Quantum Mechanics: A God-Less Theory
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Abstract
While classical physicists are busy describing what is (ontology), quantum physicists are content describing what we can know about nature (epistemology). Describing what nature is, is equivalent--according to the Pantheist Benedict de Spinoza--to describing what God is. But others may say that nature is not equivalent to God but only to what we can perceive of God. Quantum mechanics does not pretend to be able to describe nature, its sole aspiration is to described what us mortals can know about nature in terms of probabilities and expectation values. This tells us nothing what is, only what may be the outcome of some measurement. The measurement itself being part of reality is not described by quantum mechanics since it is not a unitarian process. Hence Quantum physics is rather God less and human centered in comparison to classical physics. It is more humble in its aspiration to what knowledge we humans can have about nature, about reality and about God.

Keywords: Cosmogony, myth, creation, time, chaos, evolution, big bang, god, quantum mechanics.
1 INTRODUCTION

Among the major achievements of Sir Isaac Newton is the formulation of the laws of classical physics in terms of its three laws of motion (Newton 1687; Goldstein 2001). Those laws had numerous experimental verifications and seemed to be the final word one can say about physics. They describe a deterministic universe for which one having complete knowledge of the positions and velocities of all particles and knowing their masses and interactions can predict the past and the future of the universe. Although physical knowledge expanded later on, the central theme of determinism remained. By the middle of the nineteenth century Maxwell has formulated the laws of electromagnetism in his famous four partial differential equations (Maxwell 1865; Jackson 1999; Feynman 2011) which were given their current form by Oliver Heaviside (Heaviside 1889). Those equations describe a deterministic evolution of the electromagnetic field in which knowing the currents and charges for all space and time as well as the current status of the electromagnetic field enables one to know its status at any other time in the past and in the future. One of the consequences of these equations is that an electromagnetic signal cannot travel at speeds exceeding that of light. This was later used by Albert Einstein (Einstein 1905; Jackson 1999; Feynman 2011) (among other things) to formulate his special theory of relativity which postulates that the speed of light is the maximal allowed velocity in nature. But also in the modification of Newton laws in which the expression momenta and energy were changed to fit the relativity principle, the principle of determinism was not modified. Nor was it modified ten years later when Einstein has incorporated gravity into the theory of relativity and thus created general relativity (Einstein 1915; Einstein 1916; Eddington 1923; Weinberg 1972). In general relativity the energy momentum tensor of matter determines the metric of space-time while the metric determines the geodesics of particles. General relativity has won yet another empirical triumph only recently when a direct measurement of gravitational waves was announced (Castelvecchi 2016). Moreover, general relativity emphasizes the approach of Minkowski (Minkowski 1908) which has shown that there is know physical meaning to space and time separately only a combined space-time has a physical significance. The beginning part of Minkowski’s address delivered at the 80th Assembly of German Natural Scientists and Physicians (21 September 1908) is now famous: "The views of space and time which I wish to lay before you have sprung from the soil of experimental physics, and therein lies their strength. They are radical. Henceforth space by itself, and time by itself, are doomed to fade away into mere shadows, and only a kind of union of the two will preserve an independent reality.” General relativity is much more persuasive in the sense that it does not assume the separation of a four dimensional universe into space and time as in special relativity, rather its equations deterministically enforce such a partition as other possibilities (two
space dimensions and two time dimensions or four space dimensions) are not stable (Yahalom 2008; Yahalom 2009; Yahalom 2010; Yahalom 2011; Yahalom 2014). This leads to a view denoted as the "block universe" (Kuipers 2007) in which one realizes that not only is nature deterministic but in fact it is frozen when one abandons the mortal three dimensional perspective and adopts the ontological four dimensional view.

However, physical data in particular atomic spectroscopic lines, the photo electric effect, the dual wave-particle behavior of electrons and photons and additional phenomena have caused the physicists of the 1920's in particular Erwin Schrodinger to disengage from the determinist tradition. In 1926, Schrodinger (Schrodinger 1926a; Schrodinger 1926b) writes a wave equation to describe the probability to find a particle in a single volume of space. Although, at that time, the theory of special relativity was already known and the Lorentz transformation law was known as the right one under which any theory should be invariant, Schrodinger focused on a nonrelativistic form of the equation. The complete mathematical formulation of the theory is known as Dirac-von Neumann axioms (Neumann 1932; Dirac 1958; Cohen-Tannoudji 1977; Zettili 2009). The more formalistic and axiomatic approach introduced later does not change the basic tendency of the theory which is abandoning the hope of knowing the exact state of affairs. If one know where the particle is he cannot possibly know where the particle is going and in the prevalent case one cannot know exactly neither location nor momenta.

Thus a complete description of nature is abandoned and what is left if a theory of knowledge. But a theory of knowledge refers only to a vehicle of such knowledge which is a human being. Thus the realm of quantum mechanics is quite different from the realm of classical mechanics, it does not seek to describe nature it suffices with describing what can be known about nature by humans, which is basically an epistemological question. If God is the truth, a concept which includes the true state of affairs of our world then quantum mechanics is a God less theory as it abandons hope to have a complete knowledge of nature. What remains are probabilities and expectation values.

The struggle to merge the theories of special relativity and quantum mechanics was initially unsuccessful. The first attempts to formulate a relativistic quantum theory were done by Schrodinger (Schrodinger 1928), Gordon (1926 (Wigner 1949)), and Klein (1927 (Zmuidzinas 1966)) (Suleymanov 2015). The result was what is now known as the Klein-Gordon equation. The wave equation yielded solutions which could not be given probabilistic interpretation as they yielded negative probabilities. This led Dirac (Dirac 1928) to introduce a different equation which worked remarkably well as it enforced a four component wave function (a spinor) and predicted both the spin (which was introduced ad-hoc by Pauli in 1924) and the anti-particle (positron) which was not known at the time and was only discovered by Anderson later in 1932 (Anderson 1933). Despite adapting successfully the formalism of relativity the spirit
of relativity was gone as instead of describing a deterministic block universe all that was left was probabilities of finding a particle at a certain volume.

The structure of this paper is as follows: First we briefly review classical mechanics then quantum mechanics is introduced after that the philosophical views of Spinoza and Kant are briefly discussed finally we draw some conclusions of what classical and quantum physics suggest regarding our knowledge of reality and of God.

2 CLASSICAL PHYSICS

2.1 Classical mechanics

In 1687, Sir Isaac Newton stated, in his famous book "Philosophiae Naturalis Principia Mathematica" (Newton 1687), that time and space are absolute:

1. Absolute, true, and mathematical time, of itself, and from its own nature, flows equably without relation to anything external, and by another name is called duration: relative, apparent, and common time, is some sensible and external (whether accurate or unequal) measure of duration by the means of motion, which is commonly used instead of true time; such as an hour, a day, a month, a year.

2. Absolute space, in its own nature, without relation to anything external, remains always similar and immovable. Relative space is some movable dimension or measure of the absolute spaces; which our senses determine by its position to bodies; and which is commonly taken for immovable space; such is the dimension of a subterraneous, an aerial, or celestial space, determined by its position in respect of the earth. Absolute and relative space are the same in figure and magnitude; but they do not remain always numerically the same. For if the earth, for instance, moves, a space of our air, which relatively and in respect of the earth remains always the same, will at one time be one part of the absolute space into which the air passes; at another time it will be another part of the same, and so, absolutely understood, it will be continually changed.

The "Axioms, or laws of motion" proposed by Newton (Newton 1687) are as follows:

1. Every body continues in its state of rest, or of uniform motion in a right line, unless it is compelled to change that state by forces impressed upon it.

2. The change of motion is proportional to the motive force impressed; and is made in the direction of the right line in which that force is impressed.
3. To every action there is always opposed an equal reaction: or, the mutual actions of two bodies upon each other are always equal, and directed to contrary parts.

The second law may be written mathematically (in the familiar way)

\[ m \ddot{\vec{a}} = \sum F_i \]

Since the acceleration \( \ddot{\vec{a}} \) is the second derivative of the displacement \( \vec{r} \) it follows from the theory of ordinary differential equations, that provided that we know at any time the location and velocity and provided we know the mass and the force for all times then we may find the position and velocity of the particle at any other time in the past or the future.

These laws remain unchanged in all inertial frames, the laws are invariant under Galilean transformations of the type:

\[ t' = t \]
\[ x' = x - vt \]
\[ y' = y \]
\[ z' = z \]

According to this transformation law, time is universal and is common to all inertial coordinate systems.

2.2 Electrodynamics

In 1865, James Clerk Maxwell unified the phenomenon of electricity and magnetism by the set of differential equations (Maxwell 1865), which are called, after him, the "Maxwell’s equations" which can be written using the notation of Oliver Heaviside in MKS units:

\[ \nabla \cdot \vec{E} = \frac{\rho}{\varepsilon_0} \]
\[ \nabla \cdot \vec{B} = 0 \]
\[ \nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t} \]
\[ \nabla \times \vec{B} = \mu_0 \vec{J} + \mu_0 \varepsilon_0 \frac{\partial \vec{E}}{\partial t} \] (1)

Thus knowing the electric and magnetic fields at any time, and knowing the charges and currents at all times allows one to calculate the electric and magnetic fields for any other time in the future or in the past. The electric and magnetic fields in vacuum \((\rho = 0, \vec{J} = 0)\) obey the same wave equations

\[ \nabla^2 \vec{E} - \varepsilon_0 \mu_0 \frac{\partial^2 \vec{E}}{\partial t^2} = 0 \]
\[ \nabla^2 \vec{B} - \varepsilon_0 \mu_0 \frac{\partial^2 \vec{B}}{\partial t^2} = 0 \] (2)

Where \( c = \frac{1}{\sqrt{\varepsilon_0 \mu_0}} \) is the propagation velocity of the wave, which is numerically equal to the speed of light. Hence, the great achievement of the theory was the realization
that light is an electromagnetic wave. That unification led to the prediction of the existence of radio waves. Another very unusual result is that the speed of light is independent of the coordinate system. The problem is, then, that electrodynamics is inconsistent with the classical mechanics, in the sense that, it is not invariant under Galilean transformations. On the contrary, the transformation law that leaves the Maxwell’s theory unchanged is the Lorentz transformations of the type:

\[
x' = \gamma (x - vt) \quad y' = y \quad z' = z \quad t' = \gamma \left( t - \frac{xv}{c} \right)
\]

where \( \gamma = \left(1 - \frac{v^2}{c^2}\right)^{-\frac{1}{2}} \) is the Lorentz factor.

On the other hand, the Lorentz transformation law explains the Michelson and Morley experiment and the failure of the attempt to detect luminiferous ether.

### 2.3 Special theory of relativity

Einstein claimed that Maxwell equations are correct, hence the Galilean transformations need to be modified and thus Lorentz transformations are the true symmetry of space-time. The "Special theory of relativity" was suggested by Albert Einstein in 1905 in the paper "On the Electrodynamics of Moving Bodies" (Einstein 1905), and, its postulates are as follows:

1. The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to the one or the other of two systems of co-ordinates in uniform translatory motion.

2. Any ray of light moves in the "stationary" system of co-ordinates with the determined velocity \( c \), whether the ray be emitted by a stationary or by a moving body.

Einstein showed that the Lorentz transformations may be derived from these postulates only. According to special relativity, time can no longer be considered as absolute and universal parameter of evolution, independent of anything external, as Newton suggested, instead, it is an observable that differs from one inertial frame to another.

This type of considerations lead to a modification to the second law of Newton which now takes the form:

\[
\frac{d}{dt} \left( m \frac{\vec{v}}{\sqrt{1 - \frac{v^2}{c^2}}} \right) = q \left( \vec{E} + \vec{v} \times \vec{B} \right)
\]

but without any modification to determinism.
2.4 General theory of relativity

Without going into the mathematical details that the reader may find elsewhere we will just mention to basic equations. The Einstein field equation:

\[ G_{\mu\nu} = -\frac{8\pi G}{c^4} T_{\mu\nu} \tag{4} \]

in which \( G_{\mu\nu} \) is the Einstein tensor, \( T_{\mu\nu} \) is the stress-energy tensor, \( G \) is the gravitational constant. Which suggest that knowing the metric and its derivative on certain "temporal" surface and knowing the stress-energy tensor in all space-time one may calculate the metric at any event, hence determinism follows. The corresponding particle equation of motion is the equation of the geodesic:

\[ \ddot{x}_\alpha = -\Gamma^\mu_{\alpha\nu} \dot{x}_\mu \dot{x}_\nu, \tag{5} \]

where the coefficients have the structure of the usual connection form (here, \( g^{\mu\nu} \) is the inverse of \( g_{\mu\nu} \))

\[ \Gamma^\mu_{\alpha\nu} = \frac{1}{2} g^{\beta\beta} \left( \frac{\partial g_{\beta\mu}}{\partial x_\nu} + \frac{\partial g_{\beta\nu}}{\partial x_\mu} - \frac{\partial g_{\mu\nu}}{\partial x_\beta} \right). \tag{6} \]

The arguments suggesting determinism are the same as in classical mechanics.

2.5 Intermediate account

Determinism is the prevailing notion of classical physics, the assumption is that reality can be known and predicted at least in principle.

3 QUANTUM PHYSICS

The need of "new physics" came from experiments and phenomenon that couldn’t be explained in the existing frameworks of classical theories. Dual wave-particle behavior was observed, and that lead Erwin Schrödinger in 1925, to write a wave equation to describe particles (Schrödinger 1926a; Schrödinger 1926b). Although, at that time, the theory of special relativity was already known, and, the Lorentz transformation law was known as the right one under which any theory should be invariant, Schrödinger focused on a nonrelativistic form of the equation. The complete mathematical formulation of the theory is known as Dirac-von Neumann axioms (Neumann 1932; Dirac 1958). The postulates of quantum mechanics (Cohen-Tannoudji 1977; Zettili 2009) are as follows:

1. **State of a system**: The state of any physical system is specified, at each time \( t \), by a state vector \( |\psi(t)\rangle \) in a Hilbert space \( H \); \( |\psi(t)\rangle \) contains (and serves as the basis to extract) all that can be known about a system by human beings. Any superposition of state vectors is also a state vector.
2. **Physical quantities:** To every physically measurable quantity $A$, called an observable or dynamical variable, there corresponds a linear self-adjoint operator $\hat{A}$ whose eigenvectors form a complete basis.

3. **Principle of spectral decomposition**

Discrete spectrum: when the physical quantity $A$ is measured on a system in the normalized state $|\psi\rangle$, the probability $P(a_n)$ of obtaining the eigenvalue $a_n$ of the corresponding observable $A$ is:

$$P(a_n) = |\langle u_n | \psi \rangle|^2$$

where $|u_n\rangle$ is the normalized eigenvector of $\hat{A}$ associated with the eigenvalue.

Continuous spectrum: When the physical quantity $A$ is measured on a system in the normalized state $|\psi\rangle$, the probability $dP(\alpha)$ of obtaining a result between $\alpha$ and $\alpha + d\alpha$ is equal to:

$$dP(\alpha) = |\langle u_\alpha | \psi \rangle|^2 d\alpha$$

4. **Reduction of the wave packet:** If the measurement of the physical quantity $A$ on the system in the state $|\psi\rangle$ gives the result $a_n$, the state of the system immediately after the measurement is the normalized projection, $P_n|\psi\rangle$, of $|\psi\rangle$ onto Eigen subspace associated with $a_n$.

5. **Time evolution of systems:** The time evolution of the state vector $|\psi(t)\rangle$ is governed by the Schrodinger equation:

$$i\hbar \frac{\partial}{\partial t} |\psi\rangle = \hat{H}(t) |\psi\rangle$$

(7)

3.1 **Non relativistic quantum mechanics**

In quantum theory there are operators that related to the energy, $E \rightarrow i\hbar \partial_t$ and the momentum $\vec{p} \rightarrow -i\hbar \nabla$.

For a particle in some general potential, the Hamiltonian operator is of the form:

$$\hat{H} = \frac{\vec{p}_x^2}{2m} + V(x,t) = -\frac{\hbar^2}{2m} \nabla^2 + V(x,t)$$

where $\hat{p} = -i\hbar \nabla$ is the momentum operator.

Hence, the time dependent Schrodinger equation may be written as:

$$i\hbar \frac{\partial \psi(\vec{r},t)}{\partial t} = \left(-\frac{\hbar^2}{2m} \nabla^2 + V(\vec{r},t)\right) \psi(\vec{r},t)$$

(8)
Multiplying equation (8) with $\psi^* (\vec{r}, t)$, we obtain:

$$i\hbar \psi^* \frac{\partial \psi}{\partial t} = -\frac{\hbar^2}{2m} \psi^* \nabla^2 \psi + V\psi^* \psi$$

(9)

Taking a complex conjugate of equation (8), and then multiplying with $\psi (\vec{r}, t)$, we obtain:

$$-i\hbar \frac{\partial \psi^*}{\partial t} \psi = -\frac{\hbar^2}{2m} \left( \nabla^2 \psi^* \right) \psi + V\psi^* \psi$$

(10)

Now, subtracting equation (10) from equation (9):

$$i\hbar \left( \psi^* \frac{\partial \psi}{\partial t} + \frac{\partial \psi^*}{\partial t} \psi \right) = -\frac{\hbar^2}{2m} \left( \psi^* \nabla^2 \psi - \left( \nabla^2 \psi^* \right) \psi \right)$$

(11)

Using a mathematical identity $\nabla^2 \psi = \nabla \cdot (\nabla \psi)$, equation (11) takes the form,

$$\frac{\partial}{\partial t} \left( \psi^* \psi \right) + \nabla \cdot \left[ \frac{\hbar}{2mi} \left( \psi^* \left( \nabla \psi \right) - \left( \nabla \psi^* \right) \psi \right) \right] = 0$$

(12)

This is the continuity equation,

$$\frac{\partial \rho}{\partial t} + \nabla \cdot \vec{J} = 0$$

where we identify the probability density (which is definite positive),

$$\rho = \psi^* \psi$$

(13)

and, the probability density current,

$$\vec{J} = \frac{\hbar}{2mi} \left( \psi^* \left( \nabla \psi \right) - \left( \nabla \psi^* \right) \psi \right)$$

(14)

Thus the equations tells us is what the probability of finding a particle in a certain volume but not were the particle actually is. Probability is the knowledge of what may the outcome of some experiment and knowledge is meaningless if there is nobody to know it. Hence quantum mechanics form its first day till now is concentrated on what humans can know rather than what is.

### 3.2 Relativistic quantum mechanics

The negative probability problems in Klein-Gordon theory are due to the second order time derivative. Hence, the equation of first order in time should solve the problem. Writing (in natural units)

$$i \frac{\partial}{\partial t} \psi = \hat{H} \psi$$

(15)
Dirac’s idea was to write the Hamiltonian operator in the first order terms:

$$\hat{H} = \sqrt{\hat{p}^2 + m^2} = \alpha \cdot \hat{p} + \beta m = -i\alpha^i \partial_i + \beta m$$ (16)

Hence the Dirac equation can be written as follows:

$$i\partial_t \psi = -i\alpha^i \partial_i \psi + m^2 \beta \psi$$ (17)

In order to determine the coefficients $\alpha_i$ and $\beta$, the squared Hamiltonian has to be consistent with the known result:

$$\hat{H}^2 = \hat{p}^2 + m^2 = (\alpha^i p_i + \beta m) (\alpha^j p_j + \beta m) = \sum_i (\alpha^i)^2 p_i^2 + \sum_{i \neq j} (\alpha^i \alpha^j + \alpha^j \alpha^i) p_i p_j \beta m + \sum_i (\alpha^i \beta + \beta \alpha^i) p_i m + \beta^2 m^2$$ (18)

Hence, the coefficients have to be matrices and must obey the following relations:

$$\begin{align*}
(\alpha^i)^2 &= \beta^2 = 1 & i = 1, 2, 3 \\
\alpha^i \alpha^j + \alpha^j \alpha^i &\equiv \{\alpha^i, \alpha^j\} = 0 & i \neq j \\
\alpha^i \beta + \beta \alpha^i &\equiv \{\alpha^i, \beta\} = 0 & i = 1, 2, 3 
\end{align*}$$ (19)

Which means that the wave function $\psi$ must have several components. Since $\hat{H}$ is a Hermitian operator, so are the matrices:

$$\beta^\dagger = \beta, \quad \alpha^i \dagger = \alpha^i$$ (20)

It can be shown that the lowest dimension of matrices that satisfy these conditions is 4. A possible set of such matrices is:

$$\alpha^i = \begin{pmatrix} 0 & \sigma^i \\ \sigma^i & 0 \end{pmatrix}, \quad \beta = \begin{pmatrix} 1_{2\times2} & 0 \\ 0 & -1_{2\times2} \end{pmatrix}$$ (21)

where $\sigma_i$ are the Pauli matrices:

$$\sigma^1 = \begin{pmatrix} 0 & 1 \\ 1 & 0 \end{pmatrix}, \quad \sigma^2 = \begin{pmatrix} 0 & -i \\ i & 0 \end{pmatrix}, \quad \sigma^3 = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix}$$ (22)

That means that the wave function is a four component vector:

$$\psi = \begin{pmatrix} \psi_1 \\ \psi_2 \\ \psi_3 \\ \psi_4 \end{pmatrix}$$ (23)

And its hermitian conjugate is of the form:

$$\psi^\dagger = \begin{pmatrix} \psi_1^* & \psi_2^* & \psi_3^* & \psi_4^* \end{pmatrix}$$ (24)
3.2.1 Continuity equation for the one particle quantum Dirac theory

Multiplying equation (17) from the left by $\psi^\dagger$, one obtains:

$$i\psi^\dagger \partial_t \psi = -i\psi^\dagger \alpha^i \partial_i \psi + m^2 \psi^\dagger \beta \psi$$

(25)

The complex conjugate of equation (25), is then:

$$-i \left( \partial_t \psi^\dagger \right) \psi = i\partial_t \psi^\dagger \alpha^i \psi + m^2 \psi^\dagger \beta \psi$$

(26)

The difference of these gives:

$$\partial_t \left( \psi^\dagger \psi \right) = -\partial_t \left( \psi^\dagger \alpha^i \psi \right)$$

(27)

Hence, the probability density and density current may be written as follows:

$$\rho = \psi^\dagger \psi$$

(28)

$$\vec{J} = \psi^\dagger \vec{\alpha} \psi$$

(29)

As may be seen from equation (28), unlike in the Klein-Gordon equation, the probability density in the Dirac theory is definite positive.

3.2.2 Spin

In order to investigate the spin of the particles described by the Dirac equation, it is easy to show that the angular momentum operator in quantum mechanics:

$$\vec{L} = \vec{r} \times \vec{p} = -i\vec{r} \times \nabla$$

(30)

is not conserved. Using equation (16):

$$[\hat{H}, \vec{L}] = -\vec{\alpha} \times \nabla$$

(31)

And for $\vec{\sigma}$:

$$[\hat{H}, \vec{\sigma}] = 2\vec{\alpha} \times \nabla$$

(32)

But, the total angular momentum:

$$\vec{J} = \vec{L} + \frac{1}{2} \vec{\sigma}$$

(33)

Is a conserved quantity which commutes with the Hamiltonian:

$$[\hat{H}, \vec{J}] = 0$$

(34)

Where, $\vec{L}$ is the orbital angular momentum and $\frac{1}{2} \vec{\sigma}$ is the spin angular momentum. Hence, we may conclude that the Dirac equation describes particles with spin $\frac{1}{2}$. 
3.2.3 The Positron

For reasons that can be found elsewhere, the spinor can be interpreted as representing an electron with a upper and lower spin and a positron (a particle with the same mass as the electron but with opposite charge) also with an upper and lower spin.

3.2.4 Intermediate Account

Thus the equations tells us is what the probability of finding a particle in a certain volume but not were the particle actually is. Probability is the knowledge of what may the outcome of some experiment and knowledge is meaningless if there is nobody to know it. Hence quantum mechanics form its first day till now is concentrated on what humans can know rather than what is.

Moreover, in spite of the relativistic operator energy equation, the theory produce the probability of finding a particle in a volume. This is quite far from the ”block universe” of relativity which contains a description of what is space time.

3.3 Quantum Field Theory

The years after the second world war saw the development of the relativistic quantum field theory, first Feynman’s quantum electro dynamics (Feynman 1985) and later non abelian gauge theories (Gross 1992) and the emergence of the standard model with its great experimental success (Weinberg 1995). Instead of quantizing displace and momenta, fields are no quantized. However, the principle of the more early quantum mechanics is not forsaken. That is what can be known about reality are mere probabilities and nothing more. What reality is, is not part of the theory.

4 PHILOSOPHICAL VIEWS

4.1 Spinoza

Baruch Spinoza born Benedito de Espinosa, (24 November 1632 - 21 February 1677, later Benedict de Spinoza) was a Dutch philosopher of Jewish Sephardi Portuguese origin. The breadth and importance of Spinoza’s work was not fully realized until many years after his death. By laying the groundwork for the 18th-century Enlightenment including modern conceptions of the self and the universe, he came to be considered one of the great rationalists of 17th-century philosophy.

Spinoza argued that God exists and is abstract and impersonal. Spinoza’s view of God is denoted ”Classical Pantheism”. Spinoza has also been described as an ”Epicurean materialist”. This view was held by Epicureans before him, as they believed
that atoms with their probabilistic paths were the only substance that existed fundamentally. Spinoza, however, deviated significantly from Epicureans by adhering to strict determinism, much like the Stoics before him, in contrast to the Epicurean belief in the probabilistic path of atoms, which is more in line with contemporary thought on quantum mechanics. He contended that everything that exists in Nature (i.e., everything in the Universe) is one Reality (substance) and there is only one set of rules governing the whole of the reality which surrounds us and of which we are part. Spinoza viewed God and Nature as two names for the same reality, namely a single, fundamental substance that is the basis of the universe and of which all lesser “entities” are actually modes or modifications, that all things are determined by Nature to exist and cause effects, and that the complex chain of cause and effect is understood only in part. His identification of God with nature was more fully explained in his posthumously published Ethics (Spinoza 1677).

Let us examine Spinoza’s idea from both a classical and a quantum perspective. From a classical perspective in which a description of nature is assumed possible then also a description of God is possible or at least a description of what one can perceive of God. But according to the quantum view our knowledge is limited to probabilities of what is, but the true state of affairs cannot be known unless one performs a real experiment. Reality cannot be contemplated and only part of it can be felt through our sensory organs. Hence quantum mechanics is man centered rather than God centered and is concerned with what man may know rather than what is.

4.2 Kant

Immanuel Kant (22 April 1724 - 12 February 1804) was a German philosopher who is considered the central figure of modern philosophy. Kant argued that fundamental concepts of the human mind structure human experience, that space and time are forms of our sensibility, and that the world as it is "in-itself" is unknowable. Kant took himself to have affected a Copernican revolution in philosophy, akin to Copernicus reversal of the age-old belief that the sun revolved around the earth.

In Kant’s major work, the Critique of Pure Reason (Kritik der reinen Vernunft), (Kant 1781) he attempted to explain the relationship between reason and human experience and to move beyond the failures of traditional philosophy and metaphysics. Kant wanted to put an end to an era of speculative theories of human experience, while resisting the skepticism of thinkers such as David Hume. Kant regarded himself as ending and showing the way beyond the impasse which modern philosophy had led to between rationalists and empiricists, and is widely held to have synthesized these two early modern traditions in his thought.

According to Kant our thinking is limited by the structure of our mind such that only analyzing our empirical experience which is an extension of our daily experience
is possible for us (as evolutionary theory developed in the middle of the nineteenth century would suggest). Thus we are not able to decide on metaphysical concepts such as what is God as Spinoza argued. (This was also the view of Maimonides (Maimonides 1190))

Let us examine classical physics according the philosophy of Kant. The idea that one can have (at least in principle) a complete description of reality seems to contradict the tenet that our faculties of perception and reason are limited. Moreover, according to Kant space and time themselves which seem to be basic building blocks of reality are just "categories", that is ways to think of reality which are enforced upon us by the structure of our minds. Hence particles and fields which are the content of space-time cannot be a true description of reality. Thus while classical physics may be useful technologically eventually it must be incomplete.

As to quantum physics being a theory of knowledge (probabilities and expectation values), it does not suggest any knowledge of the true state of affair but only to what we are able to know about them. This view is more in line with the philosophy of Kant which claims that ontology is beyond us.

5 CONCLUSION

The God that Spinoza describes is abstract and impersonal and is just another name to nature. It is quite different from the personal God of monotheistic religions. Classical mechanics sets no fundamental limitations to knowing this God while quantum mechanics does. Hence quantum mechanics is a God less theory in the sense that it limits what one can know about God.

For some physicists Spinoza’s God is not a God at all. Indeed Pierre-Simon Laplace allegedly replied to Napoleon, who had asked why he hadn’t mentioned God in his book on astronomy: I had no need of that hypothesis. (“Je n’avais pas besoin de cette hypothèse-la”).

The God of Kant and Maimonides is unknowable, the notion that we can have a theory that describes reality (including its relation with God) completely is rejected, while a theory that described what we can know about reality is more plausible. But such a theory will be apriori devoid of any information of God by construction. Hence it will be God less just as in the case that we adopt Spinoza’s view. Either way quantum physics is a God less theory and anthropocentric in nature.

A famous debate between Einstein and Bohr (Bohr 1949) took place regarding "the epistemological problems in atomic physics" in which Einstein was quoted to say "God does not play dice" and Bohr replied "you cannot tell God what to do". But it seems that quantum mechanics does not tell us anything of what God does as it is a theory not of God or of nature but only of what humans can know about nature.
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