Quantum Mechanics and It's fields

C. Prabhakar

***Abstract*— The Mechanics is study of Motion of Bodies. We consider some of the fundamental particles as bodies, studies of its motion considered as Quantum mechanics. It is greatly influenced by charges and its corresponding fields and directions. It is said that charges are in pair, Positive and negative. According to coulomb's law like charges repel each other, while opposite charges attract each other. According to this law the Electrons should collapse in to central positive nucleus. But, it does not happen. Some thought it is due to the potential and kinetic energies. But, actually it may be due to the mechanics of Electron and its corresponding fields. The force of a charged particle Electron in the Electric field is equated to or balanced by the magnetic force due to moving charged particle Electron in the magnetic field generated due to its own motion. Presence of trigonometric function sine makes it clear that Electromagnetic waves originated from Electron are in sinusoidal motion.**

***Index Terms*— Quantum mechanics, Electric and magnetic field, coulomb's law of charges.**

I. INTRODUCTION

The study of the mechanics of the motion of Electron around the central positive nucleus is simple for hydrogen and helium atoms. But, it is complex for other larger atoms. Realising its study as important, new branch of science came, which is called quantum mechanics.

II. HISTORY

The study of Quantum mechanics started in the beginning of the last century. It is greatly advanced and studied in detail. But, many facts remain unsolved like why Electron in the first orbit does not collapse in to positive proton at the centre due to the attraction of charges and secondly why Electron revolves with angular momentum which has factor of multiples of $h/2\prod$ of the angular momentum.

III. EXPLANATION FOR THE NEGATIVE CHARGE ELECTRON NOT FALLING INTO THE CENTRAL NUCLEUS DUE TO ATTRACTIVE FORCE OF POSITIVE CHARGE PROTON

We all know that Electrons revolve around central nucleus along with spin motion around its own axis. These two motions are perpendicular to each other. The figure 1of the Atom shows the Electron is revolving around the central nucleus under the influence of established Electric field between central positive charge protons and revolving negative charge electrons. We know that moving
Electric charge produces magnetic field. So, from the figure 1, we see that the Electron revolving around the central nucleus should produce magnetic field, the direction of which given by right hand palm rule.

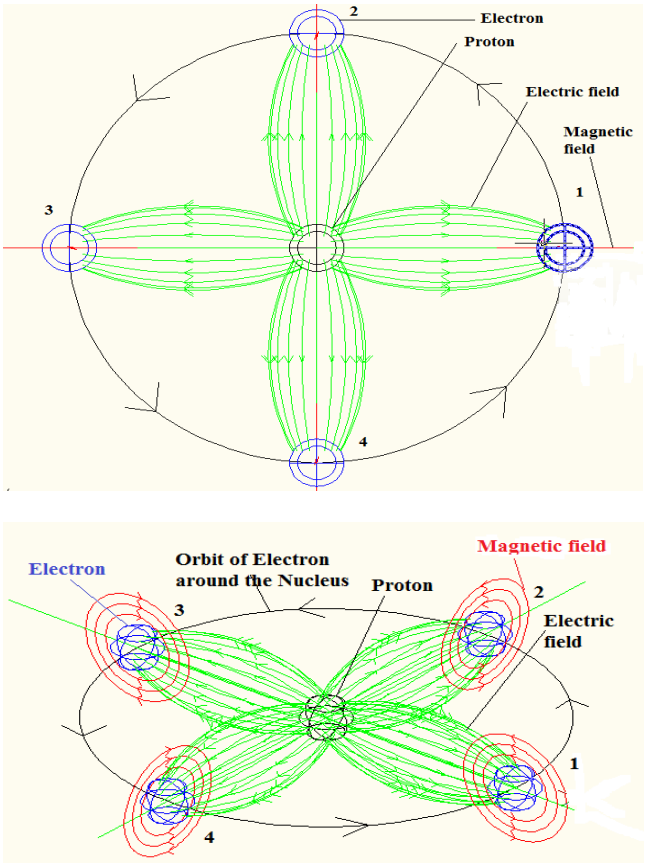

Figure 1

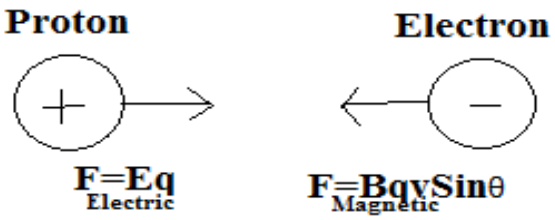

Figure 2

Secondly the spin of the Electron around its own axis also due to the force induced by revolution of negative charge Electron around the central nucleus. According to Fleming's left hand or right hand rule, force is induced on the Electron, this force makes Electron spin around its own axis, the direction of rotation is given by right hand palm rule, which says if thumb points along the direction of Electric current, the curled fingers of that hand gives the direction of magnetic field due to current. We see the 3D image in figure 1, the view of Electric field and Magnetic field at four different positions

Manuscript received April 07, 2015.

C.Prabhakar, B.E (Mech) DCA is a Mechanical Engineer presently working independently on various topics of science and technology.

around the Nucleus. Electric field is both parallel and perpendicular to the established magnetic field when field makes its complete 360 degrees course. We see that magnetic field is circular and electric field is cylindrically curved. The intersection of these two fields gives both the combination of parallel and perpendicular magnetic and Electric fields to each other. Since, charged particle introduced in to the magnetic field at right angles to the field, will move in a circle. In the same way charged particles move in a parabola, if introduced in to the Electric field in a direction at right angles to the field. Hence, shape of its orbit will be the combination of circle and ellipse. The circular movement of Electron in the Electric field around central nucleus produces magnetic force. So, from the above arguments we see that the Electron is placed in Electric field will have Electric force equal to F=Eq, where F=force, E= Electric field and q= charge of Electron, whose direction is given from the positive central nucleus to the negative outer Electron. At the same time, the movement of Electron around central nucleus induces magnetic field. This magnetic field being perpendicular to the Electric field will produce magnetic force given by F=qvB sin θ. Where F= force, q= charge of Electron, v= velocity of Electron θ = angle between velocity and the magnetic field and B=magnetic field, whose direction is given by Fleming's left hand or right hand rule. So, we can infer that Electric force is balanced by the magnetic force, which keeps the Electron not falling in to the central proton.

Lets us equate both the forces as shown in fig 2

Eq = qvB sin θ

After simplifying

We get v=E/(B sin θ)..... (1)

When Electron is placed in Electric and magnetic field, it produces velocity, In other words, when Electric field is divided by magnetic field, it results in velocity. Since, magnetic force is perpendicular to both the direction of velocity and the magnetic field; work done by the magnetic force is zero. The magnetic force changes the direction not its speed. Hence, the Electron revolves around central nucleus continuously without any input of work. Also the Electromagnetic waves originated from the Electron will have sinusoidal shape, which is evident from the presence of Trigonometric function sine in the equation 1.

IV. Electron can rotate only in those orbits in which angular momentum of the Electron mvr is a whole number multiple of h/2∏, not any other like h/3∏ or h/4∏

From the equation 1

We get v=E/B sin θ

Also we have v= rω , since ω=2∏ν

After solving for r we get r= E/B2∏ν sin θ

Since $\nu=E_n/h$

E_n is the energy levels between two orbits, h= Planck's constant

We get $r = (h/2\prod) (E/B)(1/ E_n)\text{cosec}\,\theta$..... (2)

Since angular momentum of the Electron is given by mvr

$= m v (h/2\prod) (E/B)(1/ E_n)\text{cosec}\,\theta$

Since v=E/(B sin θ)

$= m (h/2\prod) (E/B)^2(1/ E_n)\text{cosec}^2\,\theta$ ..... (3)

from the equation 3, we see angular momentum is directly proportional to h/2∏.Hence, We can say that the Electron can rotate only in those orbits in which angular momentum of the Electron mvr is a whole number multiple of h/2∏, not any other like h/3∏ or h/4∏ .Since ω=2∏ν, it cannot be ω=3∏ν, because it is one and half cycle. Even, it is same case for ω=4∏ν, 4∏ is for two cycles. Hence, the angular momentum of an Electron is always whole number multiple of h/2∏.

V. Conclusion

Hence, from above argument we can conclude that the Electron was kept in its orbit in the Atomic scale by its own magnetic field and Electric field. The attractive force of Electric field is balanced by its own magnetic force, which makes an atom being in stabilised state without Electron falling into the central nucleus by losing its Energy. The angular momentum of an Electron is always whole number multiple of h/2∏, not any other like h/3∏ or h/4∏, because of its circular motion, quantized by its Electric and magnetic fields. The strength of Electric and magnetic fields between protons and Electrons decides the radius of Electrons orbit around the Nucleus.

References

[1] Electricity and Magnetism - K.K.Tewari
[2] IIT Guide for chemistry - Dr.O.P.Agarwal

Authors Profile:

Prabhakar C., B.E (Mech) DCA is a Mechanical Engineer presently working independently on various topics of science and technology.

INTERESTED ACTIVITIES : To Bring innovative and creative ideas in all the Branches of Science and Technology.