UNDERSTANDING INTERFERENCE AND DIFFRACTION OF PHOTONS AND ELECTRONS: A NEW APPROACH

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In nature, nothing is said to occur without reason/purpose. For example, our hearts beat persistently without having a source of infinite energy, which does not happen without reason. The reason is due to their special structure that provides all the properties our hearts possess. In the same way, as electrons, nucleons, and all other particles, or quanta (since quantum mechanics is applied to all particles, these should be known as quanta) possess persistent spin motion without having any source of infinite energy, there should be some purpose. And the purpose should be due to their special structure that provides all the properties they display. Therefore, the purpose as to why quanta possess persistent spin motion, their special structures, and properties have been determined. The account of the effect of the purpose as to why quanta possess persistent spin motion (i.e. quantum spin theory) enables us to give very clear and complete explanation of all the phenomena related to them. At present, taking into account the effect of the purpose as why electrons and photons possess persistent spin motion (as the photons are emitted from the orbiting electrons, which posses persistent spin motion, the photons also possess spin motion that they derive from the orbiting electrons), it has been tried to give very clear and complete explanations of their phenomena of interference and diffraction.

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1. INTRODUCTION

As we know, in nature, nothing occurs without reason/purpose. For example, our hearts beat persistently without having a source of infinite energy, which does not happen without reason, as there is an important reason as to why they beat persistently, in addition to why they have a special structure that keeps them beating persistently to provide all the properties our hearts possess. Therefore, as electrons, nucleons, photons, and all other particles, or quanta (since quantum mechanics is applied to all particles, these should be known as quanta) possess persistent spin motion without having any source of infinite energy, there should be some purpose as to why they possess persistent spin motion. And the purpose should be due to their special structures that provide all the properties they display.

Further, as we know, all the phenomena/activities related to our hearts, for example, the continuous blood circulation taking place in our bodies, are the effects of the purpose behind the persistent beating of our hearts, its special structure and properties. Similarly, all the phenomena/activities related to electrons, nucleons, and so forth, should be the effects of the purpose behind their persistent spin motion, their special structures and properties.

Therefore, the purpose as to why quanta possess persistent spin motion (Sec. 2, Ref. 1), their special structures, and properties (Sec. 3, Ref. 1) have been determined. The account of the effect of the purpose as to why quanta possess persistent spin motion (see Sec. 2), that is, a new quantum theory or quantum spin theory (see Sec. 2, Ref. 2), enables us to give very clear and complete explanation of all the phenomena related to them. At present, taking into account the effect of the purpose as to why electrons and photons possess persistent spin motion [as photons are emitted from the orbiting electrons, which possess persistent spin motion, the photons also derive spin motion from them (for verification of its truth, see Sec. I A, Ref. 3)], it has been tried to give very clear and complete explanations of their phenomena of interference and diffraction (see Sec. 3).

Currently, it has been assumed that the electrons and photons possess wave nature, and all the phenomena related to them take place due to their dual nature (i.e. wave nature or particle nature). Their wave nature has been assumed because this alone and not the other quantum idea can account for their phenomena of interference and diffraction. However, the concept of their wave nature cannot be true (for its verification, see Sec. 1.1), and the phenomena of interference and diffraction of electrons and photons cannot take place due to their wave nature (for its verification, see Sec. 1.2).

1.1 Evidences to verify that the concept of the wave nature of quanta cannot be true

1. The sound energy, which suffers the phenomena of interference and diffraction similarly as the radiation energy suffers, does not possess the wave nature itself. The waves are generated in medium when the sound is produced in medium, because then a disturbance is produced in medium, and that generates the waves in medium. Similarly as, when a piece of stone is dropped in a water tank, a disturbance is produced in water and that generates the waves in water.

2. If to radiation energy, the electromagnetic wave nature has been associated because the electromagnetic waves need no medium for their propagation, similarly, as the radiation energy needs no medium for its propagation, and secondly, no concept, other than the concept of wave nature of photons and electrons, can account for the phenomena of their interference and diffraction; then: i- there should be some evidence(s) of interference and diffraction of microwaves and radio waves (which are assumed to be the electromagnetic waves), and ii- to electrons too, the electromagnetic wave nature should be associated because electrons also need no medium for their motion. But there is no evidence of interference and diffraction of microwaves and radio

waves, and to electrons, the electromagnetic wave nature has not been associated, instead the packet wave nature has been associated.

3. In order to explain the phenomenon of interference, it is assumed that, due to superposition of the waves of photons/electrons, and in accordance as the superposition happens to be- constructive or destructive, bright or dark fringes (black or white in the case of electrons) respectively are obtained on the screen/photographic plate. But, if the fringes are obtained on the screen/photographic plate due to superposition of the waves of photons/electrons, the screen can be used in case of electrons too to obtain the fringes, because the wave nature has been associated with both photons and electrons. Why is screen not being used in the case of electrons? Suppose, if it is argued that the screen or the photographic plate is being used in accordance as the nature of wave of the particle is, and as the waves of photons produce the illumination effect while the waves of electrons do not, the screen is being used in the case of photons. But this argument cannot be accepted. Because, if the waves of photons produce the illumination effect, then if a source of radio waves or microwaves (which emit electromagnetic waves) is somehow enclosed in a chamber made of screen, the illumination should be found on the screen of the chamber, similarly, as if a source of light is enclosed in that chamber, the illumination shall be found on the screen of the chamber. But will/can the illumination be found on the screen of the chamber if a source of radio waves or microwaves is enclosed in that? No. It leads to conclude that, either the photons do not possess the electromagnetic wave nature or the illumination of bright fringes is not obtained due to wave nature of photons. Since the photons cannot have any wave nature other than the electromagnetic wave nature, and due to electromagnetic wave nature, no illumination is obtained; the illumination of bright fringes is not obtained due to wave nature of photons, but obtained due to photons themselves. The use of photographic plate in the case of

electrons too leads to the same conclusion (i.e. the interference fringes are obtained due to electrons, not due to their wave nature). Because, the fringes on the photographic plate are obtained due to the effect of charge, and the charge is possessed by electrons.

1.2 Evidences to verify that the phenomena of interference and diffraction of photons and electrons cannot take place due to their wave nature

Currently, as shown in Fig. 1(a), it is assumed that the wave fronts of radiation energy coming from two slits S' and S'' superpose, and in accordance as at points where the superposition happens to be constructive or destructive, the bright and dark fringes respectively are obtained. But it cannot be possible, because:

1. As has been assumed that the radiation energy of photons possesses the electromagnetic wave nature, which (electromagnetic waves) possesses two types of vibrations- of electric field and magnetic fields in two planes mutually perpendicular to each other, Fig. 1(b), not one type of vibration and in one plane, as shown in Fig. 1(a).

2. Somehow, if the vibration of one field, say of magnetic field is assumed to be negligible, even then the superposition of wave fronts, as shown in Fig. 1(a), and as a result of superposition of the waves, obtaining of the bright and dark fringes cannot be possible. Because:

i. If we assume the superposition of wave fronts as shown in Fig. 1(a), number of fringes may be obtained even outside of both the ends of the geometrical shadow of the width between two edges E_1' and E_1'', while all the fringes should be obtained inside the geometrical shadow, as, for example, the fringes are obtained inside the geometrical shadow X Y, Figs. 3(a) and 5(a).

ii. According to the current interpretation of photon (see Sec. 1.1, Ref. 4), the radiation energy, which possesses wave nature, is emitted from the orbiting electrons in discrete form (i.e. in the form of photons), not in continuous form. The production of wave fronts in radiation energy and their superposition, as shown in Fig. 1(a), can be possible if the radiation energy is emitted from its source in continuous form.

The interference fringes and the diffraction bands cannot be obtained due to superposition of the waves of radiation energy of photons too. Because, for superposition of the waves of radiation energy of photons, for example, of P_1' and P_n'' of the set of photons $P_1' P_n''$, P_2' and P_{n-1}'' of the set of photons $P_2' P_{n-1}''$, and so forth [coming from the slits S' and S'' deviating round their (slits) respective edges E_1' and E_1'', Fig. 1(c)], during their fall on the screen, their waves should be propagating parallel to each other and the vibrations of their waves should be in the same plane, as shown in Fig. 1(d). But, as the two photons of every set are coming from two different slits S' and S'', their waves cannot be parallel to each other, and the vibrations of their waves cannot be in the same plane. Despite that, the sustained interference fringes are obtained. It means the interference fringes can/should not be obtained due to superposition of the waves of radiation energy of photons.

2. EFFECT OF THE PURPOSE AS TO WHY ELECTRONS AND PHOTONS POSSESS PERSISTENT SPIN MOTION

As the purpose (see Sec. 2, Ref. 1), as to why electrons, nucleons, and all other particles (i.e. quanta) possess persistent spin motion, is to generate:

1. Linear velocity (v) in them along the directions of their respective L_S, which (linear velocity) varies as the frequency of their spin motion (ω) varies (for detail information, see Sec. 2.1, Ref. 1);
2. Motional energy E_M [= kinetic energy (E_K) + spin energy (E_S)] and motional momentum p_M [= linear momentum (p_{LIN}) + spin momentum (p_S)] in them (for detail information, see Sec 2.2, Ref. 1);

the electrons, nucleons, and all other particles are always found in a state of motion, which is oriented along the directions of their respective L_S (for its verification, see Ref. 5), and during their motion, their energy, momentum, and spin angular momentum, all conserve even, for example, when the rate of increase in velocity of the accelerated electrons by a large voltage (e.g., in Bertozzi's experiment[6]) starts decreasing after attaining relativistic velocity by them, and when the electrons move along their elliptical orbits. (For detail information, see Sec 2.2, Ref. 1.)

As photons also possess spin motion (see Sec. I A, Ref. 3) and the rest mass (for verification of its truth, see Ref. 7), the spin motion of photons generate the same two properties (mentioned above), that is, linear velocity c, $E_M = h\nu$, and $p_M = h\nu / c$, in them (for detail information, see Sec. 2, Ref. 4), and they are always found in a state of motion, which is oriented along the directions of their respective L_S.

The account of the effect of the purpose as to why electrons and photons possess spin motion (i.e. of the finding of electrons and photons always in a state of motion, which is oriented along the directions of their respective L_S, and during their motion, always conservation of their energy, momentum etcetera) enables us to give very clear and complete explanation of the phenomena of their interference and diffraction.

3. EXPLANATION OF THE PHENOMENA OF INTERFERENCE AND DIFFRACTION OF PHOTONS AND ELECTRONS

3.1 Explanation of how the photons are deviated, and at different angles from their paths turning round the edge of an obstacle

3.1.1 In the geometrical shadow

We observe that, when a ball B, suppose moving with velocity v parallel to the plane of paper, gets struck at point 1 or 2 or 3 or ……..located on its surface, Fig. 2(a), by the straight edge P of an obstacle PQ placed perpendicular to the plane of the paper, the ball is deviated from its path rolling round the straight edge P of the obstacle in the geometrical shadow, as shown in Figs. 2(b, c, d). The angle of deviation of the ball depends upon:

1. At which point 1 or 2 or 3 or …., the ball gets struck by the edge P of the obstacle;
2. The momentum of ball with which the ball strikes with the edge P of the obstacle.

Suppose, the ball is deviated along the broken line paths getting struck at points 1, 2, and 3 with the edge P of the obstacle, as shown respectively in Figs. 2(b), 2(c), 2(d). If the momentum of the ball is increased from p to p', the ball is now deviated along the dotted line paths, that is, the angle of deviation is now increased. The angle of deviation of ball goes on increasing as the point at which it gets struck by the edge of obstacle shifts from 1 to 2, 2 to 3, 3 to 4, and so on, or as the momentum of the ball increases.

Similarly, when a photon is deviated in the geometrical shadow rolling round the edge of an obstacle, for example, round the edge E_1' of slit S' or round the edge E_1'' of slit S'' in interference phenomenon, Fig. 3(a), or round a straight edge, Fig. 4, or round the edges of a thin wire, Figs. 5(a and b), in diffraction phenomenon, the angle of deviation of the photon depends upon the momentum of photon, and at which point 1 or 2 or 3 or….., located on the surface of photon, the photon is struck by the edge of the obstacle. [The present concept of location of points 1, 2, 3, …..on the surface of photon, and the striking of the edge of an obstacle at different points 1, 2, 3, …..located on the surface of photon is thought hard to accept/believe because of extremely small size of photon. But this concept cannot be ruled out. Because: 1. In the current explanation of the phenomena of diffraction and interference of photons, if the sharpness of the edges of slits and obstacles used in the experimental setups to demonstrate the phenomena of interference and diffraction can be assumed to be of the order of the wavelength of waves associated with photons, the present concept too can be taken. 2. In Compton's scattering, photons and electrons are scattered at different angles, it can be possible only if they collide with each other at different points on their surface. (Photons and electrons can be scattered at different angles if they collide with each other at different angles too.) If in Compton's scattering experiment, the photons and electrons can collide with each other at different points on their surface, the present concept of striking of the edge of obstacle at different points 1, 2, 3, …..on the surface of photons too can be possible.]

If the source of light is not monochromatic but is of white light, there occur photons of seven different frequencies $\nu_1, \nu_2, \nu_3, \ldots\ldots$ and hence of seven different momentum $p_1 (= h\nu_1 / c)$, $p_2 (= h\nu_2 / c)$, $p_3 (= h\nu_3 / c)$,....... Then the angles of deviation of photons from their respective paths depend also upon their momentum. And consequently, suppose, if a photon of momentum p_1 is deviated by an angle θ getting struck at point 4 on its surface, a photon of momentum p_2 or p_3 or p_4 or ….. (where $p_1 < p_2 < p_3 < p_4$ …..) may also be deviated by the same angle θ or by an angle $\theta' (< \theta$ or $> \theta)$ getting struck at point 1 or 2 or 3 on its surface. Then obviously they (i.e. two photons of two different colors) overlap completely or partially on each other when fall on the screen. Consequently, when a source of white light is used, for example, in the phenomenon of interference, due to overlapping of photons of different colors, no clear and distinct fringes of different colors are obtained on the screen (for detail description, see Sec. 2.2.2).

3.1.2 In direction opposite to the geometrical shadow

In addition to deviation of photons of the beam in the geometrical shadow of the obstacle, some photons of the beam, for example, P_1, P_2, P_3,…. are deviated in direction opposite to the geometrical shadow too at different angles colliding with photon P, similarly, as the balls B_1, B_2 and B_3 are deviated in direction opposite to the geometrical shadow at different angles colliding with ball B, shown in Figs. 2(a), 2(b) and 2(c) respectively. Because, when the photons are deviated in the geometrical shadow rolling round the edge of obstacle, during the course of their rolling, their surface may collide with the surfaces of some passing by photons of the beam. When the collisions take place, the passing by photons are deviated in direction opposite to the geometrical shadow at different angles. The angle of deviation of the passing by photon depends upon which portion of it strikes with which portion of the rolling photon and at which instant of its rolling process.

3.2 Explanation of the phenomenon of interference of photons

3.2.1 Explanation of how the bright and dark fringes are obtained when the source of light is monochromatic

The photons, as shown in Fig. 3(a), coming from the slit S when fall at the edge E_1' of slit S', they are deviated at different angles in the geometrical shadow of edge E_1' rolling round the edge E_1', in accordance as at which point 1 or 2 or 3 or…. located on their surface, the edge E_1' strikes with them. Similarly, the photons coming from the slit S when fall at the edge E_1'' of slit S'', they too are deviated at different angles in the geometrical shadow of edge E_1'' rolling round the edge E_1'', in accordance as at which point 1or 2 or 3 or…. located on their surface, the edge E_1'' strikes with them. Suppose the photons $P_1', P_2', P_3', P_4', P_5', P_6'$ are deviated at different angles rolling round the edge E_1', and the photons $P_6'', P_5'', P_4'', P_3'', P_2'', P_1''$ are deviated at different angles rolling round the edge E_1''. In the experimental setups to exhibit the phenomenon of interference of photons, an adjustment is made (how and what adjustment is made, for detail information, see Sec. 3.2.3) such that the photon P_1' colliding with photon P_6'', the photon P_2' colliding with photon P_5'', and so forth, move along their resultant directions and fall on the screen at places Q_1, Q_2, Q_3, ….. respectively. At places Q_1, Q_2, Q_3, ….. the bright fringes are obtained. Suppose, if the photons, for example, P_2' and P_5'' do not fall at point Q_2 on the screen colliding with each other, then the photon P_2' shall fall at point somewhere in between Q_2 and Q_3, and the photon P_5'' at point somewhere in between Q_1 and Q_2. As the photons P_2' and P_5'', instead of falling respectively at point somewhere in between Q_2 and Q_3 and at point somewhere in between Q_1 and Q_2, fall together at point Q_2, a bright fringe is obtained at point Q_2, and the blank spaces are obtained in between Q_2 and Q_3, and in between Q_1 and Q_2. The blank spaces in between every two points, for example, in between Q_1 and Q_2, in between Q_3 and Q_4, and so forth, act as the dark fringes.

3.2.2 Explanation of how the overlapping fringes of different colors are obtained when the source of light is non-monochromatic, say of white light

When a source of white light is used, the photons of seven different colors, that is, of seven different momentum $p_1 (= h\nu_1 / c)$, $p_2 (= h\nu_2 / c)$,…are emitted from the source.

Suppose, at some point Q on the screen, a photon of momentum p_1, turning round the edge E_1' after getting struck at point 3 on its surface by the edge E_1', form a bright fringe colliding with a photon of same momentum p_1, coming after turning round the edge E_1''. Since the angle of deviation of photons depends upon their momentum also, and as their momentum increases, their angle of deviation increases, at the same point Q or just forward or backward to it on the screen, a photon of momentum p_2 (where p_2 >

p_1), turning round the edge E_1' after getting struck at point 2 on its surface by the edge E_1', may also form a bright fringe colliding with a photon of the same momentum p_2 coming after turning round the edge E_1''. When two bright fringes are formed on the screen by the photons of two different momentum (i.e. of two different colors) at the same point, or very little forward or backward to it, accordingly, the fringes overlap completely or partially. So, due to overlapping of fringes of different colors, there are obtained no clear and distinct fringes of different colors, instead obtained fringes of mixed colors.

3.2.3 Mathematical treatment of interference phenomenon

To obtain situation such that the photons $P_1', P_2', P_3', P_4', P_5', P_6'$ colliding respectively with photons $P_6'', P_5'', P_4'', P_3'', P_2'', P_1''$ may give rise to bright fringes on the screen C, as shown in Fig. 3(a), it is necessary that the group of photons P_1', P_2', P_3', P_4', P_5', P_6' and the group of photons $P_6'', P_5'', P_4'', P_3'', P_2''$, P_1'' should be deviated by the angles as shown in Fig. 3(a) rolling respectively round the edges E_1' and E_1''. Such situation is obtained by varying the distance D, Fig. 3(b), between plane of two slits S', S'' and the plane of screen C, shifting screen C backward or forward as the situation demands for a given distance d between two slits S' and S''. Because, the photons incident on the edges E_1' and E_1'' not normally but making some angle with the normal on the surface of edges [as appear from Figs. 3(a and b)], consequently, as distance d between slits S' and S'' increases, the region of geometrical shadow on the screen (i.e. XY) and the angles of incidence of photons (i.e. the angles between normal and the directions of incidence of photons on the surfaces of edges E_1' and E_1'') increase. Due to increase in the angles of incidence of photons, the angles of their deviation in the geometrical shadow region of the width between edges E_1' and E_1'' are decreased. Therefore, the photons $P_6'', P_5'', P_4'', P_3'', P_2'', P_1''$ fail to reach up to photons $P_1', P_2', P_3', P_4', P_5', P_6'$ respectively and give bright fringes colliding and falling together at points $Q_1, Q_2, Q_3, Q_4, Q_5, Q_6$ respectively. And hence, to obtain situation such that the photons, deviated from the edges E_1' and E_1'', colliding and falling on the screen may give bright fringes, as shown in Fig. 3(a), for every distance d between the edges E_1' and E_1'', the distance D is found out by shifting the screen C backward or forward as the situation demands. If the increase in distance d is continued, a stage comes when even the maximum deviated photon from the edge E_1' fails to reach up to the maximum deviated photon from the edge E_1''. Then no fringe is obtained by varying D to any value.

So, the situation, as shown in Figs. 3(a, b), is obtained for a particular set of d and D. And if the positions of fringes, for example, $Q_1, Q_2, Q_3, \ldots$ are determined, these should depend upon the combination of d and D. The dependence of position (x), for example, of Q_1, Fig. 3(b), over the combination of d and D can be expressed as follows:

$$\mathrm{x} = \frac{D}{d} \times \textit{path difference between photons } P_1' \textit{ and } P_6''$$

$$= \frac{Dc}{2\pi\nu d} \times \textit{phase difference between frequencies of photons } P_1' \textit{ and } P_6$$

Because, phase difference = (2π $\times$path difference) / λ = (2π $\times$path difference) $\times\,\nu$/c, where c is the velocity of light, and ν is the frequency of the spin motion of photons, not the frequency of the wave nature of photons.

As λ = c/ν, where c is constant, and ν is the characteristic of particle nature of photon, therefore, λ should also be the characteristic of particle nature of photons. And hence, the phase difference should be between frequencies of spin motion of photons, not between wavelengths of the wave nature of photons.

The photons $P_1', P_2', P_3', P_4', P_5', P_6'$ colliding respectively with photons P_6'', $P_5'', P_4'', P_3'', P_2'', P_1''$ can give bright fringes falling respectively at points Q_1, Q_2, Q_3, Q_4, Q_5, Q_6 on the screen if,

the path difference between the colliding photons = $2n\dfrac{\lambda}{2} = 2n\dfrac{c}{2\nu} = n\dfrac{c}{\nu}$

or the phase difference between frequencies of the colliding photons = $n \times 2\pi$

where n is a whole number and characterizes a particular bright fringe.

NOTE: If the distance d between slits S' and S'', Fig. 3(b), is increased, a stage comes, when the maximum deviated photon P_6'', Fig. 3(a), fails to reach and collide with photon P_1', instead succeeds to reach and collide with photon P_2' or P_3' or… , and similarly, the maximum deviated photon P_6' fails to reach and collide with photon P_1'', instead succeeds to reach and collide with photon P_2'' or P_3'' or… If the distance d is increased further, ultimately, a stage comes when suppose d is increased to d', even the maximum deviated photon P_6' fails to reach and collide with the maximum deviated photon P_6''. Then no interference fringe is obtained on the screen.

3.3 Explanation of the phenomenon of diffraction of photons

3.3.1 Diffraction at straight edge

Let A, Fig. 4, be a sharp straight edge of an opaque obstacle AB, S be a narrow rectangular slit and C be a screen. The sharp edge A and slit S both are parallel to each other and perpendicular to the plane of the paper along with the screen C. Let the slit be illuminated by a monochromatic source of light of frequency ν.

3.3.1(a) Explanation of how the intensity falls off continuously and rapidly as we move into the geometrical shadow until complete darkness is reached

Out of photons coming from the source, some photons are deviated in the geometrical shadow of the straight edge at different angles accordingly as they get struck by the straight edge at points 1or 2 or 3 or…., located on their surface. In the beginning, the deviation happens to be very little, which goes on increasing successively [it can be understood clearly looking at the location of points 1, 2, 3,….., n on the surface of the ball, Fig. 2(a)]. Therefore, in the beginning of the geometrical shadow, the photons fall on the screen partially overlapping on each other, which (overlapping) goes on reducing, and then they become separated from each other, which (separation) goes on increasing till a complete darkness is obtained, as shown in Fig. 4. So, as the density of crowd of photons on the screen varies, accordingly the intensity falls off in the geometrical shadow, Fig. 4.

3.3.1(b) Explanation of how the bright and dark bands are obtained outside the geometrical shadow

Above the limit of geometrical shadow of the straight edge on the screen, Fig. 4, the photons, coming directly from the source, and those, which are deviated in direction opposite to the direction of geometrical shadow region, like photons P_1, P_2, P_3,…. (see Sec. 3.1.2), fall. Some of the deviated photons, before falling on the screen, may collide with some passing by photons, coming directly from the source, and they fall all together on the screen moving in their resultant direction obtained after their collisions. Before falling on the screen, these groups of photons (formed due to collisions between the deviated and the directly coming photons) may collide with some other passing by photons too and they fall all together on the screen moving in the resultant direction obtained after their collisions. This process may go on and the photons may fall on the screen in groups of 2 or 3 or 4 and so forth photons.

So, due to deviations of photons coming from the source, they do not fall on the screen distributed uniformly, but fall on the screen distributed in number of groups, each group having different number of photons and separated by a gap. How many photons fall in different groups and how much widely the photons are distributed in those groups, accordingly the intensity and the width of different groups are obtained. And how the photons are distributed in different portions of different groups- little separated from each other or touching each other or overlapping (partially or densely or very densely) on each other, accordingly intensity of different portions of different groups is obtained.

The deviated photons, while colliding with the passing by photons before falling together on the screen, do not collide with any arbitrary x, y, z passing by photons, but collide only with those photons which satisfy condition depending on their path difference or phase difference between frequencies of their spin motion (ν). That condition is to be determined.

3.3.1(c) Explanation of why and how the bright bands of continuously reducing intensity and width, as their order increases, are obtained

During the rolling process of every photon round the straight edge, as shown in Figs. 2(b, c, d), colliding with this photon, not only one but several passing by photons may be deviated and by different angles from their respective paths, depending upon how many photons collide with the rolling photon during the process of its rolling. And the angles of their deviations depend upon at which different instants of the rolling process of the rolling photon the deviated photons collide with the rolling photon before the rolling photon is deviated towards the geometrical shadow. Thus, during rolling process of every photon, getting struck at every point 1or 2 or 3 and so forth located on its surface, due to collisions of the passing by photons with every such rolling photon, a series of photons is obtained deviated at different angles. Supposing, during the rolling process of some photon, getting struck at point 1 on its surface, colliding with this rolling photon, a series of m_1 passing by photons $P_{11}, P_{12}, \ldots P_{1m_1}$ are deviated respectively by the angles $\theta_{11}, \theta_{12}, \ldots \theta_{1m_1}$ from their path. During the rolling process of some another photon, getting struck at point 2 on its surface, colliding with this rolling photon, a series of m_2 passing by photons $P_{21}, P_{22}, \ldots P_{2m_2}$ are deviated respectively by angles $\theta_{21}, \theta_{22}, \ldots$ θ_{2m_2} from their path. And similarly, during the rolling process of some another photon getting struck at the last point n on its surface, colliding with this rolling photon, a series of m_n passing by photons $P_{n1}, P_{n2}, \ldots, P_{nm_n}$ are deviated respectively by angles $\theta_{n1}, \theta_{n2}, \ldots,$ θ_{nm_n} from their path. As the duration of rolling of photon, getting struck at point 1 on its surface, happens to be optimum [which we can imagine/estimate from the Fig. 2(b, c, d)], obviously m_1 happens to be optimum. And as the duration of rolling of photon, getting struck at point n on its surface, happens to be the least, m_n happens to be also the least.

The angles of deviation $\theta_{11}, \theta_{12}, \ldots, \theta_{1m_1}$ of the series of m_1 photons probably happen to be such that all the m_1 photons, colliding with photons coming straightly from the source and getting deviated along with them, fall all together on the screen C in a group producing the first bright band. And the angles of deviation $\theta_{21}, \theta_{22}, \ldots \theta_{2m_2}$ of the series of m_2 photons probably happen to be such that all the m_2 photons, colliding with photons coming straightly from the source and getting deviated along with them, fall all together on the screen C in a group producing the second bright band. And similarly, the angles of deviation $\theta_{n1}, \theta_{n2}, \ldots\ldots \theta_{nm_n}$ of the series of m_n photons probably happen to be such that all the m_n photons, colliding with photons coming straightly from the source and getting deviated along with them, fall all together on the screen C in a group producing the last bright band. As the $m_1 > m_2 > \ldots\ldots > m_n$, the density of crowd of photons and the width of spreading of photons in different bands go on reducing successively as their order increases. And consequently, the bright bands of continuously reducing intensity and width, as their order increases, are obtained on the screen, Fig 4.

3.3.1(d) Explanation of why and how after every bright band, a dark band is obtained

As the groups of photons ($P_{11}, P_{12}, \ldots P_{1m_1}$), ($P_{21}, P_{22}, \ldots. P_{2m_2}$),…….($P_{n1}, P_{n2}, \ldots.,$ P_{nm_n}) are obtained due to collisions with photons, rolling round the straight edge getting struck at their points 1, 2, 3,……., n respectively, there occurs no continuity between their groups of angles, for example, between ($\theta_{11}, \theta_{12}, \ldots.. \theta_{1m_1}$) and ($\theta_{21}, \theta_{22}, \ldots.. \theta_{2m_2}$), between ($\theta_{21}, \theta_{22}, \ldots.. \theta_{2m_2}$) and ($\theta_{31}, \theta_{32}, \ldots.. \theta_{3m_3}$), and so forth. And further, as with every group of photons ($P_{11}, P_{12}, \ldots. P_{1m_1}$), ($P_{21}, P_{22}, \ldots. P_{2m_2}$),…….($P_{n1}, P_{n2}, \ldots., P_{nm_n}$), some of the photons, coming straightly from the source, are also deviated, the blank spaces are obtained on the screen at the places where those photons (coming straightly from the source) would have fallen if they had not been deviated along with the groups of photons ($P_{11}, P_{12}, \ldots\ldots P_{1m_1}$), ($P_{21}, P_{22}, \ldots. P_{2m_2}$),……., ($P_{n1}, P_{n2}, \ldots. P_{nm_n}$). The blank spaces so obtained after every group on the screen are observed as the dark bands. Therefore, a dark band is obtained after every bright band.

3.3.2 Diffraction at a narrow wire

Let AB be a narrow wire of thickness d, held parallel to a narrow rectangular slit S placed perpendicular to the plane of paper, Figs. 5(a and b).

The case of diffraction at a narrow wire is equivalent to diffraction at two straight edges, A and B, of which the backs are joined together parallel to each other. And therefore, as shown in Figs. 5(a and b), above the geometrical shadow of A, that is, above X on the screen, and similarly, above the geometrical shadow of B, that is, below Y on the screen, the bright and dark bands of continuously reducing intensity and width, as their order increases, are obtained. And in the geometrical shadow of A, that is, below X on the screen, and similarly, in the geometrical shadow of B, that is, above Y on the screen, continuously and rapidly fall in intensity are observed, as we move into the geometrical shadow, till complete darkness are reached.

3.3.2(a) When the wire is thin

When the wire happens to be thin, the range of distribution of photons in the geometrical shadow below X, and the range of distribution of photons in the geometrical shadow above Y come very close to each other, such that the portions (of the ranges of distribution of photons in the geometrical shadows below X and above Y), where the photons are distributed separated from each other [as has been described in Sec. 3.3.1(a)], overlap. Subsequently, there arises situation such that one to one photon of both the portions colliding with each other, fall on the screen moving in their resultant directions, and give rise to interference fringes in the middle of X and Y on the screen, Fig. 5(a). Similarly, as one to one photon of both the groups of photons, deviated round the edges E_1' (e.g. $P_1', P_2', P_3', P_4', P_5', P_6'$) and E_1'' (e.g. $P_6'', P_5'', P_4'', P_3'', P_2'', P_1''$) of the slits S' and S'' respectively (e.g., photon P_1' with photon P_6'', photon P_6' with photon P_1'', and so forth), Fig. 3(a), colliding with each other fall on the screen moving in their resultant directions, and give rise to interference fringes in between X and Y on the screen.

3.3.2(b) When the wire is thick

As the thickness of wire is increased, the range of distribution of photons in the geometrical shadow below X, and the range of distribution of photons in the geometrical shadow above Y start becoming away from each other. Ultimately, a stage comes, that is, when the thickness d of the wire is increased to d', Fig. 5(b), the ranges of distribution of photons in the geometrical shadows below X and above Y become as much away from each other that the overlapping of the portions (of the ranges of distribution of photons in the geometrical shadows below X and above Y), where the photons are distributed separated from each other, finishes completely. Then no interference fringe is obtained on the screen in the middle of X and Y.

3.3.3 Diffraction at a single slit

The case of diffraction at a single slit is equivalent to diffraction at two straight edges, for example, E_1 and E_2, very close, parallel and facing to each other. But in this case of diffraction, the photons deviated in direction opposite to the geometrical shadow of the edge E_1 (i.e. towards the edge E_2) in different groups [similarly, as has been described in Sec. 3.3.1(c)], when colliding with the passing by photons (coming directly from the source) and deviating them along with themselves, move onwards to fall on the screen, on their way, they collide with photons coming in similar manner from the opposite side, that is, coming after being deviated in direction opposite to the geometrical shadow of the edge E_2 (i.e. towards the edge E_1) in different groups, and along with which the passing by photons (coming directly from the source) are also deviated. Due to their collisions on their way, when they fall on the screen, now their distribution on the screen is being changed (i.e. not obtained as shown distributed above the geometrical shadow, Fig 4). In the middle/centre of screen, a very large number of photons fall in a big group, and on both sides of this group, the photons fall symmetrically in comparatively very small groups, the size of which reduces rapidly. The symmetrical groups on both sides of the central group are obtained probably due to falling of: 1- the photons which are left from collisions and falling in the central group; and 2- the photons which do not become able to reach in the centre, and before that, they fall on the screen. And consequently, their size reduces rapidly.

The places on the screen, where the photons fall or not fall, and if they fall, how they fall, overlapping completely or partially or touching to each other or separated from each other, in huge number or large number or small number, these all depend upon: 1- the angles of directions of motion of electrons moving towards E_1 and E_2; 2- the angles at which the colliding electrons collide with each other; and 3- the resultant angles at which they start moving after their collisions, etcetera. [The collisions between photons do not take place arbitrarily/randomly, but there should be some conditions, for example, between their path difference or phase difference in their frequency of spin motion (ν).] Accordingly, the photons fall on the screen in a huge group in the centre, and on both sides of it, the photons fall symmetrically in several small groups of rapidly reducing size, and between every two groups, there is obtained a blank spaces where no photons fall.

As the density of crowd of photons in different groups, and at different places of different groups varies; accordingly, the intensity of different groups, and the intensity of their different portions vary. And as the range/width of spreading of photons in different groups varies, accordingly, their width also varies. In blank spaces, since no photons fall, these behave as the dark bands.

4. DISCUSSION

Regarding deviation of photons from their respective paths turning round the edge(s) of the obstacle, currently, it has been assumed hypothetically that the turning round the edges or round the corners of the obstacle is a characteristic of wave motion, and as the photons are the quanta of radiation energy which possesses wave nature, the photons are deviated from their paths, and at different angles turning round the edge(s) of the obstacle. While the present approach gives very clear and complete explanation, and such that we can visualise in our imagination as to how the photons are deviated, and at different angles (see Sec. 3.1.1). The present approach gives very clear and complete explanation also of how the photons are deviated, and at different angles in direction opposite to geometrical shadow of the obstacle (see Sec. 3.1.2).

Regarding obtaining interference fringes, the present approach gives very clear and complete explanation, and such that we can visualise in our imagination as to how practically the bright and dark interference fringes are obtained (see Sects. 3.2.1 and 3.2.3), and how the overlapping fringes of different colours are obtained when the source of white is used (see Sec. 3.2.2). The current approach (i.e. assuming the wave nature of photons) fails to do so (i.e. to visualise).

Regarding obtaining diffraction bands also, the present approach gives very clear and complete explanation such that we can visualise in our imagination as to how practically the bright and dark diffraction bands of continuously decreasing brightness and width, as their order increases, are obtained in direction opposite to the geometrical shadow of a straight edge [see Sec. 3.3.1(b, c, d)], and how the intensity falls off continuously and rapidly as we move into the geometrical shadow of the straight edge until complete darkness is reached [see Sec. 3.3.1(a)]. The current approach (i.e. assuming the wave nature of photons) fails to do so. In the current approach, taking a logically and practically unbelievable concept of division of wave fronts into half period elements/zones, the above phenomena have been tried to explain. It succeeds to explain the variation in intensity of the diffraction bands, but fails to explain the variation of their width. Secondly and most importantly, as the radiation energy is emitted in quantised form, and not in continuous form, the wave fronts cannot be generated, and hence, there does not arise any question of their division into half period elements/zones.

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FIGURE CAPTIONS

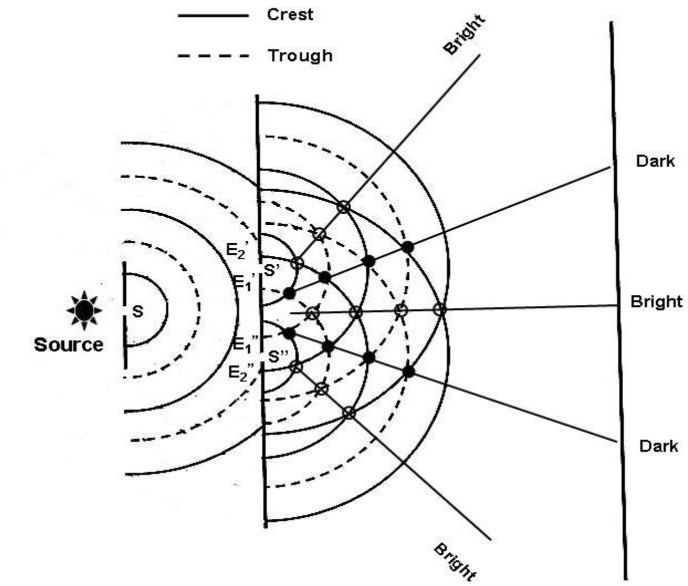
Fig. 1: (a): Interference of two wave trains; (b): Vibrations of electric and magnetic fields of electromagnetic waves during their propagation; (c): Production of bright and dark fringes due to superposition of waves of photons (waves of photons and their superposition have not been shown in Fig. to avoid complication in it).

Fig. 2: (a)- Ball B on the surface of which the points 0, 1, 2, 3. …, n are located. (b, c, d)- Deviation of ball B in geometrical shadow of obstacle PQ at different angles, depending upon its momentum p and p', and point 1, 2, 3 on its surface getting struck respectively at which by the edge P of the obstacle, it is deviated; and deviation of balls B_1, B_2, B_3 in direction opposite to the geometrical shadow at different angles, getting struck by the ball B during its (ball B) rolling process round the edge P of the obstacle PQ, where the ball B starts rolling after being struck by the edge P at point 1, 2, 3 respectively on its surface.

Fig. 3: Interference fringes due to collisions and falling on the screen of pairs of two photons, coming from two slits S' and S'' after being deviated at different angles.

Fig. 4 Diffraction bands above the geometrical shadow of a straight edge due to falling of photons on the screen in a series of groups of continuously decreasing width and density of crowd of photons; and rapidly decreasing intensity in geometrical shadow of the straight edge due to falling of photons in rapidly decreasing density of their crowd.

Fig. 5: (a, b)- Diffraction bands beyond the geometrical shadow of the width of a narrow wire due to falling of photons on the screen in a series of groups of continuously decreasing width and density of crowd of photons; and in geometrical shadow of the width of wire, in the beginnings: rapidly decreasing intensities due to rapidly decreasing density of the crowd of photons, and in the middle: (a)- interference fringes due to collisions of pairs of photons when the wire is thin, (b)- no interference fringes due to no possibility of collisions of the pairs of photons when the wire is thick.


Crest
Trough
Bright
Dark
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Dark
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S
S'
S''
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E1''
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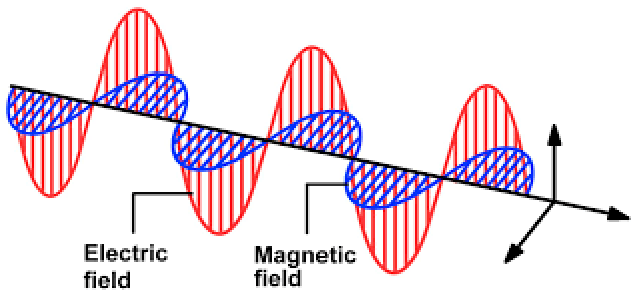
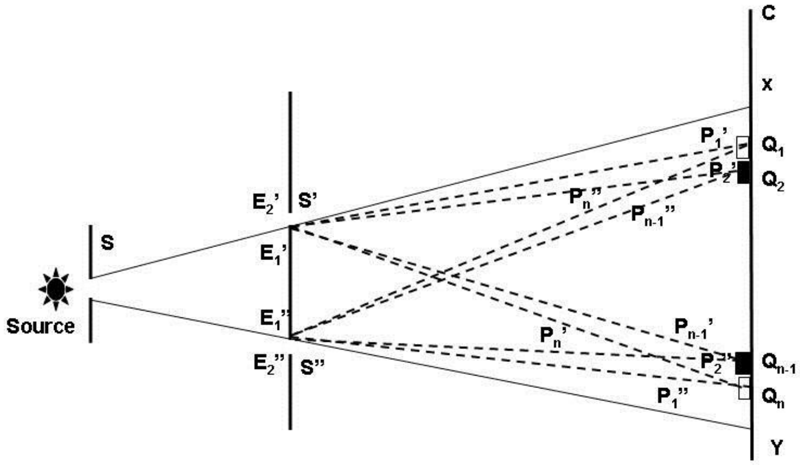
(a)


Electric field
Magnetic field

(b)



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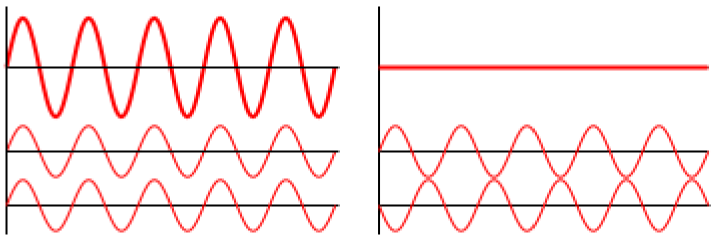
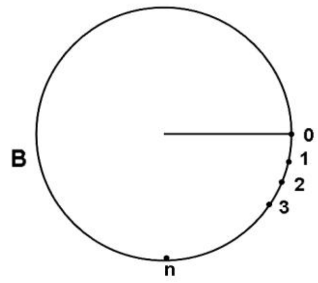


(d)

Fig. 1



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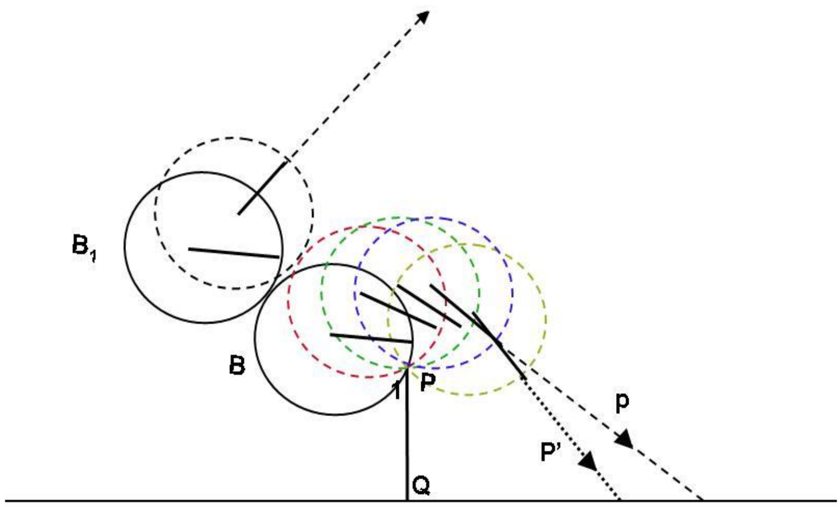

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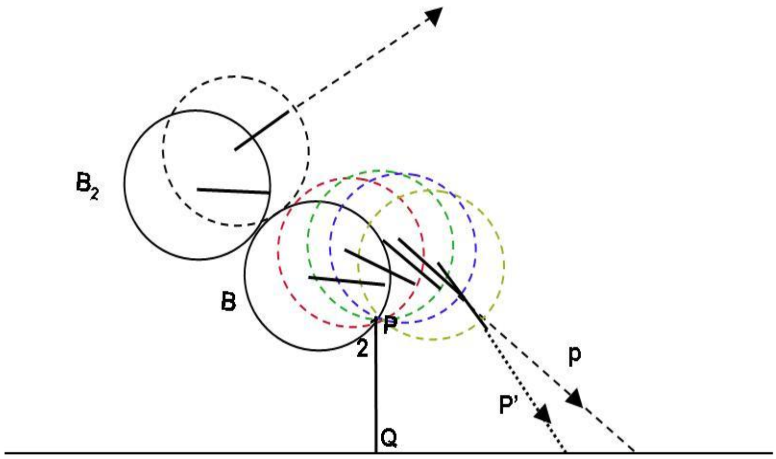

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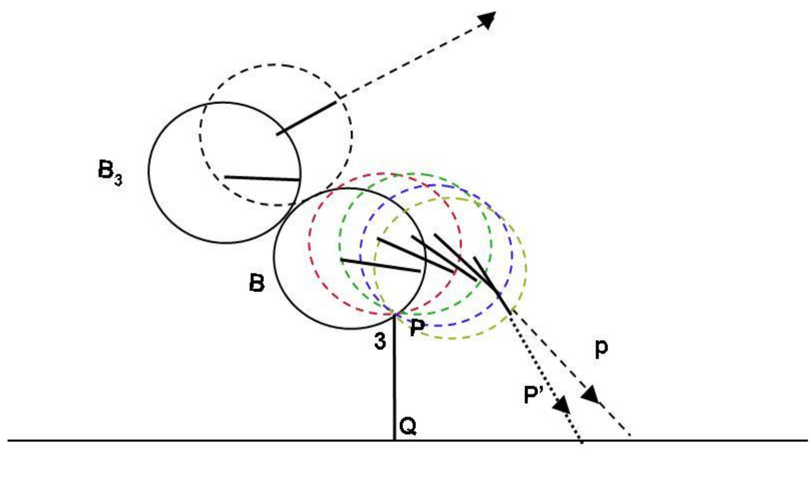

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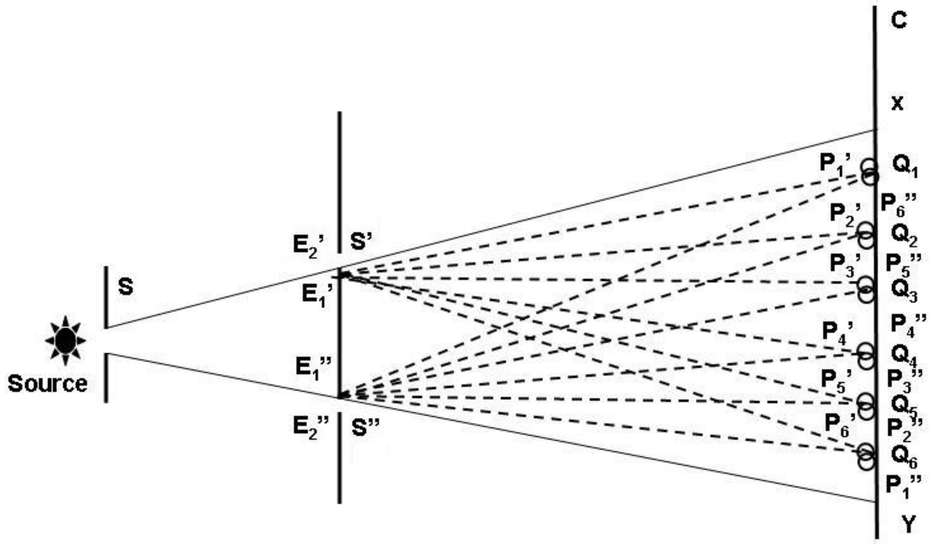
Fig. 2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X
S
Source
E2'
S'
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E1''
E2''
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P1'
Q1
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Q2
P3'
P5''
Q3
P4'
P4''
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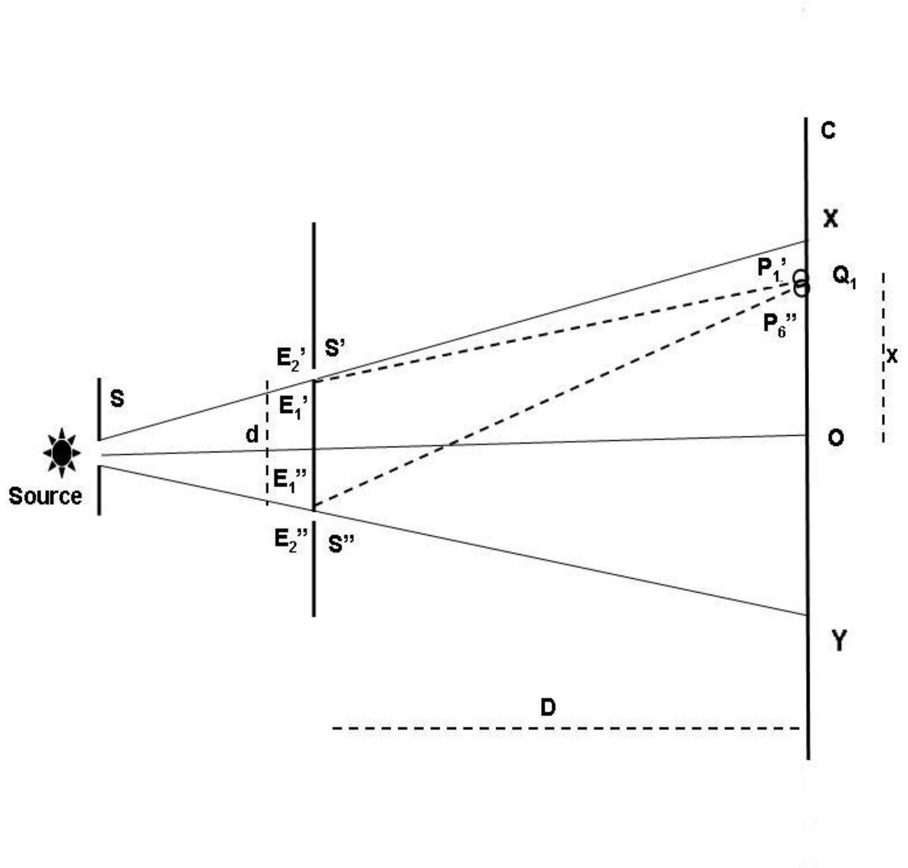
Q5
P6'
P2''
Q6
P1''
Y

(a)



(b)

Fig. 3

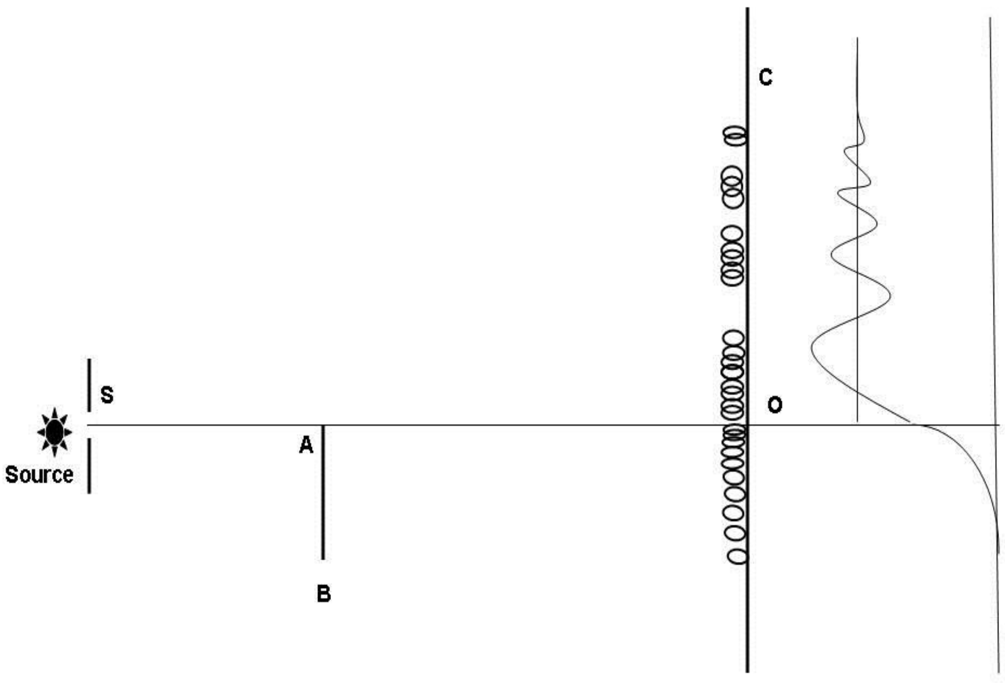
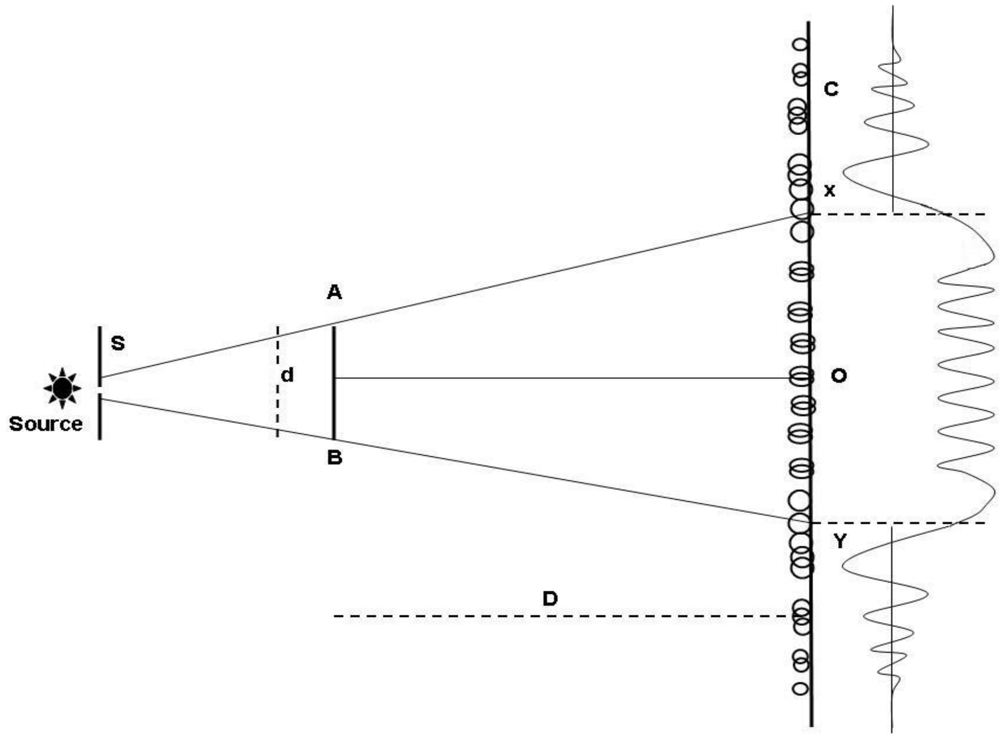
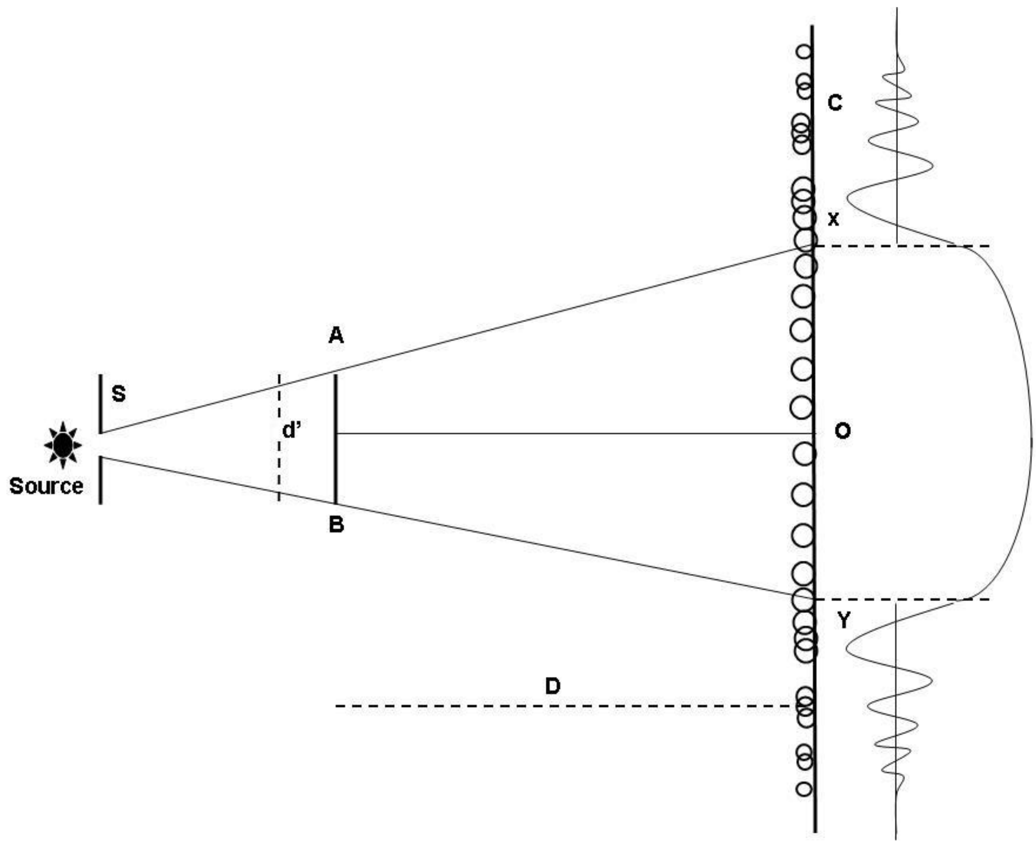


Fig. 4



(a)



(b)

Fig. 5