A Short Note on Quantum Mechanics

Jackson Henry*

Department of Physics, Institute of Science and New Technology, Tehran, Iran

Editorial

Received: 01-March-2022 Manuscript No. JPAP-22-52076; **Editor assigned:** 03- March-2022 Pre QC No. JPAP-22-52076(PQ); **Reviewed:** 15-March-2022, QC No. JPAP-22-52076; **Accepted:** 18-March-2022, Manuscript No. JPAP-22-52076(A) **Published:** 22-March-2022, **DOI:**10.4172/2320-2459.10.2.002.

***For Correspondence:**
Jackson Henry, Department of Physics, Institute of Science and New Technology, Tehran, Iran
E-mail: hernyjack54@gmail.com

Editorial Note

Quantum mechanics is a fundamental theory of physics that describes the physical properties of nature at the atomic and subatomic particle scales. It is the bedrock upon which all quantum physics is built, including quantum chemistry, quantum field theory, quantum technology, and quantum information science [1]. Classical physics, the collection of theories that existed prior to the advent of quantum mechanics, describes many aspects of nature on a large (macroscopic) scale but not on small (atomic and subatomic) scales. Most classical physics theories can be derived as an approximation valid at large (macroscopic) scale from quantum mechanics. Quantum mechanics differs from classical physics in that energy, momentum, angular momentum, and other quantities of a bound system are restricted to discrete values (quantization), objects have both particle and wave characteristics (wave–particle duality), and there are limits to how accurately the value of a physical quantity can be predicted prior to measurement, given a complete set of initial conditions (the uncertainty principle) [2].

Quantum mechanics enables the calculation of physical system properties and behavior. It is commonly used to describe microscopic systems such as molecules, atoms, and subatomic particles [3]. It has been shown to hold for complex molecules with thousands of atoms, but its application to humans raises philosophical issues, such as Wigner's friend, and its application to the universe as a whole remains speculative. Quantum mechanics predictions have been verified experimentally to an extremely high degree of accuracy. A fundamental feature of the theory is that it usually cannot predict what will happen with certainty, but only provides probabilities [4]. A probability is calculated mathematically by taking the square of the absolute value of a complex number, which is known as the probability amplitude [5]. The Born rule, named after physicist Max Born, governs this. A quantum particle, such as an electron, can be described by a wave function, which assigns probability amplitude to each point in space. When the Born rule is applied to these amplitudes, it yields a probability density function for the position that the electron will be found to have when an experiment to measure it is performed. One of the consequences of quantum mechanics' mathematical rules is a tradeoff in predictability between different measurable quantities. The most well-known form of this uncertainty principle states that no matter how carefully a quantum particle is prepared or how carefully experiments on it are set up, it is impossible to have a precise prediction for both a measurement of its position and a measurement of its momentum at the same time. Another result of quantum mechanics' mathematical rules is the phenomenon of quantum interference, which is frequently demonstrated with the double-slit experiment [6]. A coherent light source, such as a laser beam, illuminates a plate pierced by two parallel slits in the basic version of this experiment, and the light passing through the slits is observed on a screen behind the plate [7,8]. Because light is a wave, the light waves passing through the two slits interfere, resulting in bright and dark bands on the screen – a result that would not be expected if light were made up of classical particles. Quantum tunneling is another counter-intuitive phenomenon predicted by quantum mechanics: a particle that collides with a potential barrier can cross it even if its kinetic energy is less than the maximum of the potential [9]. This particle would be trapped in classical mechanics. Quantum tunneling has several important implications, including radioactive decay and nuclear fusion in stars, as well as applications such as scanning tunneling microscopy and the tunnel diode. When quantum systems interact, quantum entanglement can be created: their properties become so intertwined that describing the whole solely in terms of the individual parts is no longer possible. Entanglement was described by Erwin Schrödinger as "the characteristic trait of quantum mechanics, the one that enforces its entire departure from classical lines of thought." Another avenue opened up by entanglement is the search for "hidden variables," which are hypothetical properties more fundamental than the quantities addressed in quantum theory, and knowledge of which would allow for more precise predictions than quantum theory can provide [10]. A number of results, most notably Bell's theorem, have shown that broad classes of such hidden-variable theories are in fact incompatible with quantum physics. If nature actually operates in accordance with any theory of local hidden variables, then the results of a Bell test will be constrained in a specific, quantifiable way, according to Bell's theorem. Many Bell tests with entangled particles have been performed, and the results have been incompatible with the constraints imposed by local hidden variables. It is impossible to present these concepts in more than a cursory manner without introducing the underlying mathematics; understanding quantum mechanics necessitates not only the manipulation of complex numbers, but also linear algebra, differential equations, group theory, and other more advanced subjects. Formalized paraphrase as a result, this article will present a mathematical formulation of quantum mechanics as well as a survey of its application to some useful and well-studied examples.

REFERENCES

1. Born M, et al. Quantum mechanics of impact processes. Zeitschrift für Physik. 1926; 37:863–867.
2. Jaeger G, et al. What in the (quantum) world is macroscopic?. Am. J. Phys. 2014; 82:896-905.
3. Fein Y, et al. Quantum superposition of molecules beyond 25 kDa. Nat. Phys. 2019; 15: 1242-1245.
4. Martin B, et al. Quantum cosmology: a review. Rep. Prog. Phys. 2015; 78:023901.
5. F Trixler, et al. Quantum Tunnelling to the Origin and Evolution of Life. Curr. Org. Chem. 2013; 17: 1758-1770.
6. Wiseman H, et al. Death by experiment for local realism. Nature. 2015; 526:649-650.

7. Ballentine LE, et al. The Statistical Interpretation of Quantum Mechanics. Rev. Mod. Phys. 1970; 42: 358-381.

8. Schlosshauer M, et al. Quantum decoherence. Phys. Rep. 2019; 831:1-57.

9. Camilleri K, et al. Constructing the Myth of the Copenhagen Interpretation. Perspect Sci. 2009; 17:26-57.

10. Schlosshauer M, et al. A snapshot of foundational attitudes toward quantum mechanics. STUD HIST PHILOS M P. 2013; 44:222-230.