Journal of Multidisciplinary Engineering Science Studies (JMESS)
ISSN: 2458-925X
Vol. 3 Issue 8, August - 2017

Quantum Mechanics: A Double-Slit Blunder

Bandula Dahanayake
Farmfield Crescent, Ottawa, Ontario, Canada K2M 2S9
Bandula_Dahanayake@yahoo.com

***Abstract*—Foundation of quantum mechanics lies on the de Broglie conjecture of wave particle duality, which is supported only by the double-slit experiment under the false assumption of one-to-one correspondence between the particles and bright spots on the phosphor display screen; a double-slit blunder. The bright spots on the screen are not a result of charge particles colliding with the display screen; in fact, no charge particle ever reaches the display screen. A single moving charge particle that never crosses the double-slit barrier generates an interference pattern of fringes in bright spots on the display screen. Since the interference pattern of a single particle is fleeting, the interference pattern can be sustained on the screen by using a beam of particles. What generates an interference pattern is the induced radiation. When a moving charge particle is stopped by the double-slit barrier, it generates electromagnetic radiation that gets diffracted by the two slits creating an interference pattern of bright spots corresponding to the peaks of the wave front on the screen. A single neutron also generates an interference pattern since the unstable neutrons disintegrate under collision releasing radiation. A moving atom generates an interference pattern, because, what are stopped at the double-slit barrier are the positive nucleus and the electrons that constitute the atom. A molecule also generates an interference pattern if the separation of the constituent charge particles of the molecule is comparable to the size of the molecule. The ability of a particle to pass through a hole is not determined by its momentum, it is determined by the diameter of the particle and the size of the hole. A particle is either here or there, not in both places at once. State of a particle is certain. Plank constant is not related to the mass of a particle, and there is no wave-particle duality; hence, neither the Schrödinger's equations nor the Dirac's equations hold true. An accelerating charge particle on a linear path does not radiate. For a moving charge particle to radiate, acceleration is necessary, but not sufficient. Electrons on circular orbits do not radiate, and hence Rutherford atom is stable. Orbiting systems do not collapse under perturbation. Every rocket that leaves the earth brings orbit contraction due to mass loss. If you are preaching quantum mechanics in the dark, just replace the phosphor display screen of the double-slit experiment with a simple particle detector, you will see the light.**

***Keywords—Quantum-Mechanics; Double-Slit; Interference; Atom;* Particle-Waves; Radiation; Orbit; Fields; relativity; Global-warming;**

I. INTRODUCTION

In 1905, there appeared the misconceived notion that the Maxwell's equations and the propagation of light were relative [3]. This notion of relativity of light led to believe that the electromagnetic energy can be represented as a product of momentum and the speed of light. This erroneous representation of electromagnetic energy as a product of momentum times the speed of light led to the wavelength λ and the momentum p relationship, λ=h/p, where h is the Plank constant [4, 5]. Since the light is not relative [8], light has no momentum, and hence the wavelength λ and momentum p relationship does not hold true for light or electromagnetic energy in general, and λ≠h/p. Although we now know the relationship λ=h/p does not hold true for electromagnetic waves, it was considered to be true for a very long time. The relationship λ=h/p that does not even hold true for electromagnetic waves was assumed to hold for matter particles simply because the relationship λ=h/p provided a convenient way to relate mass of a particle to the Plank constant through the momentum term present in the relationship [5]. Yet, no one knew what is meant by the wavelength λ of a matter particle or particle wavelength. The wavelength λ in the relationship λ=h/p, when it is applied to matter particles, is referred to as de Broglie waves or particle wavelength. Extending the idea of de Broglie waves, Schrödinger came up with a mathematical wave equation for particle waves. Since no one could envision what was that is waving at wavelength λ in a matter particle, a convenient new interpretation was introduced by proclaiming that the wave of a particle is the probability of finding the particle at a given location at a given time [4]. Some of the High School Physics Text Books went even further claiming that electromagnetic wave is the probability of finding a photon at a given location at a given time; preposterous. The application of de Broglie waves or particle wavelength λ=h/p and its descendent, the Schrödinger wave equation, is the genesis of the quantum mechanics.

Schrödinger's wave equation, Dirac's wave equation, uncertainty principle, quantum spookiness, and quantum mechanics in general have one thing in common. They all originated with one erroneous assumption of wave-particle duality where fictitious wavelength λ of a particle, is related to the momentum

p of the particle and Plank constant h by the relationship, λ=h/p. Without this relationship λ=h/p, there would be no quantum mechanics or quantum spookiness. The only support for the wave-particle duality conjecture came from the misinterpretation of the double-slit experiment. In the double-slit experiment, a beam of charge particles is used in place of a beam of light that was commonly used. With a beam of light, it is possible to use any screen to display the interference pattern since the light is visible. However, when a beam of particles are used, phosphor screen is used to display the interference pattern. When an interference pattern of bright spots appeared on the phosphor screen, everybody got excited and jumped into the conclusion that the bright spots are the result of particles collision with the phosphor screen. They completely forgot or disregarded the fact that the phosphor screen reacts not only to collision with particles but also to any electromagnetic wave front present on the screen. A phosphor screen reacts to the maxima and minima of an electromagnetic wave front; the points corresponding to the peaks of the wave front on the screen will be brighter compared to the rest.

When a beam of charge particles is used in the double slit experiment, an interference pattern consists of bright spots demarcating bright and dark fringes appeared on the phosphor screen behind the double-slit barrier. This interference pattern of bright and dark fringes in bright spots was used to validate the de Broglie conjecture that the particles behave as waves. What is wrong with this interpretation? Even though no one knew what is waving in a particle wave, or what to make out of this new concept of particle waves, everybody was marveled by the bright and dark fringes that appeared on the phosphor screen in a form of a series of bright spots or dots. It was subconsciously assumed that these bright spots were a result of charge particles colliding with the phosphor screen; a fair assumption on the surface, but a false conclusion on the hind side. It was further assumed without a proof that there is a one-to-one correspondence between the incoming particles and the bright spots on the phosphor screen. If one has taken the count of the number of particles entered the double-slit experiment and the number of bright spots appeared on the phosphor screen, they should have realized the mistake, but no one bothered to do that. The interference pattern of bright and dark fringes on the phosphor screen in bright dots, at least on the first glance, is convincing enough to conclude that the particles are behaving as waves. However, the conclusion that the interference patter of fringes on the phosphor screen in bright spots is because the particles are behaving as waves is simply incorrect, a double-slit blunder.

The fact of the matter is that the bright spots appearing on the phosphor screen are not due to the particles colliding with the screen. It is not necessary to have a beam of particles in the double-slit experiment. Even a single charge particle can generate an interference pattern of bright spots demarcating bright and dark fringes on the phosphor screen in the double-slit experiment. There is no one-to-one correspondence between the incoming charge particles and the bright spots on the phosphor screen. The bright spots on the phosphor screen are not due to the particles colliding with the screen. The interference pattern of bright and dark fringes in bright spots on the phosphor screen is not due to a wave behavior of particles, or particle waves.

In the double-slit experiment, no particle could ever reach the phosphor screen. All the incoming particles were stopped at the double-slit barrier. There is no opening on the double-slit barrier along the path of the beam of particles for the particles to pass through. The beam of particles is stopped at the double-slit barrier. No particle ever reaches the display screen in the double slit experiment. The two slits on the double-slit barrier are not along the path of the particles. If no charge particle ever could pass through the double-slit barrier, what created the interference pattern of bright spots demarcating bright and dark fringes on the phosphor screen? That is the question we are going to answer here.

Property-1.1:

There is no opening on the double-slit barrier along the path of the beam of particles for the particles to pass through.

II. MISGUIDED WAVE-PARTICLE DUALITY

The false notion of particles behaving as waves is based on the following false assumptions:

Assumption-1:

It was assumed that the light is relative [3]; electromagnetic energy is relative. We now know this assumption is incorrect [8].

If the light is relative, then the electromagnetic energy of a wave burst has a momentum. If the electromagnetic energy of a wave burst has a momentum, then the electromagnetic energy can be represented as a product of the momentum and the speed of light, i.e.

$$e=pc \tag{2.1}$$

where, e is the electromagnetic energy, p is the momentum and c is the speed of light.

Since the electromagnetic energy is proportional to its frequency, the electromagnetic energy e can be written as,

$$e=hf \tag{2.2}$$

where f is the frequency of the electromagnetic burst and h is the Plank constant.

Note: This ubiquitous relationship e=hf simply has no meaning as it is. The relationship e=hf holds true for electromagnetic wave bursts of limited time duration. Without a specific time width or duration, the relationship e=hf is meaningless. Light consists of electromagnetic wave bursts of universal time duration, which is a constant [7].

Combining eqn. (2.1) and (2.2) gives,

$$\lambda=h/p \tag{2.3}$$

Eqn. (2.3) relates the wavelength λ to the momentum of light energy under the false assumption that the light is relative.

Although p appears as the momentum, it is not a momentum in a conventional sense since light has no mass. Only a particle with a non-zero mass can have a momentum. Light has no mass. So, the momentum p as applied to electromagnetic energy is a mathematical construct, not a real momentum. Further, only the kinetic energy can be written as momentum times the speed. The electromagnetic energy cannot be represented as the product of momentum times the speed. So, we have e≠pc. As a result, even though e=hf is true, λ≠h/p.

Property 2.1

Electromagnetic energy has no momentum and hence, p≠e/c. Only the kinetic energy has momentum.

Corollary 2.1:

For electromagnetic waves, λ≠h/p. The momentum is not defined for electromagnetic energy. The momentum is defined only for a particle with non-zero mass.

Assumption-2:

It was assumed that the relationship λ=h/p holds for any particle with mass. This is incorrect.

For a particle with mass, the momentum p is given by,

$$p=mv \qquad (2.4)$$

where m is the mass of the particle and v is the speed of the particle.

Under this assumption a particle of mass m with speed v behaves as a wave of wavelength λ given by the relationship λ=h/p.

Both Assumption-1 and Assumption-2 are incorrect. The relationship λ=h/p does not hold for electromagnetic energy. Since electromagnetic energy has no mass, the momentum is not defined for the wavelength of an electromagnetic energy and hence λ≠h/p. The relationship λ=h/p is non-existent. It is not possible to extend a non-existent relationship to a particle with mass. The relationship, λ=h/p cannot be assumed to hold for a particle with mass. For both an electromagnetic wave burst as well as for a particle with mass λ≠h/p.

However, a beam of charge particles has been used in double-slit experiment with a phosphor display to validate the assumption that particles behave as waves or λ=h/p holds for particles. Now, we want to find out what exactly happen when a beam of particles is used in the double-slit experiment with phosphor screen. Let us first consider the double-slit experiment with a beam of light.

III. DOUBLE-SLIT EXPERIMENT WITH A BEAM OF LIGHT

The double-slit experiment (Fig.1) was originally used to show that the light is a wave [1]. When a beam of light passes through the slit-S in its path in the single-slit barrier, the light beam undergoes diffraction, and as a result, both the slit-P and slit-Q will be illuminated if,

$$d<2L_{SD}\lambda/w \qquad (3.1)$$

where, L_{SD} is the separation between the single-slit and the double-slit barrier, d is the separation between the slit-P and slit-Q in the double-slit barrier, λ is the wave length of the light beam, and w is the width of slit-S in the single-slit barrier. If the width of a slit, w is such λ<w, and yet, w is comparable to λ, then the light from the slit will be diffracted. If λ<<w, then, the light will travel in a straight line through the slits. Therefore, it is important to choose w comparable to λ while λ<w in the double-slit experiment.

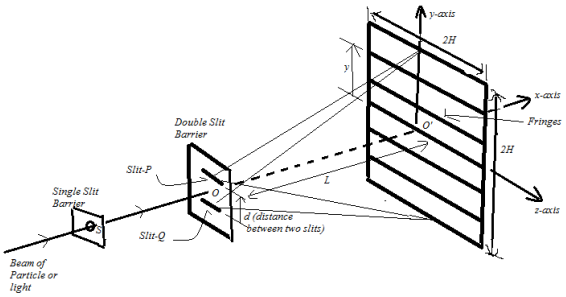

Fig. 1: Double-Slit Experiment with Light or a Beam of Charge Particles

If $d<2L_{SD}\lambda/w$, then, both slit-P and slit-Q will be within the main lobe of the diffracted beam from the slit-S of the single-slit barrier. Since slit-P and slit-Q are equidistance from the direction of the light beam, the light reaches slit-P and slit-Q on the double-slit barrier in-phase. If the width of the slit-P and slit-Q is w, then the width of the main lobe of the diffracted light from slit-P will be the same as the width of the main lobe of the diffracted light from slit-Q. If the display screen is L distance away for the double-slit barrier, then the height of the display screen will be within the main lobe of slit-P as well as within the main lobe of slit-Q, if,

$$H<L\lambda/w \qquad (3.2)$$

where, H is the height of the display screen and L>>H>>d, λ is the wavelength of the light, w is the width of both slit-P and slit-Q, and L is the distance between the double-slit barrier and the display screen, and d>>w.

When H<Lλ/w, the interference on the display screen will take place within the main lobes of the diffraction patterns from slit-P and slit-Q, and hence the diffraction pattern on the screen will be bright.

Bright lines appears when the light from slit-P and slit-Q interfere constructively on the screen, i.e. when,

$y=m\lambda L/d$, m=0, 1, 2,…

m is an integer and H<<L.

The bright lines or fringes will be repeating at every Lλ/d distance.

The dark lines appears when the light from slit-P and slit-Q interfere destructively, i.e. when,

$y=(m+\frac{1}{2})\lambda L/d$, m=0, 1, 2, …

m is an integer and H<<L.

Property 3.1:

i) A beam of light travelling through a slit undergoes diffraction.

ii) A beam of particles travelling through a slit does not undergo any diffraction. If the diameter of a particle is greater than the width of the slit, particle will be stopped on its path at the slit irrespective of its momentum; otherwise, the particle travels straight through the slit.

IV. DOUBLE-SLIT EXPERIMENT WITH A BEAM OF CHARGE PARTICLES

When a beam of charge particles is used in place of the visible light beam in the double-slit experiment, a phosphor display screen is used behind the double- slit barrier in place of the ordinary screen used in visible light. It doesn't matter whether it is a beam of light or beam of particles that is used in the double-slit experiment, when a phosphor display screen is used, the interference pattern of fringes will appear in bright spots. These bright spots correspond to the peaks of the electromagnetic wave front on the screen. The brightness at any point on the phosphor screen proportional to the strength of the wave front at that point, and hence the brightest points corresponds to the peaks of the wave front while the darkest point corresponds to the troughs of the wave front.

A large number of bright spots that appear on the screen demarcating the bright fringes represent the constructive interference between the two diffracted wave fronts from slit-P and slit-Q. The dark fringes correspond to the destructive interference of the diffracted wave fronts from slit-P and slit-Q.

However, in the past, when the double-slit experiment was carried out with a beam of charge particles, the bright spots on the screen were incorrectly interpreted as the point where the charge particles come to contact with the phosphor display screen. It was assumed that the bright spots were the direct result of the particles colliding with the phosphor screen, or there is a one-to-one correspondence between the particles and the bright spots on the phosphor display screen. In other words, it was incorrectly and shortsightedly concluded that the particles somehow has taken a detour from its path and traveled through the slits in a mysterious way creating an interference pattern of bright and dark fringes in bright spots. Since the interference pattern of bright and dark fringes is an indication that a wave has travelled through the slits, it was assumed that the particles must have behaved as waves in order to create an interference pattern of bright and dark fringes in bright spots. What do we have here? We have bright spots on the screen; we have bright and dark fringes on the screen; so, particles must have travelled through the slits in a pre-determined way as waves; that was the line of thinking that was used to interpret the result of the double-slit experiment; it is simply nonsense.

If particles were waves, then, the single-slit screen creates a diffraction pattern allowing the particles to fall on to the two slits on the double-slit barrier, although these two slits are not directly on the path of the beam of particles. The so-called particle waves from the two slits on the double-slit barrier again get diffracted as they travel through the slits creating two diffraction patterns that interfere on the phosphor display screen. The presence of bright spots on the display screen demarcating bright and dark fringes on the phosphor screen in the double-slit experiment, when a beam of charge particles are used, makes the argument that the particles behave as waves somewhat convincing although it is impossible. So, to this day, it has been the widely accepted belief that the particles hit the screen as a wave creating an interference pattern of bright and dark fringes in bright spots; this idea has lasted for almost a century without ever being questioned its believability or validity. This is in fact a misinterpretation of the results of double-slit experiment; a double-slit blunder.

When a beam of light is arrived at a slit, the light can pass through the slit irrespective the width of the slit. If the width of the slit is much bigger than the wavelength, then the light passes through the slit directly; otherwise, the light is diffracted. The width of the slit cannot prevent the light from passing through the slit. However, it doesn't matter what the so-called particle wavelength is, or it doesn't matter if such particle-wave exist or not, it doesn't matter what the momentum of the particle is, if the diameter of the particle is bigger than the width of the slit, no particle could pass through the slit. A beam of particles get stopped at the slit if the diameter of the particles is bigger than the size of the gate or the slit. If the diameter of the particles is smaller than the width of the slit, the particles travel straight without any diffraction. Without diffraction from the single-slit barrier in the double-slit experiment, particles have no possibility of landing on the two-slits on the double-slit barrier. Without diffraction, an interference pattern is not possible; it is the diffraction that generates an interference pattern.

If the diameter of the particles is less than the width of the slit on the single-slit barrier, since the single slit is on the path of the particles, the particles crosses the single slit straight and hit the double-slit barrier straight never reaching the two slits. The particles never come across the two slits on the double-slit barrier. The particles are completely stopped at the double-slit barrier. The particles can go through a barrier if and only if there is a slit along the path; the double-slit barrier has no such path. The particles have no way to cross and get to the other side of the double-slit barrier. The particles can't get to the phosphor screen. So, it is not the direct hit of the particles that created an interference pattern of bright and dark fringes in bright spots on the phosphor screen. If it is not the direct hit of the particles that created the interference pattern of bright spots, what exactly created the interference pattern of bright and dark fringes in bright spots? That is the question we have to answer.

Lemma 4.1:

A particle travel through a slit in a barrier does not generate diffraction. If the diameter of the particle is smaller than the width of the slit, and the slit is on the path of the particle, then, the particle passes through

the slit straight undisturbed; otherwise, particle is stopped at the barrier.

Corollary-4.1:
The so-called, non-existent, made-up particle wavelength λ=h/p does not determine how a particle pass through a slit. Whether a particle passes through a slit is determined by the diameter of the particle, width of the slit, and whether the slit is in the path of the particle.

Corollary-4.2:
A particle either go through a slit straight or it is stopped at the slit. There is no diffraction at a slit. In the absence of diffraction, there is no interference.

Corollary-4.3:
Contrary to the behavior of the particles, in the case of light, the size of a slit can't prevent light from passing through. The wavelength and the width of the slit determine the diffraction.

V. A BEAM OF CHARGE PARTICLES AND DOUBLE-SLIT INTERFERENCE PATTERN

When a beam of charge particles is used in the double-slit experiment, unlike a beam of light, if the diameter of the particles is smaller than the width of the slit in the single-slit barrier, since the slit is on the path of the particles, the particles take a straight path until the particles are stopped by the double slit barrier. There is no slit along the path of the beam on the double slit barrier. The two slits on the double-slit barrier are not along the path of the beam of particles; they are away from the path of the particles. It doesn't matter what the width of the two slits on the double-slit barrier is, the particles never reaches the slits.

When a beam of light is used, the light gets diffracted at the slit in the single-slit barrier allowing the light to fall on both the slits in the double-slit barrier. No such diffraction takes place at the slit in the single-slit barrier when a beam of particles is used. Therefore, particles do not reach any of the slits in the double-slit barrier. Since there is no slit on the double-slit barrier along the path of the particles, double-slit barrier prevents any particles crossing through it, and as a result, no particle ever reaches the phosphor display screen behind the double-slit barrier. Therefore, the interference pattern we observe on the phosphor screen is not from particles hitting the phosphor screen. If you replace the phosphor screen with a particle detector, it can be well assured that no particle will be detected there, behind the double-slit barrier.

The problem with the phosphor display screen is that it not only react to charge particle collisions, but also to the presence of electromagnetic wave front; peaks of an electromagnetic wave front, as well as the collision of charge particles will generate bright spots on a phosphor screen. However, in the double-slit experiment, all the charge particles are stopped by the double slit barrier since there is no slit on the double-slit barrier along the path of the beam of particles for the particles to cross the double-slit barrier. Therefore, the bright spots on the phosphor screen are not a result of particles colliding with the phosphor screen. It is due to completely different phenomena; what is that phenomena?

Nature's Motto:
No Diffraction – No Interference.

No matter what mass a particle has, no matter what speed particle is travelling at, no matter what momentum particle has, when a particle reaches an opening on its path, what determines whether the particle passes through the opening are the diameter of the particle and the width of the opening (hole or slit). If the width of the opening is greater than the diameter of the particle and the opening is on the path of the particle, then, the particle passes through; otherwise the particle will be stopped at the opening and the particle never reaches the other side of the barrier. Particles do not undergo diffraction at a slit. Only the waves undergo diffraction at a slit.

Corollary-5.1:
There are no mass-less particles. A particle by definition has a mass.

Corollary-5.2:
A particle or a beam of particles does not undergo diffraction when travelling through a slit, or a hole.

Corollary-5.3:
Electromagnetic waves have no mass. Electromagnetic waves are not particles. Electromagnetic waves come in bursts of finite length. The length of a burst is a universal constant [7].

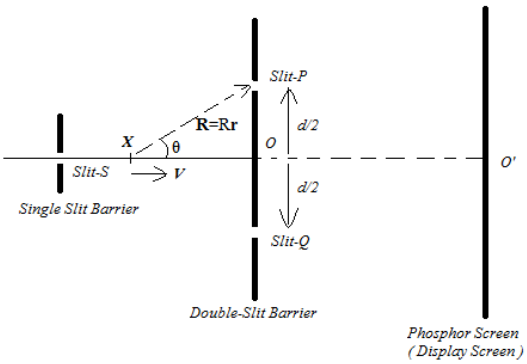

Fig. 2: Double-Slit Experiment with Particles (A Cross Section)

In the case of particles, it is the diameter of a particle that determines whether the particle can pass through a slit. The passing of a particle through a slit is not determined by fictitious, non-existent, imaginary, man-made particle-wavelength. The ability of a particle to pass through a hole is not determined by the momentum of that particle. Particles are not waves. There are no particle-waves. It is only the waves that undergo diffraction, not particles.

Assume we have a beam of particles travelling at a uniform speed V (Fig. 2).

Let us consider a charge particle at point X on its path travelling at speed V and the distant to the slit-P from X is XP and it is given by,

$$XP=R\mathbf{r} \quad (5.1)$$

where, R is length of |XP| and **r** is a unit vector along XP.

XO is the direction of the particle; θ is the angle between XP and XO. The velocity of the particle **V** is given by,

$$\mathbf{V}=V\mathbf{v} \quad (5.2)$$

where, V is the speed of the particle and **v** is the unit vector along the direction of the particle XO.

If the charge particle is moving at velocity **V**, the radiating magnetic field $\mathbf{B}_P$ at slit-P of the double-slit barrier due to the moving charge particle is given by [6],

$$\mathbf{B}_P=(\mu_o/4\pi R)\mathbf{I}_{rad} \quad (5.3)$$

$$\mathbf{I}_{rad}=(qV/\pi b)(\mathbf{v}\times\mathbf{r}) \quad (5.4)$$

where, q is the charge of the particle, μ_o is the permeability. The parameter b is the curvature of the path at the particle; in other words, small section of the path at the particle is a part of a circle of diameter b. The value of b varies in time with the path. Smaller the curvature of the path at the particle, the higher the radiation is. For a circular path b is a constant. For a linear path b is infinite. The term πb is missing in reference [6].

The radiating electric field $\mathbf{E}_P$ at slit-P of the double-slit barrier due to moving charge particle is given by,

$$\mathbf{E}_P=-\frac{\partial}{\partial t}[\mathbf{B}_P] \quad (5.5)$$

Substituting for $\mathbf{B}_P$ from eqn. (5.3), we get,

$$\mathbf{E}_P=-(\mu_o/4\pi R)\{(q/\pi b)\frac{\partial}{\partial t}[V(\mathbf{v}\times\mathbf{r})] - (q/\pi b^2)[V(\mathbf{v}\times\mathbf{r})]\frac{\partial}{\partial t}[b]\} \quad (5.6)$$

In the case of a circular path, the second term is zero since b is a constant for a circular path. In general, for a smooth path, the second term is comparatively negligible and hence,

$$\mathbf{E}_P=-(\mu_o/4\pi R)(q/\pi b)\{V\frac{\partial}{\partial t}[\mathbf{v}\times\mathbf{r}]+(\mathbf{v}\times\mathbf{r})\frac{\partial}{\partial t}[V]\} \quad (5.7)$$

When a particle is travelling on a straight path at uniform speed,

$$\frac{\partial}{\partial t}[V]=0 \quad (5.8)$$

$$\frac{\partial}{\partial t}[\mathbf{v}\times\mathbf{r}]=0 \quad (5.9)$$

Therefore, we have,

$$\mathbf{E}_P=0 \quad (5.10)$$

Since $\mathbf{B}_P=\nabla\times\mathbf{E}_P$, when $\mathbf{E}_P=0$, we have,

$$\mathbf{B}_P=0 \quad (5.11)$$

Therefore, there is no radiation, ($\mathbf{B}_P=0$, $\mathbf{E}_P=0$), when a beam of charge particles are travelling at uniform speed on a straight path.

Corollary-5.4:

Accelerating charge particle on a linear path does not radiate.

Proof:

When a path is linear, its curvature is infinite, i.e. $b\to\infty$. From eqn. (5.6), when $b\to\infty$, $\mathbf{E}_P\to 0$ irrespective of the speed of the motion, and irrespective of whether the particle is accelerating or not.

However, when a moving charge particle at uniform speed on a linear path is blocked or stopped by a barrier as it is in the case of double-slit barrier in the double-slit experiment, situation changes. The curvature b is now finite. When a charge particle is moving uniformly, there is no radiation, but when it is stopped suddenly at the double-slit barrier, a sudden change in speed and path take place, and hence $\frac{\partial}{\partial t}[V]\neq 0$, $\frac{\partial}{\partial t}[\mathbf{v}\times\mathbf{r}]\neq 0$, and b is finite, resulting in radiation, ($\mathbf{B}_P\neq 0$, $\mathbf{E}_P\neq 0$).

In the double-slit experiment, charge particles are moving at uniform speed on a linear path just before they hit the double-slit barrier. A sudden change in speed takes place in a very small time interval when a particle is blocked or prevented from moving any further at the double-slit barrier. The speed of a charge particle changes from V to zero at a very small time interval Δt, as the particle reaches point O on the double-slit barrier. So, we have,

$$\frac{\partial}{\partial t}[V]|_{at\ o}=\frac{(V-0)}{\Delta t} \quad (5.12)$$

$$\frac{\partial}{\partial t}[V]|_{at\ o}\neq 0 \quad (5.13)$$

Since $\frac{\partial}{\partial t}[V]$ is no longer zero when a particle hits the double-slit barrier, the radiating electromagnetic field ($\mathbf{B}_P$, $\mathbf{E}_P$) at slit-P, and the radiating electromagnetic field ($\mathbf{B}_Q$, $\mathbf{E}_Q$) at slit-Q are no longer zero.

From eqns. (5.3) and (5.4), we have,

$$\mathbf{B}_P=(\mu_o/4\pi R)(qV/\pi b)(\mathbf{v}\times\mathbf{r}) \quad (5.14)$$

The slit-P and the slit-Q are equidistance from a charge particle. Since the separation of the slits is d, when a charge particle reaches the double-slit barrier, we have,

$$R=d/2 \quad (5.15)$$

In addition, when a particle reaches the point O on the double-slit barrier, the unit vectors **v** and **r** are perpendicular to each other and hence θ=π/2. As a result, we get,

$$\mathbf{v}\times\mathbf{r}=1 \quad (5.16)$$

Now, we have the magnetic field $\mathbf{B}_P$ at slit-P given by,

$$\mathbf{B}_P=(\mu_o/2\pi d)(q/\pi b)V|_{at\ O} \quad (5.17)$$

The change of the magnetic field $\mathbf{B}_P$ at slit-P, $\frac{\partial}{\partial t}[\mathbf{B}_P]$ is given by,

$$\frac{\partial}{\partial t}[\mathbf{B}_P]=(\mu_o/2\pi d)\{(q/\pi b)\frac{\partial V}{\partial t}|_{at\ O} - (qV/\pi b^2)\frac{\partial}{\partial t}[b]\} \quad (5.18)$$

We also know that,

$$\frac{\partial V}{\partial t}|_{at\ O}=\frac{V-0}{\Delta t} \quad (5.19)$$

Similarly, from symmetry, we have the magnetic field $\mathbf{B}_Q$ and the rate of change of the magnetic field $\frac{\partial}{\partial t}[\mathbf{B}_Q]$ at slot-Q,

$$\mathbf{B}_Q=(\mu_o/2\pi d)(q/\pi b)V|_{at\ O} \quad (5.20)$$

$$\frac{\partial}{\partial t}[\mathbf{B}_Q]=(\mu_o/2\pi d)\{(q/\pi b)\frac{\partial V}{\partial t}|_{at\ O} - (qV/\pi b^2)\frac{\partial}{\partial t}[b]\} \quad (5.21)$$

Therefore, when a charge particle hits the double-slit barrier at O, the electromagnetic fields at the two

slits off the path of the particle, at each slit at distance d/2 from O, are given by,

$$\mathbf{E}_P=-\frac{\partial}{\partial t}[\mathbf{B}_P]\neq 0 \quad (5.22)$$

$$\mathbf{E}_Q=-\frac{\partial}{\partial t}[\mathbf{B}_Q]\neq 0 \quad (5.23)$$

where, $\mathbf{E}_P$ and $\mathbf{E}_Q$ are the radiating electric field at slit-P and slit-Q respectively. From symmetry, the electromagnetic fields at slit-P and slit-Q are in-phase.

Corollary- 5.3:

In the double-slit experiment, when a charge particle traveling at uniform speed is stopped at the double-slit barrier, it generates a radiating electromagnetic field at the two slits off the path of the particle. The electromagnetic fields at the two slits are in-phase since the two slits are equidistance away from the path of the particle.

VI. INTERFERENCE PATTERN OF THE DOUBLE-SLIT EXPERIMENT FOR A BEAM OF CHARGE PARTICLES

So far we have seen how radiating electromagnetic field is generated when a charge particle moving at uniform speed is stopped at the double-slit barrier in the double-slit experiment carried out with a beam of particles. This generated electromagnetic field passes through the two slits toward the phosphor display screen. When the electromagnetic field passes through slit-P, the slit-P creates a diffraction pattern. When the electromagnetic field passes through slit-Q, the slit-Q also creates a diffraction pattern.

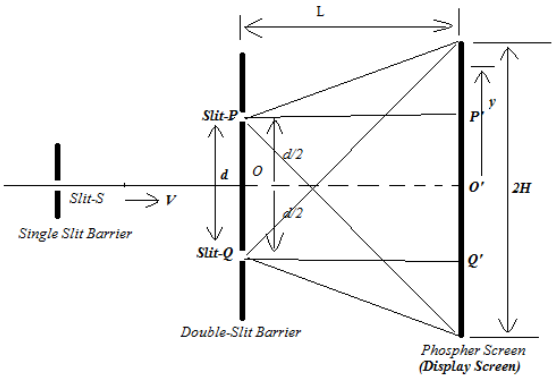

Fig. 3: Interference due to radiation generated from charge particles being stopped by the double-slit barrier

The diffraction pattern of radiating electromagnetic field from slit-P is centered at P'. The diffraction pattern from slit-Q is centered at Q'. These are shown in Fig. 3. The separation d of the slits on the double slit barrier is much smaller than the width 2H of the display screen, d<<2H. Further the width w of the slit-P and slit-Q are greater than the wavelength λ of the induced electromagnetic radiation due to the charge particles being stopped at the double-slit barrier, w>λ. Although w>λ, the width of the slit, w is comparable to the wavelength, λ, and as a result the main lobe of the diffraction pattern will be larger. The main lobes of the diffraction patterns will fill the screen if,

$$H<\lambda L/w \quad (6.1)$$

where, w is the width of the slit-P and slit-Q, λ is the wavelength of the radiation that is generated as a result of the charge particles being stopped at the double-slit barrier, 2H is the height of the screen, and H<<L. Since d<<H, when, H<λL/w, the interference between the waves from the slit-P and slit-Q takes place on the display screen within the main lobe of the each diffraction pattern. When interference occurs within the main lobe of the diffraction patterns of the two slits, slit-P and slit-Q, the fringes on the phosphor screen will be brighter.

The wavelength λ of the generated radiating electromagnetic field is not in the visible region of the electromagnetic spectrum. Therefore, a screen that is used for a beam of light in the double-slit experiment cannot be used when the double-slit experiment is carried out with a beam of particles.

The display screen must be sensitive to the intensity of the electromagnetic radiation. Therefore, a phosphor screen similar to a television screen that is sensitive to the intensity of the electromagnetic wave front is used. If the double-slit experiment consists of a phosphor screen, then whether the double-slit experiment is carried out with a beam of light or with a beam of particle, the interference pattern of bright and dark fringes on the phosphor screen will always be in bright spots. The bright spots correspond to the peaks of the electromagnetic wave front on the screen while the dark areas correspond to the valleys of the electromagnetic wave front on the phosphor screen.

Confusion can occur since collisions of charge particles with the phosphor display screen also create bright spot on the screen. One may erroneously interpret that the bright spots on the phosphor screen are the result of the direct collision of the charge particles with the phosphor display screen, as it had been done in the past in the double-slit experiment. However, since there is no slit on the double-slit barrier along the path of the particles, no particle can cross the double-slit barrier; all the particles are being stopped by the double-slit barrier. Therefore, the bright spots on the phosphor screen are completely due to the peaks of the electromagnetic wave front on the phosphor display careen. If you replace the phosphor screen with a particle detector, no particle would be found there, behind the double-slit barrier. If the phosphor display screen is replaced with an electromagnetic wave detector, the detector will indicate the presence of electromagnetic waves behind the double-slit barrier.

The two diffracted wave fronts interfere at vertical distance y on the screen from O', when,

$$y=m(\lambda L/d),\ m=0, 1, 2, \ldots \quad (6.2)$$

where, m is an integer, mλ<d, and y<<L.

The two diffracted wave fronts interfere destructively when,

$$y=(m+\tfrac{1}{2})(\lambda L/d),\ m=0, 1, 2, \ldots \quad (6.3)$$

Since y ≤ H, we can obtain the maximum number of bright fringes on the screen using the inequality,

$$m(\lambda L/d) \leq H \quad (6.4)$$

$$m \leq dH/\lambda L \quad (6.5)$$

So, we have,

$$m_{max} = dH/\lambda L \quad (6.6)$$

where, m_{max} is the maximum number of fringes.

The maximum number of fringes in the +y direction is dH/λL and the maximum number of fringes in the –y direction is also dH/λL from the symmetry. Therefore, the total number of fringes on the screen within the main lobes of the diffraction lobes is given by,

$$m_{total}=2(dH/\lambda L) \quad (6.7)$$

Lemma-6.1: Maximum Number of Fringes

The maximum number of fringes on the phosphor screen of the double slit experiment is given by,

Maximum Number of Fringes=2(dH/λL).

where, d is the distance between the slits, 2H is the height of the phosphor screen, λ is the wave length of the electromagnetic wave, L is the separation between the double-slit barrier and the phosphor screen.

The electromagnetic field at any point (x, y, z) due to the diffraction wave front from slit-P, $\mathbf{E}_P(x, y, z)$ can be written as,

$$\mathbf{E}_P(x, y, z)=E_o\exp\{jk(y-d/2)\}\exp\{jkz\}\exp\{j(kx-\omega t)\} \quad (6.8)$$

where, ω=2πf, and f is the frequency of the radiation, E_o is the amplitude of the electromagnetic wave burst, $E_o=|\mathbf{E}_P|$; k is the wave number and k=2π/λ.

We get the electromagnetic field $\mathbf{E}_P(y, z)$ on the phosphor display screen when x=L,

$$\mathbf{E}_P(y, z)=\mathbf{E}_P(x=L, y, z) \quad (6.9)$$

i.e.

$$\mathbf{E}_P(y, z)=E_L\exp\{jk(y-d/2)\}\exp\{jkz\}\exp\{-j\omega t\} \quad (6.10)$$

where $E_L=E_o\exp\{jkL\}$.

Similarly, the electromagnetic field $\mathbf{E}_Q(y, z)$ from slit-Q at any point (y, z) on the screen is given by,

$$\mathbf{E}_Q(y, z)=E_L\exp\{jk(y+d/2)\}\exp\{jkz\}\exp\{-j\omega t\} \quad (6.11)$$

The resultant interfered field $\mathbf{E}_L(y, z)$ at any point (y, z) on the screen is given by,

$$\mathbf{E}_L(y, z)= \mathbf{E}_P(y, z)+\mathbf{E}_Q(y, z) \quad (6.12)$$

Substituting for $\mathbf{E}_P(y, z)$ and $\mathbf{E}_Q(y, z)$ from eqns. (6.10) and (6.11), we get,

$$\mathbf{E}_L(y, z)= E_L\exp\{jk(y-d/2)\}\exp\{jkz\}\exp\{-j\omega t\} + E_L\exp\{jk(y+d/2)\}\exp\{jkz\}\exp\{-j\omega t\} \quad (6.13)$$

$$\mathbf{E}_L(y, z)=E_L[\exp\{-jkd/2\}+\exp\{jkd/2\}]\exp\{jky\}\exp\{jkz\}\exp\{-j\omega t\} \quad (6.14)$$

$$\mathbf{E}_L(y, z)=2E_L\cos(kd/2)\exp\{jky\}\exp\{jkz\}\exp\{-j\omega t\} \quad (6.15)$$

The maximum amplitude of the electric field on the phosphor screen is given by, $|\mathbf{E}_L(y=0, z=0)|$,

$$|\mathbf{E}_L(y=0, z=0)|=2E_L\cos(kd/2) \quad (6.16)$$

The electromagnetic wave front $\mathbf{E}_L(y, z)$ will be maximum when y=0 and z=0 on the phosphor display screen. In other words, the interference pattern is centered at O', where O' is the center point of P'Q'. The point O' is the point on the screen where particles should have hit if there had been an opening on the double-slit barrier along the path of the particles.

Important Observations:

1. If only the slit-P is open, i.e. the slit-Q is closed, then, the diffraction pattern on the screen will be centered on y=d/2. There will be no interfering fringes.
2. If only the slit-Q is open, i.e. the slit-P is closed, then, the diffraction pattern on the screen will be centered on y=−d/2. There will be no interfering fringes.
3. If both slit-P and slit-Q are open, the diffraction pattern from slit-P interferes with the diffraction pattern from the slit-Q creating bright and dark fringes. These bright and dark fringes will be in bright spots. Each bright spot has a one-to-one correspondence to the peaks of the wave front on the phosphor screen. The interference pattern will be centered on y=0 or at O' on the phosphor screen.
4. There is no spookiness to why the interference pattern is centered on y=0, while individual diffraction patterns are centered at y=d/2 and y=-d/2.

VII. THE NUMBER OF BRIGHT SPOTS ON THE SCREEN DUE TO A SINGLE CHARGE PARTICLE

The interfered electromagnetic field $\mathbf{E}_L(y, z)$ on the screen has peaks and valleys. Each particle that is stopped by the double-slit barrier generates a burst of electromagnetic wave front $\mathbf{E}_L(y, z)$ on the screen. The peaks in the wave front $\mathbf{E}_L(y, z)$ correspond to the bright spots on the screen.

From eqn. (6.7), we know that the number of peaks in the wave front $\mathbf{E}_L(y, z)$ in both ±y directions is 2dH/λL. Since the display screen is a square and the length of a side is 2H, the number of peaks in both ±z directions will be 2H/λ. So, at any time, when peaks are present in the wave front, the number of peaks n_{peaks} within the phosphor display screen is given by,

$$n_{peaks}=[2dH/\lambda L][2H/\lambda] \quad (7.1)$$

Since the phosphor screen is a square of length 2H, the area of the screen A is given by,

$$A=(2H)(2H) \quad (7.2)$$

Therefore, the number of peaks on the phosphor screen is given by,

$$n_{peaks}=Ad/\lambda^2L. \quad (7.3)$$

The points corresponding to the peaks of the wave front will be brighter than the rest of the area resulting in an interference pattern of bright spots. One bright spot on the screen does not correspond to charge particle collision with the screen. Instead for every single charge particle that is stopped at the double-slit barrier, a set of bright spots will appear on the screen illustrating the interference pattern. If the duration of the electromagnetic burst that is produced by the collision of a single charge particle with the double-slit barrier is, τ, in other words, if the time span of $\mathbf{E}_L(y, z)$ is τ, then, a set of [2dH/λL][H/λ] bright spots will appear on the screen τ f time, where f is the frequency of the electromagnetic radiation.

For each charge particle that is stopped by the double-slit barrier, a total of,

[2dH/λL][2H/λ] τf,

bright spots will be displayed on the phosphor display screen indicating the interference pattern of bright and dark fringes. The number of fringes will be,

2dH/λL.

Lemma-7.1:

The bright spots appear on the phosphor display screen in the double-slit experiment do not have one-to-one correspondence with the incoming particles.

Theorem-7.1:

The number of bright spots, n_{spots}, on the phosphor screen in the double-slit experiment for a single particle is given by,

$n_{spots} = Ad/\lambda^2 L$

where, A is the area of the screen, d is the separation of the two slits, L is the distance between the double-slit barrier and the phosphor screen, and the λ is the wavelength of the generated radiation.

Corollary-7.1:

It is not necessary to have a beam consists of many charge particles to generate an interference pattern on the phosphor screen. A single particle travelling at uniform speed on a straight path will generate an interference pattern on the phosphor screen.

Corollary-7.2:

The ability to generate an interference pattern on a phosphor display screen by a single charge particle is an indication that it is not the collision of the particles with the phosphor display screen that creates an interference pattern.

Lemma-7.2:

Particles do not behave as waves. Particles are not waves irrespective of the size of particles.

Lemma-7.3:

What generate an interference pattern on the phosphor display screen in the double-slit experiment are the diffracted electromagnetic wave fronts from the two slits; electromagnetic wave is generated when a charge particle is stopped suddenly at the double-slit barrier.

It is a misinterpretation of the double-slit experiment that led to the long held, wide spread belief that particles behave as waves at microscopic level. It doesn't matter how small a charge particle is, a charge particle does not have a wave behavior. For a particle to go through a hole, the diameter of the particle must be smaller than the diameter of the hole, and the hole must be on the path of the particle; otherwise, the particle will be stopped at the hole. It is not some mysterious, man-made, false, non-existent particle-wavelength or some voodoo behavior of particles that determines the passing of a particle through a hole. The momentum of a particle does not determine its ability to pass through a barrier. It doesn't matter what the momentum of a particle is, it doesn't matter whether the particle is microscopic or not, if the hole on the barrier is not along the path of the particle or the diameter of the particle is greater than the size of the hole, the particle cannot pass through the barrier; there is no magic. In the double-slit experiment, a particle cannot cross to the other side of the double-slit barrier if there is no hole on the barrier along the path of the particle. Even when there is a hole on the barrier along the path of the particle, the particle cannot cross the barrier if the diameter of the particle is larger than the size of the hole.

Corollary-7.3

If we replace the phosphor screen with a particle detector in the double-slit experiment, the reading on the particle detector will be zero, indicating the absence of particles at the phosphor screen. In contrast, we will get a positive reading if we replace the phosphor screen with an electromagnetic wave detector, indicating the presence of electromagnetic waves at the screen.

Corollary-7.4:

The probability of finding a particle on the phosphor display screen in the double-slit experiment is always zero.

VIII. DOUBLE SLIT EXPERIMENT WITH NEUTRAL PARTICLES

(a) A Neutron or a Beam of Neutrons

Now, we know that the charge particles do not have wave behavior. However, it has been reported [5] that when a double-slit experiment is carried out with a beam of neutrons, it has also generated an interference pattern on the phosphor screen. Since the neutrons are neutral, and have no electric charge, the stopping of moving neutrons at the double-slit barrier does not itself generate any radiation. Now, the question is, why does a beam of neutrons generate an interference pattern of bright and dark fringes in bright spots on the phosphor screen of the double-slit experiment?

In the double-slit experiment, all the neutrons are blocked by the double-slit barrier since there is no slit on the barrier along the path of the particles. Neutrons cannot get into the other side. Since the electric charge of a neuron q=0, no matter what momentum it has or what change in speed it undergoes, there will not be any generation of radiation. No particles are hitting the phosphor screen; no radiation wave front due to the stopping of the neutron at the barrier is present; what creates an interference pattern on the screen?

However, one thing is note worthy. Here again, even a single neutron can produce an interference pattern on the phosphor screen of the double-slit experiment. This is a key feature of the double-slit experiment. A single electron, proton, neutron or any charge particle can generate an interference pattern of bright and dark fringes on the phosphor screen in bright spots. So, why does a single neutron create an interference pattern of bright and dark fringes in bright spots on the phosphor screen in the double-slit experiment?

In order to answer this question, it is important to consider the physical nature of neutrons. We know that neutrons by themselves unstable. When a moving neutron collides with the double-slit barrier, the neutron disintegrates into a proton, an electron, and releases an electromagnetic wave burst [5, 7].

Neutron → proton + electron + A Wave Burst.

It is this unleashed electromagnetic wave burst together with the electromagnetic radiation generated by the change in speed of the newly created charge particles, proton and electron, that play an important role in the double-slit experiment with neutrons. Although neutrons cannot pass through the barrier since there is no slit along the path, this electromagnetic radiation can pass through the slits. This electromagnetic radiation gets diffracted while travelling through the two-slits creating an interference pattern of fringes in bright spot on the phosphor screen. A single neutron can produce an interference pattern on the phosphor screen. Even an atom or molecule can also produce an interference pattern. In order for a particle used in the double-slit experiment to generate an interference pattern, the particle has to satisfy any of the following conditions:

1. Particle has a non-zero electric charge.
2. Particle disintegrates into charge particles under impact.
3. Particle releases an electromagnetic wave burst under impact.
4. A neutral particle consists of charge particles, and the dimension of the particle is in the same order as the distance between the constituent charge particles.

A particle that does not satisfy any of the above conditions will not produce an interference pattern in the double-slit experiment. A neutral macroscopic particle, by definition, does not satisfy any of the above conditions and hence does not generate an interference pattern on the phosphor screen in the double-slit experiment.

(b) A Neutral Atom or a Beam of Neutral Atoms

A neutral atom or a beam of neutral atoms also generates an interference pattern in the double-slit experiment. When we consider an atom, it is important to note that the dimension of an atom is comparable to the distance between the charge particles the atom consists of. When a moving atom hits the double-slit barrier, what is stopped at the double-slit barrier in no longer the atom itself, but its constituent charged particles, positively charged nucleus and negatively charged electrons. When these moving positively charged nucleus and negatively charged electrons are stopped at the double-slit barrier, it results in electromagnetic radiation. It is this electromagnetic radiation that is responsible for generating an interference pattern on the phosphor display screen when an atom is used. The interference pattern generated by a single atom is fleeting, and it dies out fast. However, by using atoms periodically, it is possible to sustain the interference pattern on the phosphor screen. In other words, the use of a beam of atoms, instead of a single atom, allows us to obtain an interference pattern that is sustainable on the phosphor screen; the interference pattern will be visible on the screen as long as the beam of atoms is present.

Lemma-7.4:

A single atom or a beam of atoms also generates an interference pattern of bright and dark fringes on the phosphor screen in bright spots in the double-slit experiment.

(c) A Neutral Molecule or a Beam of Molecules

A neutral molecule or a beam of neutral molecules can also generate an interference pattern in the double slit experiment provided that the distance between the charge particles that constitute the molecule is comparable to the size of the molecule itself. In that case, what is stopped at the double-slit is barrier is not just the molecule itself, but the individual charge particles that constitute the molecule, resulting in electromagnetic radiation.

Lemma-7.5:

In a molecule, ff the distance between the charge particles that constitute the molecule is in the same scale as the size of the molecule, then the molecule or a beam of molecules will generate an interference pattern in the double-slit experiment.

(d) A Neutral Object or a Beam of Neutral Objects

If an electrically neutral macroscopic object such as a golf ball is used instead of an atom in the double-slit experiment, what is stopped at the double-slit barrier is the golf ball itself, not the charged particles that constitute the golf ball. Therefore, there will be no interference pattern present on the display screen in the double-slit experiment if a golf ball or a beam of golf ball is used. In order for a neutral object to generate an interference pattern, the size of the object must be in the same order as the distance between the individual charge particles the object consists of.

Definition-7.1: Macroscopic Object

If the separation of electrons and protons that the object consists of is negligible compared to the dimension of the object, then, the object is macroscopic.

Lemma-7.6:

A moving neutral macroscopic object does not generate an interference pattern of bright and dark fringes on the phosphor screen in the double-slit experiment since what is stopped at the double-slit barrier is the neutral macroscopic object as a whole, and not the individual charged particles the object consists of.

IX. ELECTROMAGNETIC RADIATION

A moving charge particle radiates under certain conditions. Not every moving charge particle is subjected to radiation. There are two situations where a moving charge particle does not generate radiation:

1. A moving charge particle on a linear path does not generate radiation irrespective of whether the

particle is under uniform speed or under acceleration; from eqn. (5.6) it is clear that when a particle is on a linear path, the curvature of the path is infinite and hence the radiation is zero irrespective of the speed it is travelling at.

2. A moving charge particle on a circular path at a uniform speed does not generate radiation [6].

Theorem-9.1: Necessary Condition for Radiation
Acceleration of a charge particle is necessary for a moving charge particle to generate radiation but not sufficient.

Theorem-9.2: Sufficient Conditions for Radiation
The change of speed of a charge particle is sufficient for it to undergo radiation.

Not every charge particle under acceleration generates radiation. A charge particle at stand still on a gravitational object is under acceleration, yet, it does not undergo any radiation. As it is clear from eqn. (5.6), in order for a charge particle to generate radiation, its position has to change with respect to current position in the direction of acceleration on a non-linear path.

(a) Charge Particles on Circular Orbits:

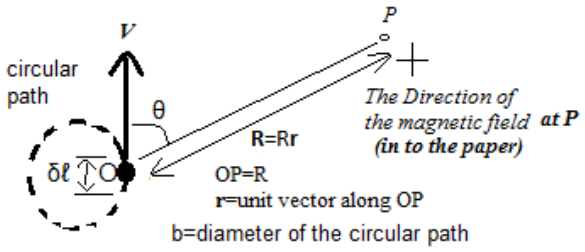

Fig. 4: Particle at small section δℓ of the path

When a charge particle O is moving at constant speed V, the magnetic field at point P is given by,

$$\mathbf{B}=(\mu_o/4\pi R)(qV/\pi b)(\mathbf{v}\times\mathbf{r}) \quad (9.1)$$

where **v** is the unit vector at O in the direction of the particle velocity **V**, **r** is the unit directional vector in the direction OP, b is the diameter of the circular path, q is the electric charge of the particle, and R is the distance to the point P from the particle O or distance OP.

The radiation at point P is determined by $\frac{\partial}{\partial t}$ [**B**] and the $\frac{\partial}{\partial t}$ [**B**] is determined by the time variation of the vector cross product (**v**×**r**) and the time variation of the diameter of the path $\frac{\partial}{\partial t}$ [b]. For a circular path, the diameter of the path, b is a constant and hence,

$\frac{\partial}{\partial t}$ [b]=0.

Therefore, time variation of **B**, i.e., $\frac{\partial}{\partial t}$ [**B**] is solely determined by the vector cross product (**v**×**r**). Since the direction of the particle, vector **v** at O is proportional to a small section δ**ℓ** of the path at the particle O, i.e. **v**=α δ**ℓ**, where α is a scalar quantity, the radiation is determined by the time variation of (δ**ℓ**×**r**). For a circular path (δ**ℓ**×**r**) is time invariant. The vector cross product (δ**ℓ**×**r**) is the same irrespective of where on the circular path the particle is. If the particle moves to any point O' on the circular path, the magnetic field at distance R at an angle θ to the direction of the motion of the charge at O' will remain the same as the field at point P when the particle was at O, i.e.

$$(\delta\boldsymbol{\ell}\times\mathbf{r})_{\text{at O}}=(\delta\boldsymbol{\ell}\times\mathbf{r})_{\text{at O'}} \quad (9.2)$$

where, O and O' are the points on the circular path.

Since O and O' are any two points on the circular path, we have, δ**ℓ**×**r**=constant

Therefore, for a circular path, we have,

$$\frac{\partial}{\partial t}[\mathbf{B}]=0 \quad (9.3)$$

When $\frac{\partial}{\partial t}$ [**B**]=0, the radiating electric field **E**=0. Since radiating field **B** has no independent existence, when, **E**=0, we have, **B**=0.There is no radiation when a particle is moving on a circular path.

Theorem-9.3: Circular Orbit Theorem
Orbiting charge particles at uniform speed on circular orbits do not radiate. Rutherford atom with circular orbits is stable.

(b) Birth of Quantum Mechanics

When Rutherford introduced the planetary model of the atom where electrons are orbiting the nucleus, it was rejected under the following false assumptions:

1. Assumption that the orbiting electrons radiate; not true (Orbiting electrons on circular orbits do not radiate [6]).
2. Assumption that the radiation leads to the slowing down of the electrons causing them to spiral down to the nucleus and hence the collapse of the orbiting system; not true [9] (Orbiting systems do not collapse due to change in speed or any other perturbations; orbiting systems are stable.)

The idea of quantum mechanics had been brought forward under the impression that it could address the long held false notion that the orbiting electrons are subjected to radiation, and as a result Rutherford atom with circular orbits would be unstable. Hence, it was believed that by introducing uncertainty into the position and speed, it could be possible to overcome the problem with radiation loss due to the motion of the electrons in an atom. In quantum mechanics, the position of an electrons and its speed are considered uncertain. It was considered that the electrons do not have a specific position or a velocity, which led to the quantum spookiness. However, one important fact was completely overlooked in this philosophy of quantum uncertainty. If the position and velocity of electrons are uncertain, and the where about of an electron can only be described by probability, then that itself generates radiation.

Corollary-9.1: Uncertainty and Radiation

Uncertainty of position and velocity of an electron or of any charge particle generates radiation and the collapse of the atomic structure. Uncertainty of a charge particle breeds radiation.

If a position of an electron is uncertain, it must be moving randomly. If the velocity of an electron is uncertain, it must be moving randomly. The random motion of an electron generates radiation. There is no possible way for the quantum mechanical model of an atom to escape the radiation loss of electrons. Electrons appear in one place only to disappear and magically reappear in some other place (Houdini-fication) will generate radiation. If the orbiting electrons spiral down in to the nucleus in the Rutherford atom due to radiation loss, so do the electrons in the quantum mechanical model.

There are only two possible paths for a charge particle to move without undergoing any radiation:

1. A linear path at any speed; at a constant or at an accelerating speed.
2. Circular orbit at constant speed.

There are no other possible paths for a charge particle to move without subjected to radiation. Since it is not possible for an electron to take a linear path in an atom, the only path an electron in atom could take without being subjected to radiation is a circular orbit at constant speed.

Lemma-9.1:

The only possible paths electrons in an atom can take without being subjected to radiation loss are the circular orbits at uniform speed.

(c) Orbiting Systems and Stability

To suggest that the reduction of speed of an orbiting particle leads to its spiraling down and the collapse of the orbiting system is to suggest that orbiting systems are in a very precarious state where even a small perturbation will make the system to collapse. If orbiting systems are unstable, every time a space explorer lifts off the earth to venture into outer space, the mass of the planet is reduced and hence the speed of the planet is increased making the planet to spiral out uncontrollably to the oblivion resulting in the collapse of the orbiting system. Similarly, every time an asteroid or meteorite hit a planet, the speed of the planet is reduced and as a result the planet should spiral down into the sun uncontrollably making the orbiting system to collapse. On earth we send space explorers into the outer space; yet, we do not see earth spiraling out into the oblivion uncontrollably. We see asteroid and meteorites hit the earth occasionally; yet, earth hasn't spiraled down into the sun uncontrollably. We do not see that happening. Orbiting systems are not in such a precarious critical stable state where even a minute perturbation result in the total collapse of the system. Orbiting systems do not spiral down or out leading to the total collapse of the orbiting system under perturbation. Orbiting systems are stable. The reduction of the speed of an orbiting object does not make the object to spiral down; similarly, the increase of the speed of an orbiting object does not make the object to spiral out. What actually happens is the complete opposite. The reduction in the orbiting speed of an orbiting object leads to orbit dilation, while the increase in the speed of an orbiting object leads to orbit contraction. Let us see how this happens.

(d) Stability of Orbiting Systems under Perturbation

Consider an orbiting system where mass m is orbiting at distant r from the center of mass M. If the mass m is orbiting at speed v, then,

$$GM=rv^2 \quad (9.4)$$

$$mv=\text{constant} \quad (9.5)$$

where, G is the gravitational parameter.

Differentiating with respect to time, we get,

$$G\frac{\partial M}{\partial t} + M\frac{\partial G}{\partial t} = 2rv\frac{\partial v}{\partial t} + v^2\frac{\partial r}{\partial t} \quad (9.6)$$

Since $G=rv^2/M$, and $M=rv^2/G$, we get,

$$(rv^2/M)\frac{\partial M}{\partial t} + (rv^2/G)\frac{\partial G}{\partial t} = 2rv\frac{\partial v}{\partial t} + v^2\frac{\partial r}{\partial t} \quad (9.7)$$

Dividing by v^2, we get,

$$\frac{r}{M}\frac{\partial M}{\partial t} + \frac{r}{G}\frac{\partial G}{\partial t} = 2\frac{r}{v}\frac{\partial v}{\partial t} + \frac{\partial r}{\partial t} \quad (9.8)$$

Rearranging eqn. (9.8), we get,

$$\frac{\partial r}{\partial t} = -2\frac{r}{v}\frac{\partial v}{\partial t} + \frac{r}{M}\frac{\partial M}{\partial t} + \frac{r}{G}\frac{\partial G}{\partial t} \quad (9.9)$$

If $\frac{\partial v}{\partial t} > 0$, orbiting distance r decreases with time resulting in orbit contraction. In other words, it the speed of the orbiting object increases, then, the orbit contracts.

If $\frac{\partial v}{\partial t} < 0$, orbiting distance r increases with time resulting in orbit dilation. In other words, if the speed of the orbiting object decreases, then, the orbit dilates.

Differentiating eqn. (9.5), we get,

$$m\frac{\partial v}{\partial t} + v\frac{\partial m}{\partial t} = 0 \quad (9.10)$$

Dividing eqn. (9.10), by mv, we get,

$$\frac{1}{v}\frac{\partial v}{\partial t} + \frac{1}{m}\frac{\partial m}{\partial t} = 0 \quad (9.11)$$

Substituting for $\frac{1}{v}\frac{\partial v}{\partial t}$ in eqn. (9.9) from eqn. (9.11), we get,

$$\frac{1}{r}\frac{\partial r}{\partial t} = 2\frac{1}{m}\frac{\partial m}{\partial t} + \frac{1}{M}\frac{\partial M}{\partial t} + \frac{1}{G}\frac{\partial G}{\partial t} \quad (9.12)$$

$$\frac{1}{r}\frac{\partial r}{\partial t} = 2\frac{\partial}{\partial t}[\ln m] + \frac{\partial}{\partial t}[\ln M] + \frac{\partial}{\partial t}[\ln G] \quad (9.13)$$

where, ln is the natural logarithm.

So,

$$\frac{\partial r}{\partial t} = Hr \quad (9.14)$$

where,

$$H=2\frac{\partial}{\partial t}[\ln m] + \frac{\partial}{\partial t}[\ln M] + \frac{\partial}{\partial t}[\ln G] \quad (9.15)$$

In general, the change of gravitational parameter G is negligible for short duration and can be considered a constant, and hence, $\frac{\partial}{\partial t}[\ln G]=0$. Therefore, we have,

$$H=2\frac{\partial}{\partial t}[\ln m] + \frac{\partial}{\partial t}[\ln M]. \quad (9.16)$$

We can see the similarity of H in equation (9.14) to the Hubble parameter in the Hubble relationship [5]. The changing mass of the orbiting object and/or changing mass of the orbiting center result in change of the orbit radius. Any change in the gravitational constant G does not lead to the collapse of the orbiting system. Although the gravitational parameter G is

considered to be time invariant, any time variation of the gravitational parameter G is also leads to the change in the orbit distance. Increasing G with time leads to orbit dilation, while any decrease in G with time leads to orbit contraction. Although the Hubble parameter had been misinterpreted to claim that the universe is expanding, the universe is not expanding; it is the orbiting distance that is changing according to the change in mass of the orbiting system (M, m), and any change in the gravitational parameter G.

Lemma-9.2:

Any change in the gravitational parameter G does not lead to the collapse of the orbiting system. Any change in G in an orbiting system is accommodated by the adjustment of the orbiting distance.

Corollary-9.2

Orbiting systems are robust to perturbations, including to the changes in the universal parameters (universal constants).

The changing parameters of an orbiting system do not lead to the collapse of the orbiting system by spiraling in or spiraling out of the orbiting object. Any change of parameters of an orbiting system result in orbit adjustment. The orbits dilate or contract in order to accommodate the changing parameters of the orbiting system. If an orbiting particle loses its speed, its orbit will dilate, while increasing speed of an orbiting particle result in orbit contraction. The widely held belief that an orbiting electron spirals down to the nucleus if the electron loses its speed due to radiation, is incorrect.

The change of mass of an orbiting system results in orbits adjustments. There are many causes for the changing mass of a planet. The most of the causes for the changing mass of the earth are man-made:

- Every rocket that blasts off into space will reduce the mass of the planet bringing with it orbit contraction leading to global warming as a result.
- Every asteroid and meteorite that hit the earth will result in orbit dilation and hence global cooling as a result.
- Since the earth's gravity is not strong enough to contain hydrogen in its natural state as a gas, the release of hydrogen gas into the air result in mass loss and will lead to global warming.
- The bio-mass is a mass creator. The forest converts the energy into mass and hence the destruction of the forest results in mass loss leading to orbit contraction and as a result to global warming.
- The burning of fossil fuel also results in mass loss and hence will lead to global warming.
- The mass loss of the sun with time also lead to orbit contraction of the planet and hence to global warming.

Theorem-9.4: Global Warming Theorem

Any activity that decreases the mass of the earth leads to global warming while any activity that increases the mass of the earth leads to global cooling. As the mass of the sun decreases with time, it is the activities that increase the mass of the earth that will maintain the planet in the life-sustaining Goldilocks zone.

X. GENESIS OF QUANTUM MECHANICS

The foundation of quantum mechanics is laid on the false conjecture that particles behave as waves [5]. This false conjecture provided convenient way to link mass of a particle to the Plank constant. The Plank constant relates the frequency of an electromagnetic wave burst to electromagnetic energy of the wave burst. Without the false assumption of wave particle duality, there is no mean to link the mass of a particle to the Plank constant. The quantum mechanics is a combination of three ideas where only one of them hold true:

(i) The fact that the electromagnetic waves come in bursts [7] and the electromagnetic energy of a burst to its frequency is related by the relationship,

$$e=hf \tag{10.1}$$

where, e is the electromagnetic energy of the burst, f is the frequency of the electromagnetic wave burst, h is the Plank constant.

Although, e is sometimes loosely referred to as energy, e is not mechanical energy or kinetic energy. The kinetic energy, or mechanical energy does not satisfy the relationship e=hf. In the e=hf relationship, e is strictly the electromagnetic energy of a single electromagnetic wave burst.

(ii) The false assumption that the light is relative gave the relationship,

$$e=m_{eq}c^2 \tag{10.2}$$

where, e is the electromagnetic energy of an electromagnetic wave burst, m_{eq} is the equivalent mass of electromagnetic energy and c is the speed of light.

The equivalent mass m_{eq} is not a real mass; yet, it is erroneously referred to as a mass in the $e=mc^2$ relationship. In $e=mc^2$ relationship, m is not a mass of an object; it is the equivalent mass of electromagnetic energy of an electromagnetic wave burst.

In $e=mc^2$ relationship, e is the electromagnetic energy, and mc^2 is the kinetic energy of a mass m; electromagnetic energy e of an electromagnetic wave burst, and the kinetic energy of a mass m are not the same, and $e\neq mc^2$. The relationship $e=mc^2$ was never proven; it was obtained by substituting m in place of m_{eq} in the relationship $e=m_{eq}c^2$, which appeared when the false assumption that the light is relative is made. The light is not relative [8], $e\neq m_{eq}c^2$, and $e\neq mc^2$.

(iii) de Broglie's false conjecture that a particle of mass m and speed v behaves as an electromagnetic wave burst of energy e.

The core of the quantum mechanics came from these three concepts. Let us see how these three concepts were used in the development of quantum mechanics.

If we accept the false concept that the light is relative, then light energy has to have a momentum and hence, we have,

$$e=pc \quad (10.3)$$

where, e is the electromagnetic energy of an electromagnetic wave burst, p is the momentum of the burst, and the c is the speed of light.

Substituting for e in eqn. (10.3) from eqn. (10.1), we get,

$$hf=pc \quad (10.4)$$

Since, $c=f\lambda$, where, f is the frequency and the λ is the wavelength, from eqn. (10.4), we get,

$$\lambda=h/p \quad (10.5)$$

The relationship λ=h/p is obtained for an electromagnetic wave burst of energy e and frequency f or wave length λ, under the false assumption that the light is relative. Light is not relative [8].

After seen the relationship, λ=h/p, de Broglie conjectured that this relationship should apply to any particle of mass m and momentum p; it is with this conjecture that the idea of particle wave was born. The wave length λ of a particle of momentum p is conjectured to be given by,

$$\lambda=h/p \quad (10.6)$$

Although the relationship, λ=h/p relates the momentum of a particle to imagined particle wave, no one had slightest idea what was really waving here. The de Broglie conjecture is incorrect in every sense. Light is not relative [8]. Electromagnetic energy has no momentum. Only a particle with mass has a momentum. Electromagnetic energy cannot be decomposed into momentum times the speed of light since the light is not relative, and hence $e \neq pc$.

Electromagnetic wave is not a particle. Electromagnetic energy is not a particle. Electromagnetic waves come in bursts. Since the light is not relative, we know that $e \neq m_{eq}c^2$, where m_{eq} equivalent mass of electromagnetic energy. The mass equivalent of energy, m_{eq} is not the same as a mass of an object, $m \neq m_{eq}$. Electromagnetic energy e is not equal to the kinetic energy mc^2 and hence, $e \neq mc^2$.

Corollary-10.1:

The relationship λ=h/p for a particle of mass m and momentum p that the quantum mechanics founded upon does not hold true, λ≠h/p; the relationship λ=h/p is meaningless.

Whether a particle of mass m goes through a hole or a slit in a barrier is not determined by fictitious particle wavelength; it is determined by the diameter of the particle and the diameter of the hole or the width of the slit. If the diameter of the particle is smaller than the diameter of the hole, and the hole is in the path of the particle, then, the particle will pass through the hole; otherwise, the particle will be stopped at the barrier irrespective of what the so called fictitious particle wavelength is. Particles do not undergo diffraction when they pass through a hole or a slit. Without diffraction, there would not be any interference, and hence no interference pattern, irrespective of what the momentum of the particle is.

XI. DE BROGLIE'S PARTICLE-WAVE CONJECTURE AND DOUBLE-SLIT BLUNDER

The relationship λ=h/p does not hold true for electromagnetic waves. The relationship λ=h/p does not hold true for particles. Although, the de Broglie's conjecture, the relationship λ=h/p, does not hold true, the result of double-slit experiment with a beam of particles had been interpreted in favor of the conjecture [5]. When a beam of charged particles is used in double-slit experiment, a series of bright spots appears on the phosphor screen demarcating bright and dark interfering fringes. In interpreting the result of double slit experiment with a beam of particles, one crucial assumption has been made. It was assumed that the bright spots appear on the phosphor screen is the result of charge particles colliding with the phosphor screen. It is believed that the charge particles somehow cross the double-slit barrier and hit the phosphor screen creating bright spots even though there is no opening on the double-slit barrier along the path of the particles for the particles to cross; two slits on the barrier are not in the path of the particles. The bright spots appear on the phosphor screen are assumed to have one-to-one correspondence with the charge particles. It is this false assumption of one-to-one correspondence that led to the incorrect interpretation that the repeating bright and dark fringes demarcated by bright spots are the result of particles behaving as waves.

So, based on the interference pattern of bright and dark fringes in bright spots, and the assumption of one-to-one correspondence between the particles and the bright spots, it was falsely concluded that the particles were behaving as if they were waves. Although, this conclusion seems reasonable on the surface, it is incorrect. Even though, the beam of particles was blocked by the double slit barrier due to the absence of an opening on the double-slit barrier along the path of the particles, it was believed, particles somehow knew to make a detour of $\pm\pi/2$ angle and travel $\pm d/2$ distance, and then again $\pm\pi/2$ turn to go through one or the other of the two slits off their original path and hit the phosphor screen creating interfering pattern of fringes in bright spots; pure magic. How do particles know that there are two slits on the double-slit barrier off their path? To add to the mystery, it was assumed that the charge particles knew exactly which slit to go through and when, in order to create an interfering pattern of bright and dark fringes in bright spots as if particles had a brain to figure it out. It is astounding to what extent people are inclined to bend and twist the common sense when they are desperate to support a false conjecture that lack any other theoretical support.

The problem is that the particles do not have any knowledge of the out-of-path slits that are present on the barrier. The charge particles do not have brain to find out that there are out-of-path slits, and which slit a particle should take to create precise pattern on the phosphor screen. Particles do not have any knowledge of the slits that are present outside the path of the particles. More importantly, it does not matter whether

a particle is microscopic or macroscopic, the ability of a particle to pass through a hole is determined by the size of the particle and the size of the hole, nothing else; it is not determined by some imaginary non-existent particle wavelength. It doesn't matter what the momentum of the particle is, if the diameter of the particle is larger than the diameter of the hole, the particle will not pass through the hole; the particle will be stopped at the hole.

As far as a charge particle is concerned in the double-slit experiment, it travels at whatever the speed it travels in a straight line and hit the double-slit barrier at the midpoint between the two slits. Since there is no hole on the barrier along the path of the particle, the charge particle can't pass through the barrier. So, the bright spots responsible for creating periodic bright and dark interference fringes in bright spots on the phosphor screen are not due to the charge particles hitting or colliding with the screen. There is no one-to-one correspondence between the charge particles and the bright spots on the phosphor screen. If you use a single moving particle in the double-slit experiment, you do not get a single bright spot on the phosphor display screen. Instead, for a single moving particle, you will get a series of bright spots on the phosphor screen demarcating an interference pattern of bright and dark fringes. The interference pattern a single moving particle generates is no different from the interference pattern a beam of particles generate in the double slit experiment.

So, it is no wonder why the foundation of quantum mechanics is incorrect and as a result it has to collapse. The quantum mechanics is built on a faulty foundation, on a swamp. There is no legitimate theoretically validated relationship between the mass of an object and the Plank constant. So, they cooked up a false relationship between the mass of an object and the Plank constant using a false conjecture $\lambda=h/p$ that does not even hold for electromagnetic waves. The momentum p is not defined for electromagnetic waves and it is meaningless. There are no waves called de Broglie waves, and $\lambda\neq h/p$. There is no wave-particle duality. Particles are not waves. Waves are not particles. The relationship $\lambda=h/p$ neither hold true for electromagnetic waves nor for particles with mass, $\lambda\neq h/p$.

When a beam of charge particles or a single charge particle is used in the double slit experiment, what creates an interference pattern of bright spots on the phosphor screen are the peaks and valleys of the interfered electromagnetic wave front on the screen. These electromagnetic waves that are generated when the charge particles are stopped at the double-slit barrier get diffracted while they pass through the slits. Two diffracted wave fronts interfere on the phosphor screen resulting in an electromagnetic wave front with peaks and valleys; these peaks correspond to the bright spots on the phosphor screen. The brightness of a point on the phosphor display screen in the double-slit experiment depends on the strength of the electromagnetic wave front at that point.

Corollary-11.1:

The brightness of a point on the phosphor screen in the double-slit experiment depends on the strength of the electromagnetic wave front at that point.

It is surprising how much work has been done to build various structures surrounding the quantum mechanics that was founded upon an incorrect, faulty foundation. Yet, no one ever question the integrity of the foundation the quantum mechanics was built upon; everything in quantum mechanics is based upon the false relationship $\lambda=h/p$. Schrödinger's equation does not hold true since there is no wave particle duality and $\lambda\neq h/p$ for a particle of momentum p; in fact, the idea of wavelength of a particle is meaningless. Dirac equations do not hold true since light is not relative [8], and the wave particle duality does not hold true, $\lambda\neq h/p$, for a particle. There is nothing waving in a particle. It is no surprise, when the false foundation is ultimately exposed, everything will collapse bringing down the work of almost a century; a double-slit blunder.

XII. SOME NOTEWORTHY FACTS [6, 7, 8, 9]

a) Light is not a collection of particles. Light does not consist of random particles called photons. Light is not spatially random [7].

ab) If light consists of photons that are spatially random, light can't be directional and as a result, the night and day is not possible.

ac) Light comes in electromagnetic wave bursts of constant duration. The electromagnetic energy of a single wave burst is related to its frequency by the relationship, $e=hf$.

ad) The relationship $e=hf$ only applies for an electromagnetic wave burst of limited time duration. The relationship $e=hf$ has no meaning without specific time width.

b) Light is not relative.

bc) Electromagnetic energy e is not the same as the kinetic energy of a particle with mass m, and hence $e\neq mc^2$.

c) Electromagnetic energy has no mass.

cd) Mass and electromagnetic energy are not one and the same. It is only the mass and kinetic energy that are related. Mass and electromagnetic energy are not related.

d) Light has no momentum. Electromagnetic energy has no momentum.

e) Electromagnetic energy, e cannot be decomposed into momentum, p times the speed of light, c, since light is not relative, $e\neq pc$.

ef) Only the kinetic energy can be represented as the momentum of a particle times the velocity of the particle.

f) For electromagnetic waves, $\lambda\neq h/p$.

fg) Particles are not waves, $\lambda\neq h/p$. There are no de Broglie waves.

fh) It does not matter what the momentum of a particle is, whether a particle is able to go through a hole (non-hostile passing through) is not determined by the momentum of a particle.

fi) Whether a particle can pass through a hole is solely determined by the diameter of the particle and the size of the hole.

fj) If the diameter of a particle is smaller than the diameter of a hole, and the hole is directly in the path of the particle, then the particle will pass through the hole; otherwise, the particle will be stopped at the hole.

g) Light get diffracted when travels through a hole.

gh) Particles do not undergo diffraction when travel through a hole.

h) A single moving particle can generate an interference pattern of bright and dark fringes in bright spots on the phosphor display screen in double-slit experiment.

i) There is no one-to-one correspondence between the number of particles and the number of bright spots on the phosphor screen in the double-slit experiment.

ij) A single particle, an electron, a proton, a neutron, an atom, or a molecule can generate a complete interference pattern of bright and dark fringes in bright spots on a phosphor display screen in the double-slit experiment..

j) It is the electromagnetic radiation generated as a result of the moving charged particle being stopped at the double-slit barrier that creates an interference pattern on the phosphor screen. Each slit creates diffraction wave front that interferes with each other wave fronts on the phosphor screen resulting in an interfering pattern of bright and dark fringes corresponding to the peaks and valleys of the wave front. The peaks of the wave front appear as bright spots on the screen while the valleys of the wave front appear dark.

k) No particle ever reaches the phosphor display screen of the double-slit experiment.

l) Particles, however small they are, do not have wave behavior. Particles are not waves. Waves are not particles.

lm) Since particles are not waves, Schrödinger's equations do not hold true.

ln) Since particles are not waves and the light is not relative, Dirac's equations do not hold true.

m) Electrons orbiting at constant speed on a circular path do not radiate. Rutherford atom with circular orbits is stable.

n) There are only three situations where a charge particle is not subjected to radiation:

1. A particle that remains still on a gravitational object.
2. A particle that is moving on a linear path at constant speed or at an accelerated speed.
3. A particle that is orbiting at uniform speed on a circular orbit.

o) If an orbiting particle or planet loses speed, it does not spiral down leading to the collapse of the orbiting system.

op) Orbiting systems are not in a critical state of stability. Orbiting systems are stable under perturbation.

oq) Any perturbation in an orbiting system does not lead to the collapse of the orbiting system.

or) Any perturbation in an orbiting system is compensated for through orbit dilation and contraction.

os) Orbiting systems are robust.

ot) Even if the gravitational parameter G has undergone change, that change is accommodated by orbit adjustment.

ou) There are no universal constants. There are universal parameters that appear as constants for us due to their slow variations.

ov) The universe is robust to the changes in the universal parameters.

p) Orbiting systems under perturbation remain stable through orbit adjustment irrespective of whether the perturbation is small or large, continuous or not.

pq) Contrary to the Newton's proclamation, "some divine intervention is required to maintain the stability of the orbiting system", no such divine intervention is required to keep the planetary system stable (divine exists only in human imagination, not in reality).

q) The destruction of the forest reduces earth's ability to generate mass. Over exploitation of the hydrocarbon deposits reduces the earth's mass. Any hydrogen released in to the atmosphere, in its natural form as a gas, reduces the mass of the earth since the earth's gravity is not strong enough to prevent hydrogen from leaking out into space. Mass loss causes the earth's orbit to contract, which leads to global warming.

r) Any rocket that blasts off into space leads to the reduction of the mass of the planet leading to orbit contraction resulting in global warming.

s) Acceleration of a charge particle is necessary for radiation, but not sufficient.

t) Electromagnetic radiation is not relative.

tu) If the electromagnetic radiation is relative, no orbiting system would be stable; the matter as we know it would not exist since the atom itself become unstable [6]. If electromagnetic radiation is relative, you should be able to make charge particle radiate simply by running away from it.

u) Not all the charge particles under acceleration radiate.

uv) Accelerating charge particle on linear path does not radiate.

uw) A charge particle at stand still on the ground is under acceleration, yet it does not radiate.

ux) A charge particle orbiting at uniform speed on a circular path does not radiate.

uy) Rutherford atom with circular orbits stable.

v) Universe is not expanding.

w) There was/is no big-bang.

x) Universe is not finite.

y) Electromagnetic energy is its frequency, and hence, propagation loss leads to a shift in the frequency.

yz) Light undergoes a gradual frequency shift due to propagation loss. Although this frequency shift is insignificant for smaller distances, the frequency shift is significant for large distances.

z) The red shift observed from distant galaxies is due to propagation loss. The galactic red shift is not an indication of the radial motion of galaxies.

za) Increasing galactic red shift is an indication of radial movement of galaxies.

az) Visible universe is the maximum distance light can travel before being frequency shifted below the visible region; it is an observer dependent 3D-horizon, an indication that the universe is not finite.

bz) The observed microwave background is the light that is frequency shifted below the visible region.

baz) The presence of microwave background is no way an indication that the universe had a beginning.

cz) If we send a light burst, our out-of-the-visible region distant neighbors will receive it in the microwave band.

dz) Time is absolute; time does not depend on the observer.

ez|) Time does not depend on space; there is no space time [8].

fz) The earth's ability to sustain life depends on its ability to maintain its mass so that it can remain in the Goldilocks zone.

gz) Schrödinger's equations do not hold true since there is no wave particle duality and $\lambda \neq h/p$.

hz) Dirac equations do not hold true since light is not relative, $e \neq mc^2$ and wave particle duality does not hold true, $\lambda \neq h/p$.

iz) Quantum mechanics is a theoretical as well as an experimental blunder; a double-slit blunder.

jz) Everywhere, Quantum mechanics has been touted as the panacea for all natural ill-illusions; if quantum mechanics works, quantum mechanics must be a blunder that appears to work. Snake-oil is also said to work for some.

zz) If you are a preacher of quantum mechanics in the dark, just like so many others, you are not far from salvation. Try the double slit experiment with a particle detector in place of the phosphor display screen; you will indeed see the light! However, unlike for quantum mechanics preachers, there is no such an easy salvation for all those other misguided self-absorb preachers who think solution to everything lies on the man upstairs.

XIII. CONCLUSIONS

False de Broglie conjecture that particles behave as waves led to the Schrödinger equation and the general discipline of quantum mechanics. It is the false concept of wave-particle duality that paved the way to relate the Plank constant to the mass of a particle. Without the false assumption of the wave behavior of particles, there is no way to relate the Plank constant to the mass of a particle. When the de Broglie conjecture fails to be true, so does the quantum mechanics as a whole.

There is no theoretical justification to the wave particle duality. So, the result of double-slit experiment on a phosphor display screen to a beam of charged particles is misinterpreted to justify the de Broglie conjecture that the particles behave as waves; a double-slit blunder. When a beam of particles are used in the double-slit experiment, the charge particles are completely stopped on their path by the double-slit barrier. The two slits on the double-slit barrier are not on the path of the particles, and hence no particle reaches the slits. No particle crosses the double-slit barrier. When charge particles that are travelling at uniform speed are stopped suddenly at the barrier, the sudden change of the speed of the charge particles generates electromagnetic radiation. It is this generated electromagnetic radiation that passes through the two slits. Although, the particles cannot cross the double-slit barrier since there is no opening big enough for particles to pass through along the path, the electromagnetic radiation has no such limitation. Each slit diffracts the electromagnetic waves that pass through it, creating diffraction pattern on the display screen. The two diffracted wave fronts from two slits interfere on the phosphor display screen creating an interference pattern. The peaks of the electromagnetic wave front appear as bright spots on the phosphor screen demarcating an interference pattern of bright and dark fringes on the screen.

The bright spots on the phosphor screen in the double-slit experiment do not have one-to-one correspondence with the incoming charge particles.

Important Property:

All it takes is a single moving charge particle to generate an interference pattern of bright and dark fringes in bright spots on the phosphor display screen in the double-slit experiment.

It is not the particles colliding with the phosphor display screen that creates the bright spots demarcating interference pattern of bright and dark fringes on the phosphor display screen of the double-slit experiment. It is the interference of two diffraction patterns of electromagnetic radiation wave fronts from the two slits that resulted from the charge particles being brought to a dead stop at the double-slit barrier that created the interference pattern on the display screen. The sequence of events in the double-slit experiment with charge particles is:

1. Charge particles are moving at uniform speed from single-slit barrier to the double-slit barrier.
2. Charge particles hit the barrier resulting in change of speed of the charge particles.
3. Change in speed of the charge particles generates electromagnetic radiation.
4. Electromagnetic radiation passes through the slits.
5. Two slits diffracts the electromagnetic waves passing through the slits creating two out of phase diffracted wave fronts on the phosphor display screen.
6. Two diffracted wave fronts interfere on the phosphor display screen generating an interference pattern of bright and dark fringes.
7. Since the display screen is a phosphor screen, the peaks of the wave front create bright spots on the screen demarcating bright and dark interfering fringes in bright spots.

The double-slit experiment with even a single charge particle will create an interference pattern of

bright and dark fringes in bright spots on the screen. The double-slit experiment with a single neutron or a beam of neutrons also create an interference pattern of bright and dark fringes in bright spots on the display screen since a neutron is unstable in its very nature. When a moving neutron is stopped by the double-slit barrier, the neutron decomposes into a proton, and an electron while releasing an electromagnetic wave burst. It is this generated electromagnetic wave burst together with any radiation resulted from the changing speed of the newly generated electron and proton that generate an interference pattern on the phosphor display screen. No particle ever reaches the phosphor display screen in the double-slit experiment since there is no opening on the double-slit barrier along the path of the particles. The path of the particles is completely blocked by the double-slit barrier.

A single moving atom or a beam of atoms can also generate an interference pattern on the phosphor display screen in the double-slit experiment. When a moving atom is used, it is no longer just the atom that is being stopped by the double-slit barrier. What are being stopped by the double slit barrier are the constituent parts of the atom, the positively charged nucleus and the negatively charged electrons, which result in electromagnetic radiation generating an interference pattern on the phosphor display screen.

If a moving neutral golf ball is used in the double slit-experiment, what is being stopped at the double-slit barrier is simply the golf ball, and hence there would not be an interference pattern on the phosphor screen. If dimension of an object is in the same scale as the separation of its constituent charge particles, or in other words, the object is microscopic, what are being stopped at the double-slit barrier are the constituent charge particles of the object. When a family is stopped at the US border, what are being stopped at the border are the individual members of the family; the overall outcome will be the result of the individual member's outcome. On the other hand, if the separation between the constituent charge particles of an object is negligible compared to the dimension of the object, object is no longer microscopic; it is macroscopic, and hence what is being stopped at the double-slit barrier is the object itself, not the constituent charge particles. If a pregnant mother is stopped at the US border, what is being stopped is the pregnant mother, not a lady and a fetus.

Important Property:

If a dimension of particle is comparable or in the same scale as the distance between its constituent charges, then, the particle will generate an interference pattern in the phosphor screen of the double-slit experiment; an atom will generate an interference pattern for this very reason.

As far as particles are concerned, the slits do not exist, because the slits are not on the path of the particles. The mysterious voodoo interpretation of the double-slit experiment, a crazy idea that somehow particles can be in many states at the same time (Schrödinger's cat is both dead and alive at the same time ─ downright nonsense) is simply a human blunder; a double-slit blunder. It is a theoretical as well as an experimental blunder. It is a theoretical blunder from the false assumption that the particles are waves described by $\lambda=h/p$. It is an experimental blunder from the Houdinified, voodoo interpretation of the interference pattern in the double-slit experiment. Particles do not create an interference pattern, electromagnetic waves do. When microscopic particles are stopped on their track, it generates radiation; it is this radiation that generates double-slit interference pattern, not the particles themselves. Whether an interference pattern is in discrete bright spots is determined by the kind of display screen used. Since a phosphor screen responds to electromagnetic fields as well as to the direct collision of the charge particles, misinterpretation is understandable. However, what is important to note is that the charge particles or any particle, in that mater, cannot cross a barrier when there is no opening along the path. So, what creates the interference pattern on the phosphor screen in the double slit experiment is obvious, radiation. The idea of particle-wave is simply preposterous, utter nonsense. Quantum mechanics can't stand true when its foundation, wave particle duality, $\lambda=h/p$ seizes to exist, or when, $\lambda\neq h/p$.

If you still believe in quantum mechanics, you should be able to show at least that particles are arriving at the phosphor display screen. If you want to find out if there are particles at the phosphor screen, get rid of the phosphor screen and use a simple particle detector in its place. The reading of the particle detector will be zero, indicating that there are no particles passing through the double-slit barrier. It doesn't matter how microscopic a particle is, it can't cross a barrier if there is no hole big enough on the barrier along the path of the particle for the particle to go through. You can drill as many holes as you want on a barrier, if there is no hole big enough along the path of the particle, particle cannot cross the barrier; it is as simple as that; not voodoo science. Of course, Voodoo-fication, Houdini-fication, Harry-potter-rization, of science has other benefits; sells million copies.

Light is not relative and as a result $e\neq mc^2$. There are no particles of light or photons. Light is a wave not a particle. The light consists of electromagnetic wave bursts of constant duration. The electromagnetic energy of a single wave burst is related to its frequency by the relationship $e=hf$. Waves are not particles and particles are not waves. There is no wave particle duality. A particle, by definition, has a mass. There are no mass-less particles. Since light is not relative, electromagnetic energy has no momentum. Electromagnetic energy cannot be decomposed into the momentum times the speed of light since the light has no mass, in other words, $e\neq pc$. It is only the kinetic energy that can be represented as the product of momentum times the velocity of the particle. Electromagnetic energy is not the same as the kinetic energy, and hence electromagnetic energy cannot be treated the same way as the kinetic energy is treated.

If the electromagnetic energy is the same as the kinetic energy, we wouldn't have had an electric power crisis; all you have to do to generate electricity is just to throw a rock.

There is no such thing called de Broglie waves or particle-waves. Particles do not behave as waves, and waves do not behave as particles. Particles are not waves. Waves are not particles. The relationship λ=h/p neither hold true for electromagnetic waves nor for particles, and as a result, λ≠h/p for both waves and particles. It is the false wave particle duality conjecture that made a relationship between the mass of an object and the Plank constant possible. Since there is no wave particle duality, there is no link between the mass of an object and the Plank constant. The Schrödinger equation is rooted on the false relationship λ=h/p. When, λ≠h/p, the Schrödinger equation is not possible. Since the quantum mechanics is rooted in Schrödinger equation, without Schrödinger equation, there would be no wave mechanics or quantum mechanics in general. Physical reality is observer independent. Sun doesn't shine because someone is there to witness it. The fate of the Schrödinger's cat is not determined by any observer; the fate of the cat is determined by the physical reality, not relativity. By nature, relativity is not real. The fate of the Schrödinger's cat is observer independent. A cat can't be both alive and dead at the same time. The idea of cat being alive and dead at the same time is simply preposterous, nonsense.

Acceleration is necessary for a charge particle to radiate, but acceleration itself is not sufficient. The change of speed of a charge particle is sufficient for a charge particle to radiate. However, a change of speed is not necessary for charge particle to radiate. If **V** is the velocity of a charge particle and **r** is any vector relative to the charge particle in the 3D-space that does not coincide with **V**, then the charge particle will radiate if $\mathbf{V}\times\mathbf{r}$ vary with time, $\frac{\partial}{\partial t}(\mathbf{V}\times\mathbf{r})\neq 0$, where × is the vector cross product. A charge particle sitting still on a gravitational object is under acceleration, yet, it does not radiate. A moving charge particle on a linear path does not radiate irrespective of whether the charge particle is accelerating or moving at a uniform speed. Orbiting charge particles on circular orbits at uniform speed do not radiate. For a charge particle orbiting at uniform speed on a circular orbit, $\mathbf{V}\times\mathbf{r}$=constant and $\frac{\partial}{\partial t}(\mathbf{V}\times\mathbf{r})=0$. Rutherford's planetary model of the atom with circular orbits is stable.

If the position or the speed of a charge particle is uncertain, then the charge particle will radiate. Quantum mechanical probabilistic description of electrons does not make them radiation free. There is only one path an electron can take in an atom without being subjected to radiation; it is a circular orbit at uniform speed. There is no any other path in an atom electrons can take without being subjected to radiation. The widely believed quantum description of the atom falls apart due to the following reasons:

1. λ≠h/p, particles do not have a wave behaviour; particles are not waves. The concept of particle-wave is simply nonsense.
2. No particle ever crosses the double-slit barrier. There are no particles at the phosphor screen in the double-slit experiment.
3. There is no one-to-one correspondence between the particles and the bright spots on the phosphor screen of the double-slit experiment.
4. Even a single charge particle or a single neutron is sufficient to generate an interference pattern of bright and dark fringes in bright spots on the phosphor display screen of the double-slit experiment.

Orbiting systems are not under a precarious stable situation where even a slightest perturbation can throw the system out of stable position by making it spiraling in or out. Orbiting systems are stable. Planetary systems are stable. Electrons orbiting the nucleus on circular orbits are stable. If an orbiting particle or planet loses its speed, it does not lead to spiraling down of the orbiting particle or planet into the orbiting center; if it does a single hit by an asteroid or meteorite would have made the earth spiraling down into the sun. Earth has undergone many collisions with asteroids as well as meteorites, yet, the earth has not spiraled down into the sun. The earth is still orbiting in spite of all those hits by the meteorites as well as asteroids. The fact is that the orbiting systems have the ability to whether any perturbation through the self-adjustment of the orbiting distance automatically. Orbiting systems are robust systems. Orbiting systems even can withstand the changes in the universal gravitation-parameter, G, through orbit adjustment. In fact, it is not just gravitational constant G, all the universal constants are not constants; they are universal parameters that are subjected to change. The changes in universal parameters do not cause universal systems to collapse. Universal systems go through a self adjustment as the universal parameters change. If an orbiting particle or planet loses it speed, it undergoes orbit dilation and remains orbiting in a new larger orbit. If an orbiting particle or planet gains speed, it undergoes orbit contraction and remains orbiting in a new smaller orbit. If the gravitational parameter G increases, the orbits will dilate. Similarly, the reduction in the gravitational parameter G causes the orbits to contract.

The claim that the universe cannot exists if the universal constants had been any different is incorrect. There are no universal constants. There are universal parameters. Universal parameters can change collectively while maintaining the universe intact. The changes of universal parameters do not make the universe or the systems it contains to collapse. Universe is robust to the changes in the universal parameters. Universe is adaptable to the changes in the universal parameters. As we have seen, the changes in the gravitational parameter G leads to changes in the orbits; any change in the gravitational parameter G does not make the orbiting system to collapse.

If the sun in our solar system loses its mass, planetary orbits will contract resulting in global

warming. The sun loses its mass as it burnt its fuel. The earth loses its mass as we burn its fossil fuel. The earth also loses its mass due to the destruction of the earth's mass generator, the bio-mass, the forest. The earth gains mass through vegetation in a continuum, as well as occasional collisions with asteroids as well as meteorites. Mass of a planet is time varying. Mass of the sun is time varying. Orbits of planets are time varying. Orbit of solar system is time varying. Mass of a galaxy is time varying. Orbit of a galaxy is time varying.

However small it is, the space exploration also reduces the mass of the earth. Rockets carry large amount of liquid hydrogen as well as other instruments that will be either burnt or left in space. Every time a rocket is left for space, it results in a mass loss as far as the earth is concerned. The loss of mass of the earth makes the orbit of the earth to contract resulting in global warming. So, space exploration comes at a cost; its contribution to irreversible global warming. Since the mass loss is permanent, the global warming due to the mass loss is not reversible. In addition, when we generate hydrogen for fuel, any hydrogen leaks into the air in its natural state will be leaked out into the space since the earth's gravity is not strong enough to hold the hydrogen on in the atmosphere bound to the earth. So, the earth loses not just the hydrogen carried in the rocket as fuel, but also any hydrogen leaked into the atmosphere in the process, resulting in a mass loss, which further enhances the global warming.

The sustainability of life on earth depends on its ability to remain in the Goldilocks' zone. The earth's ability remains in the Goldilocks' zone depends on its ability to maintain its mass, the critical mass within a slight plus or minus deviation, $m \pm \Delta m$. If we drive Δm too far off in either direction, the life on earth will not be possible. We have been treating the earth as an all you can eat/grab/destroy/or whatever, buffet; a bottomless source. We falsely believed the earth's orbit was fixed. Earth's mass is not fixed. Earth's orbit is not fixed. It is time to take the physical limits of earth to consideration [9]. Although we have no clue to why we are here, we know clearly what make us not to be here.

Universe is not expanding. The observed galactic red shift is not a result of the radial movement of galaxies. The galactic red shift is due to the propagation loss. Electromagnetic energy is the electromagnetic frequency and hence the loss of energy due to the propagation is equivalent to down-shift or red shift of the frequency. The light does not travel long distances without undergoing frequency down shift due to propagation loss. Any observed frequency shift for short distances can be attributed to the Doppler's effect. However, the same cannot be said about the observed red shift from the distance galaxies. The observed red shifts from the distance galaxies are due to the propagation loss. However, the increasing galactic red shift is due to the Doppler's effect as a result of the radial movement of galaxies; orbit contraction due to mass loss or orbit dilation due to mass increase is the cause of galactic radial movement.

The maximum distance light can travel before being frequency down-shifted or red-shifted out of the visible region is our visible universe. The visible universe is a moving 3D-horizon that varies from observer to observer. The visible universe for someone on earth is different from the visible universe for someone on a distant planet [9].

The observed cosmic microwave background from the distance is the light from the far away stars that is already frequency red-shifted below the visible region when it reaches us. The cosmic background is not a representation of a baby universe; there is/was no baby universe. The cosmic microwave background carries the information about the makeup of the universe outside the visible region; the region we can't see. If we want to explore the universe outside our visible region, then, we have to use the electromagnetic waves in the microwave region instead of the visible region. If we send a burst of light, our out of the visible region friends will receive it as a microwave burst. The concept of multi-verse is simply a publication mill invented by the academia for the sole purpose of their survival under publish or perish environment that they are in; it is simply a waste of time and resources, nothing more.

Even though the quantum mechanics is touted as the greatest scientific discovery, and the panacea for all the ills we have faced in our understanding of the nature of the atom, it is simply a result of a theoretical blunder as well as an experimental blunder; a double-slit blunder. Rutherford atom with circular orbits is stable. The only possible way electrons can move in an atom without being subjected to electromagnetic radiation is on circular orbits. Quantum uncertainty cannot prevent radiation loss of electrons. Uncertainty of electrons in an atom results in radiation loss. Particles, it doesn't matter how microscopic they are, don't just appear and disappear (Houdini-fication). Particles may appear and disappear in human mind, but never physically in nature. Particles are not waves. Waves are not particles. Time is observer independent. Time does not depend on space [8, 9]. There is no space-time. Mass is observer independent. Electromagnetic radiation is observer independent [6]. Mass and gravitational field are a single entity; neither one has an independent existence from each other [6]. The gravitational field is not a wave and it doesn't propagate. There is/was no big-bang. Universe is not expanding. Universe is not finite. Light undergoes frequency red-shift when light travels long distances due to propagation loss; as a result our ability to probe the universe in the visible region of the spectrum is limited. The makeup of the universe beyond the visible region of the universe can be explored in the microwave band. The loss of mass of the earth leads to orbit contraction bringing with it global warming. Plants, bio-mass create mass. Depletion of hydrocarbon reduces mass. Every rocket that blasts off into the space reduces the mass of the earth. Unguarded, unrestricted, unregulated, everlasting fierce economic competition under limited resources is a real recipe in making the earth uninhabitable; the Aral Sea is a case in point. The planet's ability to remain

habitable depends on its ability to maintain it's mass to remain in the Goldilocks' zone.

If you are preaching quantum mechanics in the dark, just try replacing the phosphor screen with a simple particle detector, you will see the light. There is no such a simple salvation for all the other preachers in the dark.

Appendix: Amendments to Reference [6]

There are few missing words and parameters, and miscommunications in the paper, "Atom in a New Light: orbiting electrons do not radiate, and Rutherford's atom is stable". The corrections are given here.

i) The resonating idea is "A moving charge object radiates when, $\frac{\partial}{\partial t}(\mathbf{V}\times\mathbf{r})\neq 0$, where, **V** is the velocity of the charge object and **r** is any 3D vector originating from the object ".

In some places in the paper this main idea is not clearly communicated.

ii) Introduction

2) Velocity of an orbiting object under constant speed is time invariant relative to any vector originating from the object.

3) Every moving object under acceleration is not under time varying velocity relative to any vector originating from the object. A good example is an orbiting object under uniform speed. It is only an object at time varying velocity relative to any vector originating from the object that radiates.

iii) Axiom-3:

Decreasing direction of gravitational field, Coulomb electric field, and Biot-Savart magnetic field are radial and independent of the movement of the particles.

The word "Decreasing" is missing in the original.

iv) The equation (3.4) should be,

$$I(t)=[\frac{qV(t)}{\pi b}]\sin\theta \qquad (3.4)$$

where, b is the curvature of the path at the charge particle, in other words, a small section of the path at the particle is also a small section of the circle of diameter b.

The b is missing in the original.

v) Equation (3.6) should be,

$$\oint \mathbf{B}\bullet\delta\boldsymbol{\ell}=\mu_o I(t) \qquad (3.6)$$

The dot product operator ● is missing in the original.

vi) Biot-Savart magnetic field is circular. However, the decreasing direction of Biot-Savart magnetic field is radial. This is not clearly stated in the original.

Any place where it appears "Biot-Savart magnetic field is radial" should be replaced with "The decreasing direction of the Biot-Savart magnetic field is radial".

vii) In Section VI, Sub-section,

Radiation Free Paths for a Moving Charge at Constant Speed:

1) If a charge object is moving at constant speed on a linear path, then,

V**v**(t)= constant (time invariant).

V**v**(t)×**r**=constant (time invariant).

2) If a charge object is moving at constant speed on a circular orbit,

V**v**(t)≠constant (time varying).

V**v**(t)×**r**=constant (time invariant).

viii) In Section IX, Sub-section c, the last paragraph should be,

"The decreasing direction of the Biot-Savart magnetic field is always radial ..."

The word "decreasing" is missing in the original.

REFERENCES

[1] Halpern Alvin and Erich Erlbach, "Beginning Physics II: waves, Electromagnetism, Optics, and Modern Physics", Schaum's Outline Series, McGraw-Hill, 1998.

[2] Chabay Ruth and Bruce Sherwood, "Electric and Magnetic Interactions", John Wiley and Sons, Inc., 1995.

[3] Kennedy Robert, "A Student Guide to Einstein's Major Papers", Oxford University Press, 2012.

[4] Hawking Stephen, editor, "The Dreams that Stuff is Made of, The most astounding papers on quantum physics and how they shook the scientific world", Running Press, 2011.

[5] Wikipedia, "Matter Waves, Wave-Particle Duality", Aug. 2017.

[6] Dahanayake Bandula, "Atom in a New Light: orbiting electrons do not radiate, and Rutherford atom is stable", International Journal of Multidissiplinary Engineering and Scientific Studies (JMESS), vol. 2, Issue 5, May 2017.

[7] Dahanayake Bandula, "Light in a New Light: Always a Wave, Never a Particle", Science Discovery, vol. 3, Issue 4, Aug. 2015.

[8] Dahanayake Bandula, "Maxwell's Equations and Propagation of Light: Not Relative", International Journal of Astrophysics and Space Science, vol. 3, Issue 6, Dec. 2015.

[9] Dahanayake Bandula, "General Universal Relativity (GURL): No Big Bang", International Journal of Astrophysics and Space Science, vol. 4, Issue 4, Aug. 2016.