as a 'universal observer': every single quantum event is a creation of God via His observation; God is a 'transcendental observer' of the universe. Chiao replaces the effect of the human mind on the observer with 'God's mind', thereby extending the Divine action throughout the entire space-time.[408]

The radical change in the epistemological role of the observer, brought about by quantum mechanics,

405 John von Neumann, *Mathematical Foundations of Quantum Mechanics*, Princeton University Press, Princeton (1955); Eugene Wigner, *The Scientist Speculates*, Heinemann, London (1961).

406 Jeremy Butterfield, "*Some Worlds of Quantum Theory*", (ed: Robert John Russell et al, Quantum Mechanics), Center for the Theology and the Natural Sciences, Berkeley (2001), p. 122.

407 Raymond Y. Chiao, "*Quantum Nonlocalities: Experimental Evidence*", p. 37.

408 Raymond Y. Chiao, p. 38.

has given way to eccentric ideas such as an enhanced ontological status of the mind creating free will, or association of God's creation to His 'observations'. Even further, there have been claims that the universe first existed as a 'quantum potential' and the universe as we know it was created via 'initial observation'. Although these ideas may seem bizarre, they have occasionally been bolstered by prominent scientists, including John Wheeler (he coined the term 'black hole' and made important contributions to nuclear physics).[409] John Cramer argues that the future can affect the past: when we observe a star one hundred light years away,[410] we create an effect one hundred years back in time.[411] These, and similar approaches, are against our common sense, as well as causality. In some ways, they are similar to Ockham's ideas about God's omniscience and free will. According to this angle, free will can change the past and this is not regarded to conflict with God's omniscience.[412]

409 Philip Clayton, "*Tracing the Lines: Constraint and Freedom in the Movement from Quantum Physics to Theology*", p. 218.

410 Since the speed of light is finite (about 300.000 kilometers per second), when we 'see' a star one billion light years away, we actually observe the state of the star as it was one billion years ago.

411 John Cramer, "*The Transactional Interpretation of Quantum Mechanics*", International Journal of Theoretical Physics, no: 27 (1988).

412 Alvin Plantinga, "*On Ockham's Way Out*" (ed: Eleonore Stump and Michael J. Murray, Philosophy of Religion: Big Questions), Blackwell Publishing, Malden (1999).

In my opinion, these approaches and their relatives largely exaggerate the epistemological role of the observer described by quantum mechanics. As Polkinghorne has nicely stated, it is important to make a distinction between the 'role of observer' and 'creation by observer'.[413] It is true that quantum mechanics ascribes an augmented role to the observer, but this in no way implies any form of creation.[414]

We should keep in mind that claims about the creative action of the observer primarily stem from misinterpretation of the terminology 'collapse of wavefunction'. Some scientists hope that future developments will shed more light on the 'role of observer'.[415] Even though we do not perfectly understand this phenomenon, there is no such implication as the 'creative action of an observing mind'. One can record the results of quantum mechanical experiments on a computer disk, and print out the data many years later. In this case, the mind will have learned about the outcomes of the experiments from the printouts; there is no rational reason to expect that such an observation would affect experiments many years in the past.[416] As main-

413 John Polkinghorne, *Science and Theology*, p. 34.

414 Arlen J. Hansen, "*The Dice of God: Einstein, Heisenberg, and Robert Coover*", p. 50.

415 Philip Clayton, p. 219.

416 John Polkinghorne, "*The Quantum World*", p. 337.

tained by Barbour, what determines the collapse of wavefunction is the interaction between the equipment and the particle at quantum level; the human mind has no role therein.[417] Though I will not further delve into shortcomings of Berkeleyan interpretations, for our purpose suffice it notice that exploiting the collapse of wavefunction in support of Berkeleyan idealism is too much of an exaggeration, and quite an improper one. Berkeleyan idealism has neither gained nor lost anything by the onset of quantum mechanics. There is no reason to expect contributions from New Berkeleyan views on the problem of free will, based on the inclusion of quantum mechanical discussions.

Some philosophers attempt to apply the principle of complementarity to the problem of free will, using the following analogy: according to this principle of quantum mechanics, the wave-like and particle-like behavior of a particle is not contradictory but complementary. Analogously, theological/scientific determinism and free will are complementary concepts, even though they appear to conflict. We have previously seen that Pollard supports the view that all quantum gaps are filled by God; in order to reconcile the resulting theological

417 Ian Barbour, *When Science Meets Religion*, p. 80.

determinism with free will, he has found a rescue in the analogy just mentioned.[418]

Niels Bohr, the founding father of the principle of complementarity, mentioned that it is possible to use analogous ideas in other domains, where seemingly contradictory concepts are indeed complementary.[419] This pathway has been followed by many. These thinkers argue that our way of using logic prevents us from solving these dilemmas. Werner Heisenberg (inventor of the uncertainty principle) suggested that quantum mechanics requires abandoning the logical 'law of noncontradiction'.[420] Furthermore, many philosophers argue that quantum mechanics requires a new set of logical rules, which would be called 'the quantum logic'.[421] The principle of complementarity is based on experimental observations; on certain occasions, a particle demonstrates wave behavior and in another, particle behavior; these observations are interpreted that 'seemingly contradictory' properties, such as being a wave or particle, are in fact complementary. On the other hand, when the principle is applied to the

418 William Pollard, *Chance and Providence: God's Action in a World Governed by Scientific Law*, p. 137-141.

419 Abraham Pais, *Niels Bohr's Times: In Physics, Philosophy and Polity*, Clarendon Press, Oxford (1991), p. 440-445.

420 Werner Heisenberg, *Physics and Philosophy*, p. 171.

421 Andrej A. Grib, "*Quantum Cosmology, Observer and Logic*", p. 182-183.

problem of free will, one would argue that the same entity (e.g. human being) is governed by deterministic laws of nature, but in the meantime, is able to make free choices; here, determinism and free will, although they appear to be contradictory, are indeed complementary. Our lack of understanding of what free will exactly is contributes to our interpretation of these concepts as contradictory. We cannot solve the problem of free will based solely on a quantum mechanical analogy. However, as in the case of quantum mechanical problems, we can realize that most difficulties in these and similar problems stem from the fact that we are constrained by the linguistic, conceptual and logical rules we are accustomed to.

CONCLUSIONS

The quantum theory describes the atomic realm, a domain with particles too small to be seen by naked eye. Ever since it was formulated at the beginning of the 20th century, this theory has been the subject of vehement scientific and philosophical debates. Scientific determinism was challenged for the first time; likewise, 'ontological indeterminism' gained scientific grounds with the quantum theory. The notion of 'action at a distance', long-regarded to be a superstition, was first predicted by quantum mechanical calculations, and later demonstrated by Aspect's experiments. With this theory, it has become clear that it is impossible to perform an experiment on a system without affecting it. Yet again, with this theory the impossibility of reductionism is understood; the whole is not a simple collection of its pieces.

All these groundbreaking scientific developments brought about a fundamental paradigm shift in ontology and epistemology. It should be kept in mind,

however, that scientists may differ in their philosophical interpretations; their hermeneutic approaches to scientific theories are shaped by their philosophies. In fact, there have been divergent views on the consequences of quantum mechanics, ranging from 'classical realism' (i.e. scientific theories and concepts describe ontological realities) to metaphysical belief in a determinist universe. The followers of the latter, including Einstein, believe that in its present form the quantum theory is incomplete, and this is why it appears to advocate indeterminism. In other words, there is no consensus about a particular interpretation of the quantum theory. Nevertheless, the approach known as the Copenhagen interpretation is the most commonly adopted view within scientific communities. To date, there is ample convincing evidence for quantum phenomena such as the 'impossibility of reductionism' and the 'effect of the observer on the experiment'. Furthermore, despite its counter-intuitiveness, the 'action at a distance' is shown to be a fact of nature via experiments performed by Aspect in the 1980s. All these discussions aside, I agree with Popper that 'determinism' and 'indeterminism' are metaphysical arguments. Popper's metaphysical perspective led him to follow indeterminism; personally, however, I do not see any good

reason to choose one or the other, and hence decide to remain agnostic on this matter.

'Quantum indeterminism' has been quite controversial; in fact, the majority of philosophical debates about quantum mechanics boil down to the question of 'ontological indeterminism'. In other words, philosophical and theological debates take place on scientifically loose grounds (frankly, there is no other option here). Throughout this book, I have struggled to stay prudent so as not to describe 'may' as 'is'. Even though 'quantum indeterminism' is a controversial issue, the quantum theory for sure negates 'classical realism'. Moreover, I do not feel sympathetic at all towards 'instrumentalism', in which scientific theories are regarded to be inventions of the human mind, independent of ontological realities in nature. As advocated by Polkinghorne, Barbour and Peacocke, I recommend 'critical realism' as the most consistent option. In this approach, science inevitably contains human elements such as sociological factors, presuppositions, prejudices and conceptual limitations. These factors necessitate being 'critical'. On the other hand, the profound impact of scientific developments (in particular, those related to the quantum theory) in bearing new technologies imply that these theories should contain some essence of the reality of

nature. When these factors are considered in harmony, 'critical realism' comes about as the most appropriate philosophical position.

Biased by historical prejudices, many theologians prefer to stay away from establishing relationships between science and religion. In my view, bad examples in the past should motivate theological thinkers to be much more prudent and elaborate when approaching scientific matters. As with the scientific domain, I believe that 'critical realism' should also be applied to theistic arguments. Even though religion is of Divine roots, theological interpretations are produced by human beings. As a result, human elements such as sociological factors, presuppositions, prejudices and conceptual limitations are also encountered in theologies. Just as 'classical realism' should be abandoned in the scientific domain, 'hermeneutic realism' (for example, considering the views of the Catholic Church synonymous to Divine revelation) should be abandoned in theology. If critical realism is adopted in both realms, when science and religion come to conflict about a certain matter, one would scrutinize both domains, not just one of them. Since the errant thoughts in theology are associated with 'human limitations', this approach does not contradict with theistic absolutism. Equivalently,

one would say: "Nature as God's creation and religion as His decree do not conflict; however, science as the study of nature, and theology as the endeavor to understand religion may contain errors; apparent conflicts between religion and science stem from these errors."

In this book, we have described perspectives in which Divine action is believed to take place by God's determination of quantum uncertainties (also called 'gaps'). This idea should not be confused with the notion of 'God of the gaps'. In the latter, one first draws attention to gaps in our knowledge of the universe, and then these gaps are filled with Divine action. According to 'quantum indeterminism', the gaps are ontological, not at all related to our ignorance. Not all advocates of Divine action via 'quantum indeterminism' follow the same pathway. Some - e.g. Pollard - believe that God fills all quantum uncertainties; others - e.g. Tracy - limit Divine action to a small portion of the uncertainties; and yet others - e.g. Peacocke - consider that Divine action leaves these gaps intact. Among various alternatives, I find Murphy's view particularly appealing. Murphy assumes that Divine action fills all quantum gaps, and hence is effective throughout the universe. In this perspective, no uncertainty is left, and so it is in accord with 'the principle of sufficient reason',

making it philosophically more attractive. Murphy further maintains that, while God determines the uncertainties, He also respects human free will and properties of individual particles such as electrons. Staying away from occasionalism and pantheism, and allowing space for free will are further positive aspects of Murphy's standpoint.

Polkinghorne believes that Divine action does not violate the laws of nature; regarding its mechanism, however, he prefers to focus on the chaos theory, instead of quantum mechanics. The determinist structure of the chaos theory is an approximation of the indeterminist structure of nature; God acts on nature through corresponding flexibilities. As suggested by Murphy, Tracy and Russell, I prefer to defend indeterminism based on the 'seemingly-indeterminist' quantum theory, rather than the 'seemingly-determinist' chaos theory.

Merging the chaos theory with the quantum theory becomes fruitful in discussions about non-violative miracles. The most important characteristic of the chaos theory is 'sensitive dependence on initial conditions': a very minute modification on the starting conditions can yield enormous changes in the output. Some models of non-violative miracles are thereby suggested, in which the initial conditions are triggered by

God's determination of quantum uncertainties. Scientifically, there have been significant efforts to harmonize the two theories; however, to date no promising result has yet been obtained. Nevertheless, there is sufficient logical reason to expect the two theories to meet at some point, since transition from the visible to the atomic world should be a smooth one. When this happens, the 'epistemological uncertainty' in the determinist structure of the chaos theory will turn into 'ontological uncertainty', due to the involvement of quantum mechanics. This is the main idea behind models of miracles that do not violate the laws of nature: God creates major events in the visible world by making corresponding choices among 'objective probabilities' in the microscopic world.

The picture of a closed, deterministic universe was widely accepted after Newton; in this epoch, miracles (if they exist at all) were regarded to overrule the laws of nature. Corresponding discussions occupied philosophical and theological minds. The idea of miracles violating the laws of nature was made the subject of heated debates. Followers of naturalism and scientism maintained that "religion contradicts with science, since the former defends the existence of miracles"; whereas some theologians rejected miracles (in

violation of laws of nature) by arguing that "God does not break His own rules". When 'quantum indeterminism' put an end to the closedness and determinism of the universe, many philosophical and theological critiques constructed upon determinism in the past couple of centuries had lost their grounds. These developments present critical lessons for philosophy of religion, in order to avoid similar mistakes in the future. Likewise, naturalism and scientism were mistaken in considering Newtonian physics as the final word in science; theologians were mistaken in associating the words of Newton with the words of God. Pantheists like Spinoza were mistaken in associating mechanical laws with Divine nature.

Throughout this book, I have emphasized that while the quantum theory presents opportunities to construct models for miracles to occur without violating the laws of nature, I by no means assert that these models represent reality. My primary goal is to draw your attention to the mistakes above. First of all, there is no theological mandate on miracles not violating the laws of nature. Eminent thinkers including Newton, Boyle and Mersenne felt no discomfort about the idea of miracles violating the laws of nature. In fact, according to Boyle and Mersenne, such an approach to understanding

miracles is more appropriate. On the other hand, miracles may violate the laws of nature, only if these laws are interpreted as 'necessities'. In 'regularity' and 'instrumentalism', the laws have a lower ontological status and there is essentially no such thing as a 'violation of laws'. If necessitarianism is adopted, the 'ontological probabilities' as brought about by quantum mechanics present opportunities to defend miracles within the natural order. In summary, there is no such problem as 'miracles violating the laws of nature', except for 'necessitarianism, that accepts the laws of nature as ontologically determinist'.

My stance about whether or not God overrules the laws of nature during miracles is 'theological agnosticism'. My motivation behind this comes from the following: first of all, I do not think that necessitarianism is preferable to regularity. Secondly, with the onset of 'quantum indeterminism', it is no longer possible to dictate necessitarianism-determinism as the mainstream modern scientific opinion. Thirdly, even in necessitarianism-determinism, miracles can be interpreted as created by God within the reign of laws, via the fine-tuning of initial conditions at the beginning of the universe. Our discussions about the concept of time and God's transcendentality show that the length of time

being extremely long relative to us is immaterial from God's perspective. Fourthly, God's creation of miracles either by violation of the laws of nature or in accord with them, does not contradict the fundamental theist tenet about an omnipotent God. Fifthly, Holy Texts of monotheistic religions are unanimous on the creation of miracles by God, whereas there is no clear indication in any of these texts about whether these events suspend the laws of nature or not. Based on these arguments, I maintain that theological agnosticism is the most appropriate stance to take on the problem of miracles. The theological remarks above (fourth and fifth) further support my stance, also from the religious angle.

When all these arguments are considered together, the significance of the quantum theory on the problem of miracles can be established without 'exaggeration or demeaning'. First of all, for those who believe that God suspends the laws of nature during miracles, what quantum mechanics (or any other scientific theory) may imply on this matter is totally irrelevant. Likewise, for those who adopt regularity or instrumentalism, there is essentially no such thing as the 'violation of natural laws'; hence, they can turn a blind eye to quantum models for non-violative miracles. 'Divine action on initial conditions' explains how miracles can occur

in a determinist universe, without breaking any laws; again, in this perspective, the quantum theory has no involvement. The interpretation of the quantum theory is quite significant on the problem of miracles, for those who adopt necessitarianism and defend non-violative miracles. According to this angle, since the laws as necessities are not deterministic but ontologically probabilistic, they open up possibilities for Divine action to cause miracles within the reign of law. We should underline once more that, since the establishment of Newtonian mechanics, this kind of an interpretation was not possible until the emergence of quantum mechanics: the first ever fundamental scientific theory to reveal the existence of 'ontological probabilities'.

The relationships between the problems of evil, free will, and the quantum theory are entangled. The role quantum theory would play on the problem of evil depends on how much reference is made to free will. Throughout history, numerous explanations are given to the problem of evil, such as "evil should exist for metaphysical ascend of mankind", or "minor evil is necessary for the major good". However, the most outstanding explanation for the problem of evil is that human beings have free will, which they can use for good, as

well as for evil. Emphasis on free will occurs in many alternative evaluations of this problem.

I believe that philosophical and theological answers to the problem of evil must draw particular attention to the limitations of the human mind. Wykstra's philosophy is a brilliant example of this method. Likewise, different approaches to free will, as well as those that do not ascribe much importance to it, should all be considered seriously. Since we can never learn the Divine motivation behind the creation of good and evil, it would be worthwhile to contemplate all alternatives. In doing so, as suggested by Plantinga, we should be satisfied when we feel convinced that God's creation is compatible with the existence of evil in the universe, and not further attempt to prove that evil is a necessity. Furthermore, as a response to associating theism with the problem of evil, we can draw attention to the fact that atheism is faced with a challenging 'problem of good' (the motivation in doing this is to demonstrate the inappropriateness of deriving ontologies based on the concepts of good and evil). I reemphasize that since we do not know the Divine purpose, instead of following an 'explanatory' method, it would be much more appropriate to remain 'defensive', and show that

the presence of evil in the universe cannot be exploited to support any atheist ontology.

The problem of free will, as compared to that of evil, is more directly linked to the quantum theory. After determinism had become the dominant scientific paradigm, the problem of free will turned into one of the most controversial topics of philosophy: if determinism uniquely fixes everything from the beginning, including the human character and actions, how can we talk about free will? Many thinkers, atheists and theists alike, felt profoundly uncomfortable about this threat to free will. The first scientific challenge to determinism arrived with the onset of 'quantum indeterminism'. As a result, all discussions about free will in a deterministic universe must be revised under the light of quantum indeterminism.

In the 'soft determinist' (compatibility) angle, since free will is reconciled with determinism, arguments of 'quantum indeterminism' become irrelevant. The quantum theory is most relevant to clashes of free will with determinism. Hard determinists exhibit confidence in determinism and reject free will. Libertarians, on the other hand, reject determinism to save free will; as a result, the quantum theory plays a critical role in this approach. Alternatively, if one prefers dualism or

emergence and claims that the human mind is above determinism, there would be no further need to make reference to quantum mechanical arguments.

Searle maintains that 'quantum indeterminism' has no influence on macroscopic systems such as the human mind; this approach is akin to hard determinism and in this angle, quantum indeterminism does not relate to the problem of free will. On the other hand, many thinkers, including Penrose and Ellis, believe in the importance of quantum events for mental phenomena. However, as a word of caution, such relationships between the quantum world and the human mind do not in any way imply a 'magical' conversion of atomic-level indeterminism into free will. In order to make a proper libertarian defense of free will, all else being equal, a person should be able to make different choices among possible alternatives. The quantum theory reveals 'objective probabilities', and one may argue that free will is in some way related to the human mind's determination of these probabilities (uncertainties); this is consistent with the libertarian approach to free will. If the human mind were a mechanical system like a pool table, Searle's arguments would be reasonable. However, aspects of the human mind like consciousness and volition are nothing like mechanical processes; therefore,

Searle's analogy is erroneous (as noted by Griffin). In my personal view, implications of quantum mechanics such as 'objective probabilities', and corresponding changes on the level of the brain are profoundly valuable for discussions about the problem of free will.

In the New-Berkeleyan philosophy, the quantum phenomenon of 'observer's effect' is interpreted as 'observer's creation'; furthermore, free will is associated with this kind of observer action. In this perspective, the ontological status of the mind is so augmented that it is no longer affected by determinism. I find these and similar views problematic: not only is the effect of the observer confounded, but also epistemological limitations about the measurement processes are exaggerated. As a result, this approach cannot make much contribution to resolve the problem of free will. Just as it was wrong to exploit Newtonian determinism for the sake of materialism, it would be wrong to exploit quantum indeterminism for the sake of Berkeleyan idealism.

A similar analogy is suggested between the complementarity principle of quantum mechanics and the problem of free will. According to this principle, contradictory-appearing properties (such as being a wave and being a particle) may coexist in a complementary manner. Analogously, seemingly conflicting concepts

of theological/scientific determinism and free will can also be complementary. This analogy by itself does not resolve the problem of free will. Moreover, it extends a physical principle into metaphysical domain. Nevertheless, this approach yields important clues as to why we face immense difficulties in understanding free will. Our conceptual, logical, linguistic etc. limitations are the foremost reasons why we have difficulty comprehending the phenomena described by the complementarity principle, as well as comprehending the nature of free will.

For the discussion about free will, three distinct types of determination are to be discerned: determinations by God, by the laws of nature and by human volition. Quantum indeterminism indicates that nature contains 'objective probabilities' and these gaps make room for Divine action and human free will (as well as for miracles). On the other hand, no scientific theory can help determine the line between Divine action (theological determination) and human action by free will. This is a purely theological question, related to the way in which attributes of God are understood.

The most critical attribute of God related to the problem of free will is His omniscience, covering everything in the past, present and the future. If God knows

everything that will happen, how can we talk about being 'free'? In my opinion, the classical theistic belief in the omniscience of God is compatible with free will. To delve further into the matter, Molinism provides a remarkable methodology. In Molinism, God is believed to know every action every human being will perform in different circumstances, right from the beginning of the universe, and He places humans in a medium where they can make willful choices. God knows and created the future in its entirety, and He also creates free will (in a libertarian sense). Molinism has some similarities to the interpretation of miracles as 'Divine action on initial conditions'.

The vital argument in resolving the dilemma of free will and God's omniscience is that, "God is transcendental to time". The belief in the absoluteness of time was shaken from its roots by Einstein's theory of relativity; henceforth, it is easier to defend 'transcendentality'. God's knowledge of the future is not as if He watches all future events from an infinite past; instead, it is more like Him watching the frames of a photographic film simultaneously, from above the frame. God simultaneously 'sees' the past and the future. Naturally, our minds cannot perfectly comprehend what it is like to be 'above time'. These remarks, even though

they do not solve the problem of free will, allow us to understand why we are unable to do so.

Besides His omniscience, many other attributes of God, such as omnipotence, justice, goodness, and perfectness, are also related to the problem of free will. Despite their importance, we did not delve into these discussions in this book.

As a concluding remark on our discussions about free will, we can comfortably assert that no scientific theory can threaten the existence of free will. In addition to the quantum theory, free will can be defended via dualism, emergentism, Molinism and other ways. For those who favor compatibility, no such alternative is needed.

In summary, as with the problem of evil, it would be more appropriate to follow a 'defensive' approach to the problem of free will, instead of a 'descriptive' one. We even have shortcomings in understanding what 'will' means; hence, no theist or atheist attempt to explain free will has a chance to succeed. We should grant that the problem of free will is unsolvable; yet, this situation holds from both theist and atheist angles. Hard determinism, soft determinism and libertarianism are adopted by theist and atheists thinkers - further indication that there is no clear line between theistic and atheistic

approaches to this matter. I prefer to reject hard determinism, but remain agnostic between soft determinism and libertarianism. Theology alone does not determine where to draw the line between Divine action and human free will. On the other side, no atheistic thought can successfully explain how a system completely determined by physical conditions can exhibit 'freedom'. Even though theological problems are not completely resolved, a theist can find comfort in believing that God can grant free will to humans, as He wishes. The quantum theory comes to the rescue of free will when it is challenged by scientific determinism. However, no theist or atheist approach can completely resolve the problem of free will; this problem is metaphysical in essence, and corresponding views are primarily determined by metaphysical choices.

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