University of Mosul
College of Science
Department of Physics
Fourth Class
Lecture 1

Quantum Mechanics

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Lecture 1: Historical origin of the Q.M.

Preparation

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Unit 1

Historical origin of the Q.M.

1.1 theory

Quantum mechanics came in the 20th century. Date of birth Dec./17/1900. It was on this day that the German physicist Max Planck reported to a meeting of the Berlin Academy of sciences physical society on his attempt to overcome the difficulties of the theory of thermal radiation. Out of Planck's concepts grew Q.M. which opened an entirely new world of the ultrasmall of atoms, atomic nuclei and elementary particles.

1.2 How was the new theory Q.M. name? Why mechanics?

There was nothing mechanics in the new theory and there couldn't be. The word mechanics is justified only in that it is used in a general sense, like we speak of the mechanics of an electronic watch, meaning the principle of operation. The conceptual range of quantum mechanics is better covered by the broad definition of physics itself.

Why Quantum:

Quantum in a Latin means discrete portion or quantity. Further on we shall see that the new science does actually deal with discreteness in the properties of the surrounding world. That is one of its basic principles. On the other hand, this discreteness is not at all general and is not always found everywhere or.

A no less peculiar aspect is the duality of the properties of matter. The dual nature of matter lies in the fact that one and the same entity object combines the properties of particles and waves.

The new science was refined to, wave mechanics, But there again we have only half of it, there is no mention of quanta.

We conclude that none of the names of the new physical theory was satisfactory. But couldn't something be thought up more in keeping with the actual content of the subject.

1.3 Approach to quantum mechanics

There are two approaches to Q.M., one is to follow the historical developed of the theory from the first indication that the whole fabric of classical mechanics and electrodynamics should be held in doubt to the resolution of the problem in the work of Planck, Einstein, Heisenberg, Schrödinger &

Dirac. The other is to stand back at a point late in the development of the theory and to seek its underlying theoretical structure.

In our study we shall discard the historical approach to Q.M. in favour of axiomatic approach. We shall do this because the axiomatic approach is more logical, and we are able to adopt it because we have the benefit of hindsight.

1.4 What is a theory

A theory is made up of two parts. These are its mathematical formalism or framework on the one hand and the interpretation of this formalism on the other.

Theory = Formalism + Interpretation

The formalism of Q.M. followed a process of conceptual trial and error.

1925 Heisenberg developed a formalism which has become known as Matrix mech.

1926 Schrödinger developed a formalism called wave mechanics basing on wave – particle duality.

About 1929 Neumann put his formalism called " Hermitian operator "

Around the same time Dirac introduced his notation "bra <| " and " Ket |> " .

The formalism we shall adopt in this study is a wave mechanical formalism which uses differential operators rather than matrix operators.

The interpretation of this formalism is not so straight forward, and we must be prepared to put in some more effort to get our ideas straight.