Understanding interference and diffraction of photons and electrons: a new approach

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All electrons, nucleons, and other particles or quanta (because quantum mechanics is applied to all particles, these should be known as quanta) undergo a persistent spin motion without possessing any infinite energy source, and therefore, they should have a unique structure that maintains their spinning and provides all the properties that they display. Additionally, because nothing in nature occurs without a reason or purpose, there should be an explanation for their persistent spinning motion. The photons also possess spin motion that they derive from the orbiting electrons from which the photons are emitted, and not obtain from their unique structure. Therefore, purpose why all electrons, nucleons, and other particles possess persistent spin motion, and unique structures of electrons and nucleons have been determined. The results of the determination of the purpose why all electrons, nucleons, and other particles possess persistent spin motion provide very clear and complete explanations for all related phenomena. Present study is focused on to provide clear and complete understanding of the phenomena of interference and diffraction of electrons and photons.

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1. Introduction

In nature, nothing occurs without a reason or purpose. For example, our hearts beat persistently without having a source of infinite energy, which does not happen without a reason. The reason is due to their unique structure that provides all the properties our hearts possess. In the same way, as all electrons, nucleons, and other particles or quanta (because quantum mechanics is applied to all particles, these should be known as quanta) undergo a persistent spin motion without having any source of infinite energy, they should have unique structures that provide their persistent spinning, as well as their other properties that they display. In addition, there should be some reason or purpose why they show a persistent spin motion. Photons also possess spin motion that they derive from the orbiting electrons from which the photons are emitted, and not obtain from their unique structure (see Section I A, [1] for verification).

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 unique 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 unique structures and properties.

Therefore, the purpose why all electrons, nucleons, and other particles possess persistent spin motion (see Section 2, [2]), and unique structures of electrons and nucleons (see Section 3, [2]) have been determined. The results of the determination of the purpose why all electrons, nucleons, and other particles possess persistent spin motion (see Section 2) provide very clear and complete explanations for all related phenomena. In the present study, the focus is on to provide very clear and complete explanation of why and how the phenomena of interference and diffraction of electrons and photons occur (see Section 3).

All electrons, nucleons, photons, and other particles are currently assumed to possess wave characteristics, and all related phenomena are assumed to occur because of their dual nature (wave and particle characteristics). Their wave nature is assumed because this alone and not the other quantum idea can account for the phenomena of interference and diffraction of electrons and photons. However, the concept of their wave nature cannot be true (see Section 1.1 for verification), and the phenomena of interference and diffraction of electrons and photons cannot take place due to their wave nature (see Section 1.2 for verification).

1.1 Evidences to verify that the concept of the wave characteristic of electrons, nucleons, photons, and other particles 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 the medium, because then a disturbance is produced in the medium, and that generates the waves in the medium. Similarly, when a piece of stone is dropped in a water tank, a disturbance is produced in the water and that generates waves in the water.

2) Photons were assigned an electromagnetic wave nature because first, electromagnetic waves require no medium for propagation, similar to photons that require no medium for their motion; and second, no concept other than the wave nature of photons and electrons can account for the interference and diffraction phenomena. Thus, i) there should be some evidence(s) of interference and diffraction in microwaves and radio waves (assumed to be electromagnetic waves), and ii) the electromagnetic wave nature should be associated with electrons as well because they require no medium for their motion. However, there is no evidence of interference and diffraction in microwaves or radio waves, and electrons are instead associated with a packet wave nature.

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. However, 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. Suppose, if it is argued that the screen or the photographic plate is being used in accordance as the nature of waves of

photons and electrons is (because to photons electromagnetic wave nature and to electrons wave packets are associated), and second, 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. However, 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. 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 the wave nature of photons. Because 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 the 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 of magnetic field in two planes mutually perpendicular to each other, Fig. 1(b), and 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 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 Section 1.1, [3]), the radiation energy, which possesses wave nature, is emitted from the orbiting electrons in discrete form (i.e. in form of photons), and 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 diffraction bands cannot be obtained due to superposition of the waves of radiation energies contained in photons too, because occurrence of waves in radiation energies contained in photons cannot be possible. Further, for superposition of the waves of radiation energy of, e.g., photon P_1' (coming from slit S' after getting deviated round its edge E_1') and photon P_n'' (coming from slit S'' after getting deviated round its edge E_1''), of photons P_n' (coming from slit S' after getting deviated round its edge E_1') and photon P_1'' (coming from slit S'' after getting deviated round its edge E_1''), and so forth, Fig. 1(c), during their fall together on the screen, the waves of radiation energy of photons P_1' and P_n'' 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). Similarly, the waves of radiation energy of photons P_1'' and P_n' 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, because the propagation and vibrations of the waves of photon P_1' and photon P_n'' reaching at point Q_1, and similarly of the waves of photon P_n' and photon P_1'' reaching at point Q_n, and so forth, cannot always be in same direction and in same plan respectively, and hence their waves cannot superpose either constructive or destructive. Therefore, sustained interference fringes cannot be obtained, while on the contrary, sustained interference fringes are obtained. It means the interference fringes cannot be obtained due to superposition of the waves of radiation energy of photons.

2. RESULTS OF THE DETERMINATION OF THE PURPOSE WHY ELECTRONS, NUCLEONS, AND OTHER PARTICLES POSSESS PERSISTENT SPIN MOTION

Because the purpose (see Section 2, [2]) behind the possession of the property of spinning motion in electrons, nucleons, photons, and other particles is to generate in them:

1) linear velocities (v) along the directions of their respective spin angular momentum (L_S), where v varies with the spinning motion frequency (ω) (see Section 2.1, [2] for detail information);

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)] (see Section 2.2, [2] for detail information);

electrons, nucleons, photons, and other particles are always found in a state of linear motion oriented along their respective L_S directions. The energy(E_M), momentum (p_M), and spin angular momentum (L_S) of quanta are always conserved during their motions, even when the rate of velocity increase in electrons accelerated by a large voltage (see Bertozzi's experiment [4] for example) starts decreasing after they attain their relativistic velocity, or when electrons move along their elliptical orbits (see Section 2.2, [2] for details)

Because photons also possess spinning motion (verification: Section I A, [1]) and rest mass (verification: [5]), their spinning motion generates the energy $E_M (= h\nu)$ and momentum $p_M (= h\nu / c)$ within them (see Section. 2, [3] for details), and they are always found in a state of motion with velocity c oriented along their respective L_S directions.

These results provide very clear and complete explanation of the phenomena of interference and diffraction of photons and electrons.

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

3.1 Explanation of why and how photons are deviated around the edge(s) of an obstacle and achieve different angles

3.1.1 Why and how photons are deviated and achieve different angles in a geometrical shadow

We can observe that when a ball B suppose moving with velocity v parallel to the plane of the paper and gets struck at point 1 or 2 or 3 or……., which are suppose located on its surface, Fig. 2(a), by the straight edge P of an obstacle PQ of which straight edge's length is 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, i.e., the angle of deviation is now being increased. The angle of deviation of the 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 forth, 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 its momentum, 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 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, during their collisions, they strike with each other at different points on their surface. If in Compton's scattering experiment, the photons and electrons can collide with each other striking 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 ν_1, ν_2 ,ν_3, and so forth, and hence of seven different momentum $p_1 (= h\nu_1 / c)$, $p_2 (= h\nu_2 / c)$, $p_3 (= h\nu_3 / c)$, and so forth. 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 θ' (< θ or > θ) 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 together 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 (see Section 3.2.2 for detail description).

3.1.2 Why and how photons are deviated and achieve different angles in direction opposite to 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 [as shown of the ball B by broken line circles of different colors in Figs. 2(a), 2(b) and 2(c)], 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, similarly, as the ball B_1, B_2 and B_3 are deviated at different angles. The angle of deviation of a 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 Why and how bright and dark fringes are obtained with monochromatic light sources

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 surfaces, 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 surfaces, 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 Section 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 together along their resultant directions and fall on the screen at places Q_1, Q_2, Q_3, ...,Q_6 respectively. At places Q_1, Q_2, Q_3, ... ,Q_6, the bright fringes are obtained. Suppose, if the photons, for example, P_2' and P_5'' do not fall together 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 photon P_2', instead of falling at point somewhere in between Q_2 and Q_3, and the photon P_5'', instead of falling at point somewhere in between Q_1 and Q_2, they 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 Why and how overlapping fringes of different colors are obtained with non-monochromatic light sources, such as white light

When a source of white light is used, the photons of seven different colors, or 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 momentums, or of two different colors at the same point Q, or very little forward or backward to Q, 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 the photon 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 do not incident on the edges E_1' and E_1'' normally but incident making some angle with the normal on the surface of edges [as appears 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. 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 on the screen 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. If the positions of fringes, i.e., positions of points $Q_1, Q_2, Q_3, \ldots$ 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:

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

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

Because, phase difference = ($2\pi \times$path difference) / λ = ($2\pi \times$path difference) $\times \nu$/c, where c is velocity of light, and ν is frequency of the spin motion of photons, but 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. Hence, the phase difference should be between frequencies of spin motion of photons, but 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 $= 2n\frac{\lambda}{2} = 2n\frac{c}{2\nu} = n\frac{c}{\nu}$

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 d becomes $= d'$, 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 photon interference phenomenon

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 lengths of sharp edge A and slit S both are parallel to each other, but perpendicular to the plane of the paper. The plane of the screen is also perpendicular to the plane of the paper but parallel to the lengths of slit and sharp edge. Let the slit be illuminated by a monochromatic source of light of frequency ν.

a) Why and how intensity falls off continuously and rapidly with movement into a 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 surfaces. Looking at the locations of points 1, 2, 3,….., n on the surface of the ball, Fig. 2(a), it can be understood that the angle of deviation of the photons increases as the point changes from 1 to 2, 2 to 3, and so forth, but the rate of increase in angle of deviation happens to be very slow in the beginning. Gradually it starts increasing faster, and goes on faster and faster. Consequently, in the beginning of the geometrical shadow, the photons fall on the screen partially overlapping on each other, which (overlapping) goes on reducing. Gradually they start becoming separated from each other which (separation) goes on increasing till a complete darkness is obtained, as shown in Fig. 4.

b) Why and how bright and dark bands are obtained outside a 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, like photons P_1, P_2, P_3,…. (see Section 3.1.2), fall. Some of the deviated photons, before falling on the screen, may collide with some other photons which are found in their way, and after colliding, they fall all together in form of groups on the screen moving in their resultant direction that they obtain after their collisions. Before falling on the screen, some of the groups of photons may collide further with some more photons, which are found in their way, and then they fall all together on the screen moving in the resultant direction that they obtain after their collisions. This process goes on and the photons may fall on the screen in groups of 2 or 3 or 4 and so forth photons.

So, the photons coming from the source do not fall on the screen distributed uniformly, but fall on the screen distributed in number of groups. Each group has different number of photons, and is separated from each other 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. How the photons are distributed in different portions of different groups, e.g., touching each other, or partially overlapping, or densely overlapping, or very densely overlapping on each other, accordingly intensity of different portions of different groups is obtained.

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

c) Why and how 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 rolling photon, not only one but several passing by photons (e.g., those coming directly from the rectangular slit) may be deviated. Their number depends upon how many photons collide with the rolling photon during its course of rolling, and their angles of deviation depend upon at which instants of rolling of the rolling photon the deviated photons collide with the rolling photon. 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. Suppose, during the rolling process of a 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 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 $\theta_{21}, \theta_{22}, \ldots \theta_{2m_2}$ from their path. Similarly, during the rolling process of some other 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 $\theta_{n1}, \theta_{n2}, \ldots, \theta_{nm_n}$ 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/guess from 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 some more photons, which are coming straightly from the source, and getting deviated fall on the screen C all together along with them (photons which were coming straightly from the source) in a group producing the first bright band. The angles of deviation $\theta_{21}, \theta_{22}, \ldots.$ θ_{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 fall on the screen C all together along with them in a group producing the second bright band. Similarly, the angles of deviation θ_{n1}, $\theta_{n2}, \ldots\ldots$ θ_{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 fall on the screen C all together along with them 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. Consequently, the bright bands of continuously reducing intensity and width, as their order increases, are obtained on the screen, Fig 4.

d) Why and how a dark band is obtained after every bright band, the darkness and width of which goes on decreasing as their order increases

As in group of photons ($P_{11}, P_{12}, \ldots P_{1m_1}$), maximum number of photons occur, obviously, with this group, maximum number of photons, which were coming straightly from the source to fall on the screen, are deviated. As in group of photons (P_{21}, $P_{22}, \ldots. P_{2m_2}$), a lesser number of photons occur, with this group, a lesser number of photons, which were coming straightly from the source to fall on the screen, are deviated. And in group of photons (P_{n1}, $P_{n2}, \ldots., P_{nm_n}$), because least number of photons occur, with this group, a least number of photons, which were coming straightly from the source to fall on the screen, are deviated. Because of deviation of a maximum number of photons, which were coming straightly from the source to fall on the screen with the first group, a maximum gap is obtained between the starting point O on the screen and first group. Because of deviation of a lesser number of photons, which were coming straightly from the source to fall on the screen with the second group, a lesser gap is obtained between first and second groups. And, because of deviation of a least number of photons, which were coming straightly from the source to fall on the screen, with the last group, a least gap is obtained between last and last but one group.

Thus, after every bright band, a dark band is obtained, the darkness and width of which go on decreasing as their order increases.

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, and these, along with screen C, are held perpendicular to the plane of the 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 back portions (or opposite sides) are joined together parallel to each other. Therefore, as shown in Figs. 5(a and b), above the geometrical shadow of A (i.e., above X) on the screen, and similarly, above the geometrical shadow of B (i.e., below Y) on the screen, the bright and dark bands of continuously reducing intensity and width, as their order increases, are obtained. Moreover, in the geometrical shadow of A (i.e., below X) on the screen, and similarly, in the geometrical shadow of B (i.e., above Y) on the screen, continuously and rapidly fall in intensities are observed as we move into the geometrical shadows of A and B (i.e., we move into the geometrical shadow of the thickness of the wire from either of its side), till a complete darkness is obtained in the middle of the geometrical shadow.

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 their geometrical shadows, where the photons are happened to be distributed separated from each other [as has been described in Section. 3.3.1(a)], start overlapping. Subsequently, there arises situation such that one to one photon of both the portions colliding with each other, and after collision, moving in their resultant directions fall on the screen and give rise to interference fringes in the middle of X and Y on the screen, Fig. 5(a). Similarly, as, e.g., photon P_1'

colliding with photon P_6'', photon P_6' colliding with photon P_1'', and so forth, Fig. 3(a), fall on the screen moving in their resultant directions and give rise to interference fringes in between X and Y on the screen.

b) When the wire is sufficiently 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, i.e., 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 happened to be 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 (why and how a central bright band flanked symmetrically on both sides by a series of alternating dark and bright bands is obtained)

The case of diffraction at a single slit is equivalent to diffraction at two straight edges, e.g., E_1 and E_2, which are very close, parallel, and facing to each other. Therefore, in this case of diffraction, some of the photons coming from the source are deviated in direction opposite to the geometrical shadow of the edge E_1 (i.e. towards the edge E_2) in number of groups [as has been described in Section 3.3.1(c)], and some photons are deviated in direction opposite to the geometrical shadow of the edge E_2 (i.e. towards the edge E_1). The former groups of photons (those are deviated towards the edge E_2), on their way, collide with the latter groups photons (those are deviated towards the edge E_1**).** After their collision, when they fall on the screen, now their distribution on the screen is being changed. 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 those are left from collisions and falling in the central group; and 2) the photons those do not become able to reach in the centre, and before that, they fall on the screen. Consequently, their size reduces rapidly.

4. DISCUSSION

The current approach (considering a wave nature for photons and electrons) regarding photons deviated at different angles from their respective paths turning around the edge(s) of an obstacle assumes, hypothetically, that turning around the edges or corners of an obstacle is a characteristic of wave motion, and as photons are radiation energy quanta possessing a wave nature, they deviate from their paths and turn around obstacle edge(s) at different angles. Conversely, the proposed approach (considering the property of persistent spinning motions for photons and electrons) provides a clear, complete, and logically convincing explanation for how photons are deviated and achieve different angles in a geometrical shadow (see Section 3.1.1), as well as how photons are deviated and achieve different angles in the direction opposite the geometrical shadow of the obstacle (see Section 3.1.2).

Regarding interference fringes, the present approach provides a clear and complete explanation as to how the bright and dark interference fringes are obtained (see Sections. 3.2.1 and 3.2.3), and how the overlapping of fringes of different colours are obtained when a white light source is used (see Sec. 3.2.2). The method by which these occur can be imaginatively visualized by the proposed approach, whereas by the current approach, assuming photons possess a wave nature, this cannot be visualized.

The proposed approach also provides a clear and complete explanation for how diffraction bands of unequal intensity and decreasing width are obtained beyond the limit(s) of geometrical shadows in various cases [see bullets b), c), and d) of Section 3.3.1, and bullets a), and b) of Section 3.3.2], how and why their intensity falls off continuously and rapidly moving into the geometrical shadow [see bullet a) of Section 3.3.1], how and why interference fringes are obtained inside the geometrical shadow of a thin narrow wire [see bullet a) of Section 3.3.2], and why these fringes vanish once the wire is sufficiently thick [see bullet b) of Section 3.3.2]. The contemporary approach, assuming photons possess a wave nature, tries to explain the above phenomena using the logically and practically unbelievable concept that wavefronts are divided into half-period elements/zones. First, though this approach successfully explains the intensity variations in the diffraction bands, it fails to explain their width variations. Second, and most important, as radiation energy is emitted in a quantized rather than continuous form, wave fronts could not be generated (see Section 1.2 for detail information), dismissing any question of their division into half-period elements/zones.

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FIGURE CAPTIONS

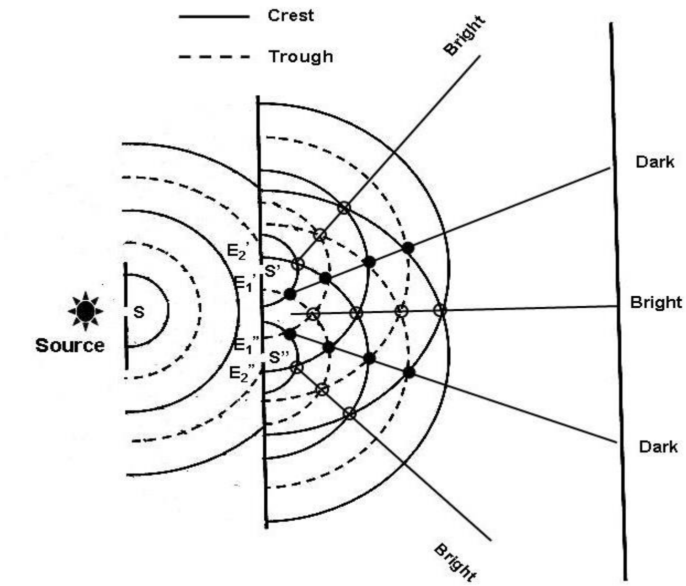
Fig. 1: (a) Interference of two wave trains; (b): Vibrations of electric and magnetic fields of electromagnetic waves during their propagation; (c): Production of bright and dark fringes due to superposition of the waves of photons (waves of photons and their superposition have not been shown in Fig. 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 the ball B in the geometrical shadow of an obstacle PQ at different angles, which (angles) depend upon the momentum p and p' of the ball, and point 1, 2, 3, and so forth, those are located on the surface of the ball, getting struck respectively at which by the edge P of the obstacle, the bal 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 located on its surface.

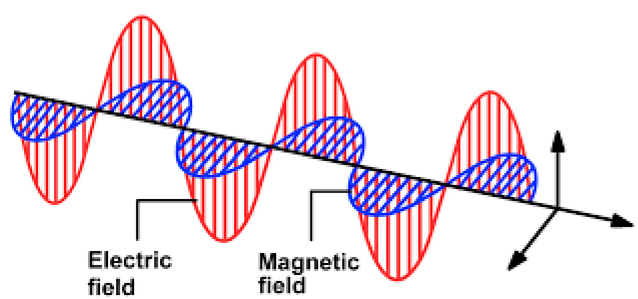
Fig. 3: Interference fringes due to collisions and falling on the screen of pairs of two photons, which are coming from two slits S' and S'' after being deviated at different angles.

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 photons, of which the width and intensity (i.e., density of crowd of photons contained in them) continuously decreases as their (groups) order increases; and rapidly decreasing intensity in geometrical shadow of the straight edge due to falling of photons in rapidly decreasing density.

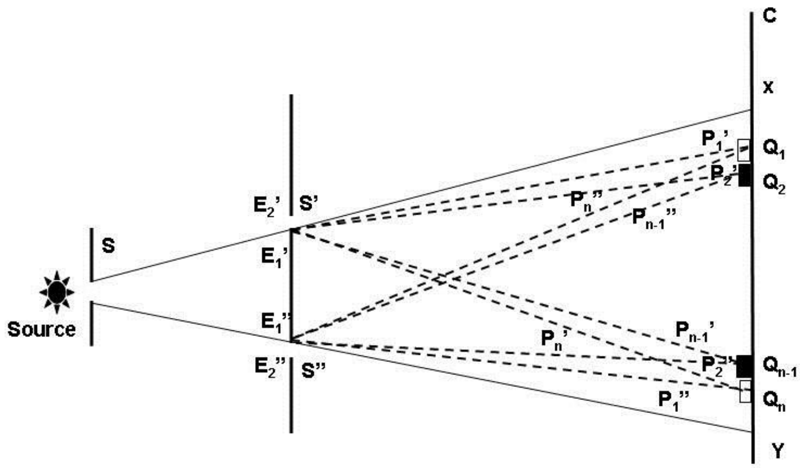
Fig. 5: (a, b) Diffraction bands beyond the geometrical shadow (X Y) of the width of a narrow wire due to falling of photons on the screen in series of groups of continuously decreasing width and density, and rapidly fall in density of crowd of photons in geometrical shadow of the width of wire; (a) Appearance of interference fringes in the geometrical shadow when the wire is thin (b) Disappearance of interference fringes when the wire is thick.


Crest
Trough
Bright
Dark
Bright
Dark
Bright
Source
S
S'
S''
E2'
E1'
E1"
E2"

(a)


Electric field
Magnetic field

(b)



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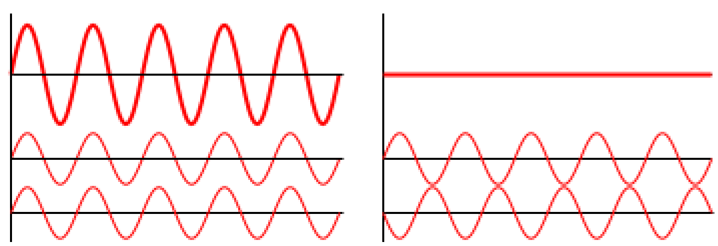
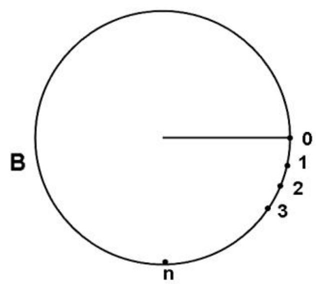


(d)

Fig. 1



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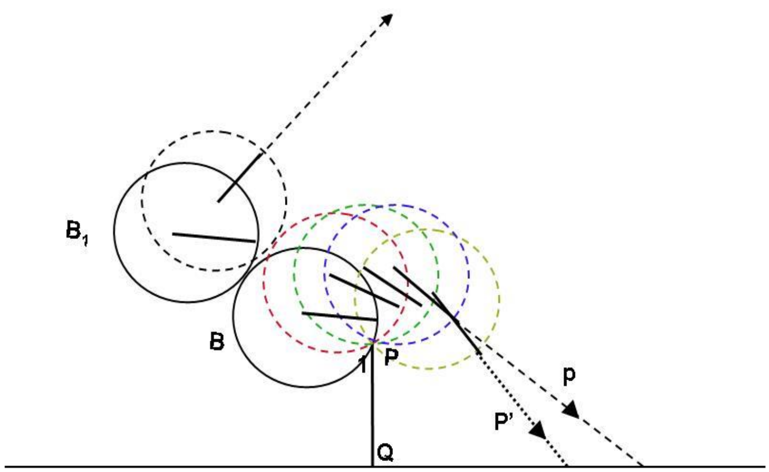

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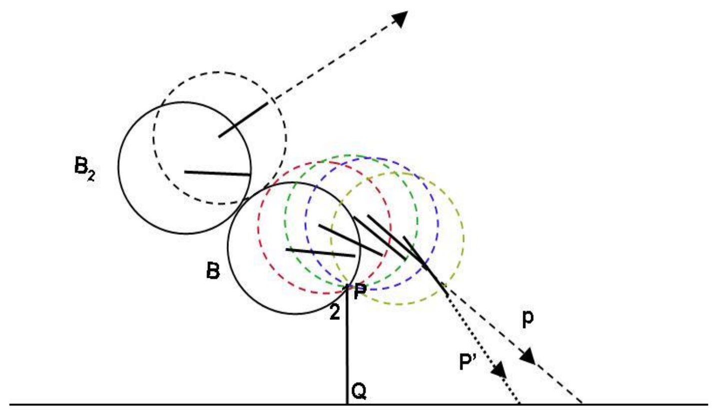

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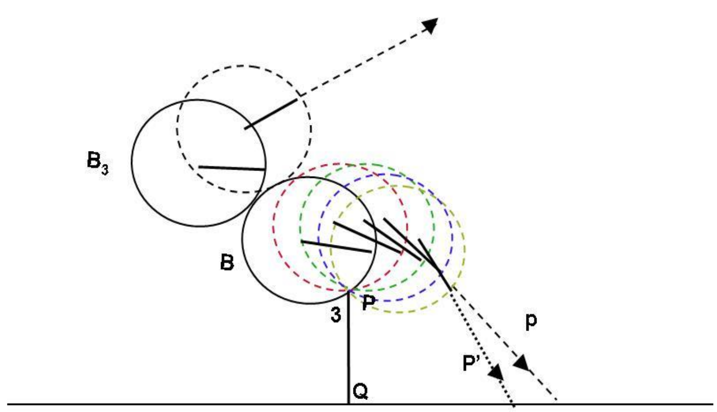
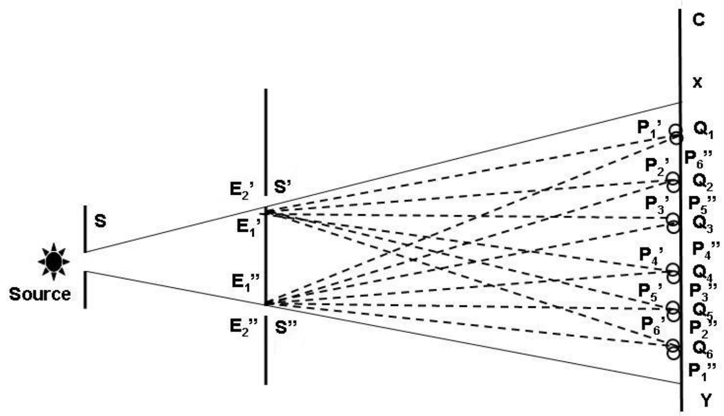
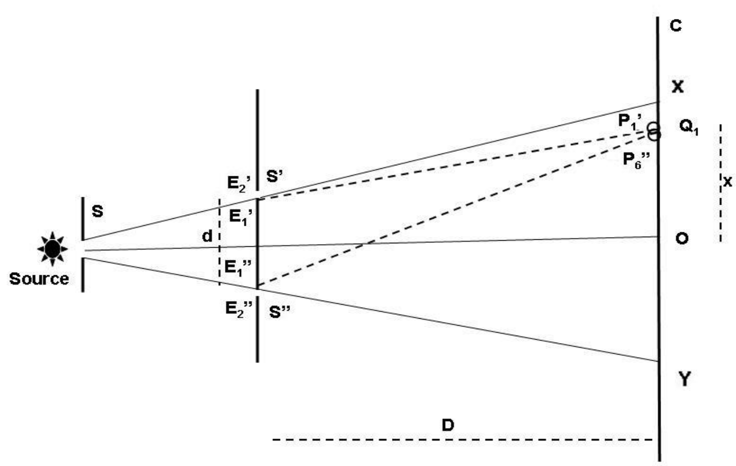


(d)

Fig. 2


C
X
P1'
Q1
P6''
P2'
Q2
P3'
P5''
Q3
P4'
P4''
Q4
P5'
P3''
Q5
P6'
P2''
Q6
P1''
Y
S
Source
E2'
S'
E1'
E1''
E2''
S''

(a)


C
X
P1'
Q1
P6''
x
O
Y
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E2'
S'
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d
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E2''
S''
D

(b)

Fig. 3

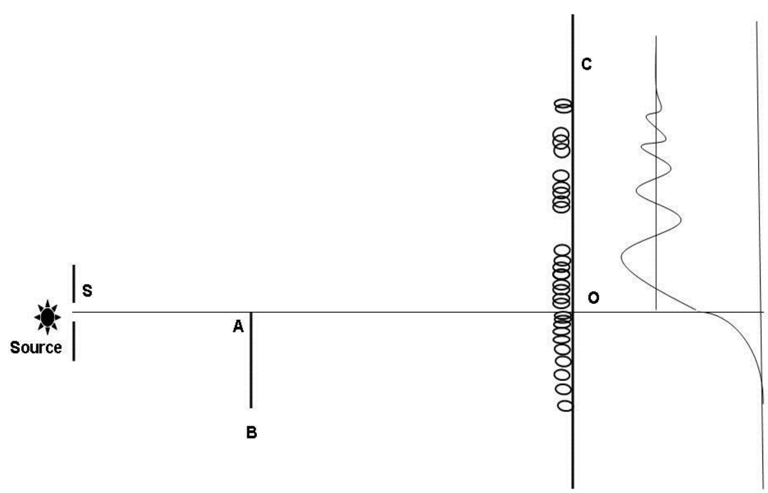
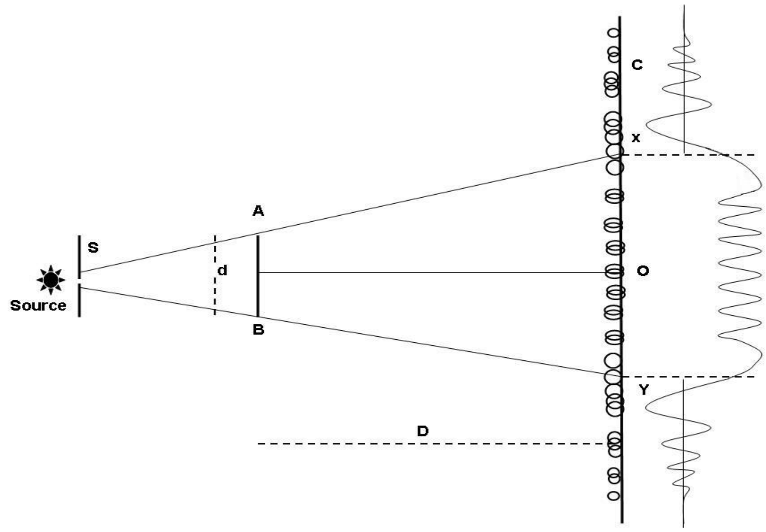
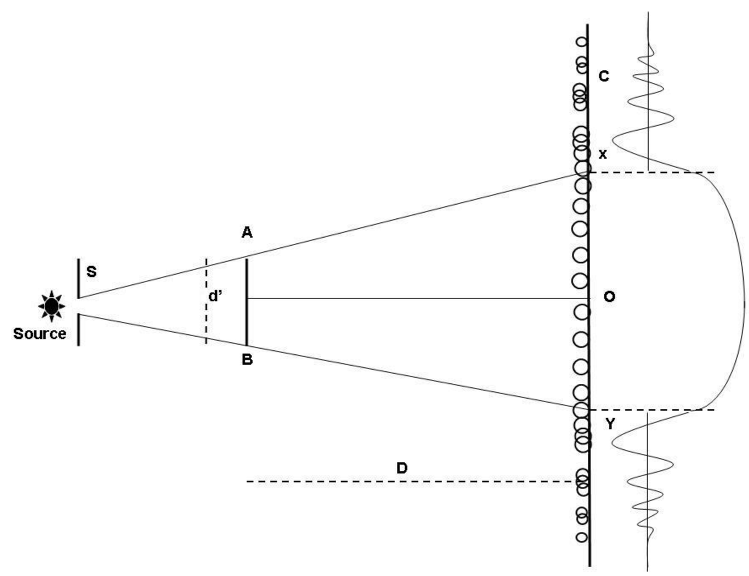


Fig. 4



(a)



(b)

Fig. 5