

Theory of Electron in Uniform Magnetic field inside Cathode Ray Tube and Possible Prediction of New Particles

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Abstract

This Paper essentially focuses on the weird new form of mathematical equation that absolutely shows justification of an electron in uniform magnetic field. This paper also shows the alternate method to calculate electron's charge to mass ratio. This note also makes possible speculations about the two new elementary particles. This work however also describes the very early brilliant experimental observations of Sir Thomson in Cambridge, England and its impact on this modern theoretical study. The main attractive part is the general prediction which needs to be vindicated by experiments.

Keywords: Magnetic Field, e/m Ratio, Cathode Ray Tube.

Introduction

Recent work which was conducted by the author* shows the existence of massive agreement between experiment and theoretical equations. The theoretical and experimental studies simply define the true ways to view the internal structures of atoms. The outstanding work of Sir J.J Thomson [1] in 1897 clearly transforms and indeed the previous ideas of atoms, like Sir Dalton. The essence of fact is the discovery of the first subatomic particle electron. The pure experimental justification can be explained in two simple ways, first the massive indication that atom is not fundamental in fact it is composite and second the accurate measurement of the particles charge to mass ratio. The fact of this ratio again lies in the experiment which was carried out at Cavendish Laboratory, which shows that electron might possess charge. This conclusion that it has charge can be verified by putting the electric and magnetic fields in the linear path of the electron inside the tube, the deflection clearly occurs in presence of electric field and magnetic field if applied individually.

We have concentrated these factors and have tried to deduce the possible equation of an electron in magnetic field.

Core Discussions with Materials and Methods

A very recent experiment which was conducted with a cathode ray tubes by simply applying the potential difference of different voltage and obtained the results similar to those which was discovered by Sir Thomson. The idea of calculating e/m ratio was very astonishing but when we measured by using

the technique independently discovered by me I found the acceptable value of its ratio which without emerging any difficulty clearly states that electron has charge and mass and the method is indeed correct. But first let use the idea to calculate this ratio using Thomson's method which is an electric and magnetic field of X and B respectively were induced and a fluorescent screen, he showed that the ratio of e/m can be given in the form

$$\frac{e}{m} = \frac{Xs}{B^2lL}$$

This equation shows the perfect order for computing the ratio, s is the shift of the electron beam on the fluorescent screen, l is the length of the corresponding field and L is the distance between anode and cathode. However many techniques have been proposed to calculate the electrons charge to mass ratio including Dempster's method which will be discussed later. However the newly deduced method is very peculiar but signifies accurate results as occurred in experiment. Any electron accelerated through a potential difference V must obey the relation with kinetic energy as can be given as

$$\frac{1}{2}mv^2 = eV$$

So clearly one can follow that velocity of an electron is

$$v = \sqrt{\frac{2eV}{m}}$$

Inside magnetic field B an electron experiences a force which is in the form

$$F_B = Bev$$

Dempster showed that if an electron accelerated through a potential difference V in a magnetic field must therefore its e/m ratio will be

$$\frac{e}{m} = \frac{2V}{B^2r^2}$$

Where r is the radius of the electrons circular path in uniform magnetic field and radius is therefore given by

$$r = \frac{mv}{Be}$$

However the new alternative method can be discussed as follows

Sir de Broglie showed that any particle in motion must somehow behave as wave nature in fact he showed that the nature of the particle has indeed dual nature, which is called wave-particle duality. He argued that with every particle of matter with mass m and velocity v a real wave must be 'associated', which is related to the momentum by the equation:

$$\lambda = \frac{h}{mv}$$

It has been discussed that electron experiences a force inside the magnetic field so from calculation it is shown that the ratio e/m can be theoretically given by the proposed relation

$$Beh - F_B \lambda m = 0$$

Therefore the ratio is

$$\frac{e}{m} = \frac{F_B \lambda}{Bh}$$

This method also shows accurate numerical data analysis and the result is in the agreement with experiment. The cathode ray tube experiment in the presence of magnetic field and applying potential difference V proves this calculation in highest order.

This simply establishes a new method for calculation but however the crucial essence is that we have tried to deduce some other expressions which are true and in accordance with experiment. As in the past theoretical discussions on the electron's behavior in magnetic field in the form of paper [2] it was introduced that a mathematical parameter which is a physical constant essentially written as φ which here frames a crucial part in the deduced expressions. The constant is introduced by the definition given by

$$\varphi = \hbar e$$

We have found an interesting equation which not only simple but also workable according to observations. It appears to me highly accurate and does not emerge any sort of complexities as far within limits. This weird physical constant is however very significant and clearly fits in the new form of the proposed theoretical equation.

Earlier in this paper we have discussed that accelerated electron must satisfies the relation with its Newtonian kinetic energy equation, simply by

$$\frac{1}{2}mv^2 = eV$$

Such that it follows

$$v = \sqrt{\frac{2eV}{m}}$$

Inside uniform magnetic field electron bends in a circular path of radius r which is also discussed above, so the electron moving inside the cathode ray tube must holds the equation as given in the form

$$-\frac{v^2 \hbar}{4k} \int \varphi \frac{\partial^2 V}{\partial v^2} \partial m + \frac{1}{4} \hbar^2 m = 0$$

Clearly the magnetic field is not introduced in form I

So we can say that form 1 must be

$$-\frac{v^2 \hbar}{4k} \int \varphi \frac{B^2 r^2}{2V} \partial m + \frac{1}{4} \hbar^2 m = 0$$

Clearly

$$\frac{\partial^2 V}{\partial v^2} = \frac{B^2 r^2}{2V}$$

Or

$$-\frac{v^2 \hbar}{4k} \int \varphi \frac{Bh}{F_B \lambda} \partial m + \frac{1}{4} \hbar^2 m = 0$$

Again

$$\frac{\partial^2 V}{\partial v^2} = \frac{Bh}{F_B \lambda}$$

This equation leads our thought to a general prediction that a particle must exist similar to electron in nature like electrostatic charge (-1), behavior and may be mass but must possess a spin of $\frac{1}{4}$ therefore this electron like particle is not Fermionic in nature but it seems that it is elementary, if only electron is elementary. The e/m of this predicted particle is approximately equivalent to that of electron if its mass is nearly same as electron. This must have its own antiparticle like positron with all properties of positron excluding spin so spin is $\pm \frac{1}{4}$. The movement in magnetic field of these new particles and its antiparticle is same as electron and positron respectively. An electron neutrino like particle should also exist (as its partner) which must be chargeless but possess a spin of $+\frac{1}{4}$ and may be it is a Majorana like particles but not fermions. One needs to confirm these ideas in super weird physical laboratories.

So if we further look a bit forward then clearly it can be deduced that

From experience in CRT experiment one gets the relation

$$\frac{p}{2\pi r} - \frac{B\varphi}{h} = 0$$

Where P is the Newtonian momentum for an electron

Then it further shows the form II

$$0.0044 \times 10^{-7} \frac{1}{\varepsilon_0} \frac{mv^2}{r} \frac{\partial B}{\partial F_B} \int_{e^-}^{e^0} \frac{er}{m} \varphi \frac{\partial V}{\partial m} \partial v + h = 0$$

Where ε_0 is the physical constant of permittivity of free space, e^- = electrons charge = -1 and e^0 = neutral electron = 0 (electron neutrino)

These described equations (FORM I, and FORM II) seem to be sufficient in the experimental aspect inside cathode ray tube.

Data Accessibility- The data supporting this mathematical study are available on the "References" mentioned below.

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References

[1] JJ Thomson, 1897 "Cathode Rays" Phil. Mag.44, 293

[2] Deep Jyoti Dutta, 2018, International Journal of Research, vol-5, Issue-1, 337