The Status of Quantum Mechanics as a Scientific Theory

This article gives an overview about the status of quantum mechanics as a scietific theory.

The quantum theory of material and light is of approximately 100 years old that was formulated in the beginning of the 19^{th} century as a result of experiments that were done in various areas of classical physics and which the classical laws of mechanics by Issac Newton were not able to explain by appropriate mathematical equations.

Examples include the failure of Newton Laws to explain the phenomenon of black body radiation. This is a model which was used theoretically to calculate physical properties of remote stars in the universe such as the temperature of the surface of the stars and their atomic contents. This latter information was usually obtained by interpreting the light spectrum that is emitted by the specific star and by analyzing its wavelength.

The mathematical equations that depict this phenomenon could not lead to satisfactory results that commensurate with the experiments that were performed. Thus this issue was resolved by using quantum mechanical concepts of quantizing the energy of light in the form of discrete photons that have specific energy and related specific equations. Also other experiments in physics at the atomic level led to similar problems as with the black body radiation. These in turn were also settled by using similar concepts of quantization of energy and other physical observables such as the momentum of a particle.

The application of the concepts of quantization of physical observables seemed to work well with solving the mathematical problems that arised due to the failure of Newton laws to explain these phenomena satisfactorily. This theory was further developed by the development of the Schroedinger equation which relies on the assumption of wav-particle duality of the matter in nature. This equation is very fundamental for the development of many areas of physics and chemistry.

Therefore any discovery that can lead to weakening of the scientific credibility of this equation as occurred with the

theory of relativity can have catastrophic effects on this science in general and on all other fields of sciences that rely in their scientific development on the formulations of this fundamental equation.

Therefore one must be very cautious when building ad formulating new theories in science because of pitfalls and defects in the theory that can jeopardize its scientific credibility and eventually leads to its invalidity. Therefore a good scientific theory must stand all scientific challenges that can face it.

Weaknesses of the quantum theory of matter and light can be summarized as follows:

The quantization of physical observables as contrasted with th e continuous nature of these observables in classical mechanics is an unusual assumption that works well mathematical but is exotic idea on the physical aspect. Also the uncertainty principle is an exotic assumption that does not have an analogous phenomenon in classical mechanics. This principle is an experimental fact that has mathematical formulas. Failure of this principle in one occasion can lead to failure of the whole quantum theory of matter. In addition the probabilistic nature of the wave function that is associated with the quantum system is also an issue of controversy but works well mathematically and their results give good predictions about the behavior of the quantized system.

Also the complex nature of the wave function has no physical meaning and one must deal with its squared value in order to receive results of physical significance. Again their credibility is maintained by the satisfactory mathematical results they provide with the experimental results.

Also the vector space that support the functions and bases of this theory is called Hilbert space. This space is a subject of investigation as to the properties of the wave functions and quantum mechanical operators that are used extensively in this theory of mechanics.

Therefore we see that many factors play roles in the success of this theory of mechanics. Failure of any of these factors

to give satisfactory results that commensurate with the logic behind its use can jeopardize the whole theory and lead to its invalidity. Caution here is a key factor not to be confident about any theory of the physical sciences. This is so because most of these theories are built to commensurate with experimental data only. The fact that the theory works well in predicting experimental results does not guarantee the correctness of the theory.

The quantum theory of matter is an exotic and unusual in its physical structure like the theory of relativity. An example of a controversial concept in this theory is the zero point energy concept of physical quantities such as the harmonic oscillator gound state energy. The fact that quantum physical systems have nonzero gorund state energies is in contradiction with the basic laws of nature which say that every physical system in the universe tends toward minimum thermodynamic stability as manifested by its presence at a state of minimum energy.

This concept of ground state energy in the quantum theory of matter is a controversial subject that can lead to the failure of the whole theory. this concept stands in contadiction with the basic laws of nature which state that all systems in the un iverse tend towards maximum themdynamic stability and minimum energy states. Also the use of operators in this theory to depict physical observables is an exotic idea and unprecedented application of mathematical concepts in describing the natural world in physics.

The operators theory in mathematics should be studied extensively to see if this theory continue to be valid in all circumstances. Theories that depict natural phenomena are never to be taken for granted and search must always be continued.

Also **the classical laws of motion should be investigated further which already showed failure at the atomic level**.

In addition, **The failure to formulate a theory of quantum gravity should give an alarming signal whether the theory of gravity and the quantum theory are correct or not**.

Thermodynamic systems in nature are divided into two types. One is systems that are at equilibrium state with the environment and systems that are in a state of nonequilibrium with the surrounding. On earth nature has made preference for systems that are at equilibrium state with the surrounding. This is so due to the principle of minimum energy that every object in the universe aspires to have. All systems in the world with few exceptions tend toward minimizing their content of energy. Examples of such systems are chemical reactions in the laboratory which usually reach a state of thermodynamic equilibrium that is favored thermodynamically.

Thermodynamics plays here a major factor in determining whether a given system will be at equilibrium or nonequilibrium states. Examples of systems in nature that are in a state of nonequilibrium are the light phenomenon and gas and liquid systems that have gradients in their concentrations and gradients in temperature. These systems are controlled by the phenomenon of diffusion that drives the system that is under nonequilibrium state into a state of equilibrium. Chemical gases and chemical liquids form part of these systems under nonequilibrium state. Diffusion and heat conduction of chemical systems are two classes of nonequilibrium states that are driven thermodynamically into a state of thermodynamic equilibrium. In this case of nonequilibrium the systems restore their thermodynamic stability after a short time.

Another example of a nonequilbium process occurs in the biologic process that is known as osmosis. This biologic process can occur for example across the cellular membrane of all cells in the body. The tendency of this process to occur is driven by a thermodynamic force which tends to give the system a state of minimum energy. Also another biologic process which is also a nonequilibirum state is the active transport of ions across the cellular membrane of neurons and muscle cells in the body. In this case a state of thermodynamic nonequilibirum is maintained across the cellular membrane by the effect of ion channels and enzymes that catalyze the process of active transport. By virtue of its being in a nonequilibium state this process is thermodynamically not favored so that it requires expenditure of energy in order to be maintained.

The processes of osmosis and active transport across the cellular membranes are typical of living systems that are

usually in a state of nonequilibrium with the environment. This state of nonequilibrium is only broken when the individual dies so that all systems of the body stop to work. At this stage the molecules inside the body begin to analayzed by the bacteria into small molecules that can be used by the microorganisms for their nutritional processes. Light is another system that is existent in a state of nonequilibirum with the environment. Its continuous motion in a high speed as much as the light speed c is a cause of thermodynamic instability for this system that violates the the rules of nature that says: all systems in the world tend to release their energy content in favor of reaching a state of minimum energy and reach a state of thermodynamic stability.

This process is never reached with light according to the theory of relativity which assumes that light travels all the time

at the same speed of c. This assumption was shown previously to be not correct in another published article which can give an indication that light is in essence a system that tends toward equilibrium state by slowing down its velocity. The nature of this unique entity has yet to be explored in details after the finding that it does not have a constant velocity but rather a variable velocity that depends on the force the acts on it. One postulate about this entity is that it can have certain form of life that is analogous to other systems that are under a state of nonequilbirum such as living humans and animals.

The so far known information about this entity is that it can have wave as well as particle properties. One of the

consequences of the fact the speed of light is variable is the existent of a hypothetical mass that is associated with the photon particle. This can be shown to be the case by solving the force equations for a photon system by substituting F =mdv/dt and equate it to F1(c/v) or

Mdv/dt=F1(c/v)

By solving this equation one can get a value for the mass of the photon.

One of the results of applying this equation to photon systems is the obtaining of complex valued wavelength according to the traditional equation of photon energy that is expressed in term of the force F.

Thus it still needs to verify the existence of the hypothetical mass that is associated with the photon experimentally.