Quantum Mechanics and Jain Philosophy

Jain Scientist
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Today all scientists are in puzzle to true nature of light. Long ago scientists like Newton (1642-1727) and others believed that light is in the form of particles while some others such as Huygens strictly believed that light is in the form of waves.

After the invention of Quantum Mechanics all scientists unanimously believed that light has a dual nature whereas Jain philosophy strictly offers that light is absolutely in the form of particles, because it is a one form of matter.

In modern physics, some phenomena such as Compton Effect, Photoelectric effect cannot be explained with the wave nature while some cannot be pursued except wave nature. That is why all scientists unanimously accept the dual nature of light.

According to the ancient Jain treatises, light is nothing but the modification of matter. Hence it is absolutely in the form of particles. And we can easily explain all physical phenomena like diffraction of light, interference of light through corpuscular theory.

Light is nothing but the electromagnetic waves. German physicist Heinrich Rudolf Hertz (1857-1894) succeeded in producing an electromagnetic wave and studied its velocity and properties, which were exactly in accordance with the calculations of Maxwell. But in the fundamental experiment performed by Hertz the particle form of light peeped out to him. But he overlooked it.

Thus, the question "Is light formed of waves or particles?" surfaced again in a new form.
In England Dr J. J. Thomson discovered electrons and in Germany the scientist Lenard experimentally proved, electrons are emitted if ultraviolet light of definite frequency is incident upon light sensitive surface of metals. This phenomenon is known as photoelectric effect.

Max Planck found out a new equation but could not give derivative proof of it, in 1900 A. D. and the particle theory of light emerged in a new form.

Max Planck stated that emission of radiation takes place in the form of particles and when it propagates from one point to another, it behaves as a wave. But Einstein stated that the emis-

sion of radiation takes place in form of quanta (particles) and also it propagates from one point to another in the form of quanta (particles).

But Indian physicist Dr Satyendra Nath Bose presented his well-known research paper in 1924 A. D. entitled "Planck's law and the light quantum hypothesis" This research paper marks the beginning of the quantum statistics in the modern physics.

Dr S. N. Bose was the first mathematician to put quantum statistics logically in formulae:

$$E(v)dv = \frac{8\pi v^2}{c^3} \bullet \frac{hv}{[\exp(\frac{hv}{KT}) - 1]} \bullet dv$$

This is the world-famous radiation equation of Max Planck. In explaining this equation, several scientists accepted radiation in the waveform but while deriving this formula Bose accepted the fact that radiation was in the form of electromagnetic particles. This was his original achievement and it is based on Jainism. In short all radiations including light are in the form of material particles.

Dr Bose took inspiration from Jain literature and Jain treatises. Because during the discussion with Dr. Jogendra Chandra Sikdar, who had done Ph.D. on Bhagawati Sutra, the Jain treatise, Dr. S.N. Bose himself suggested the subject "Concept of Matter in Jain Philosophy" for D.Litt. De Broglie had given an equation $l = \frac{h}{mv}$ regarding wave-particle nature of light. The experimental proof of the aforesaid equation of De-Broglie was arrived at in the year 1925 A.D. It was observed that electrons were found to be acting in the form of waves and it's wavelength in accordance with De-Broglie's formula $l = h/mv$

In the phenomenon of photoelectric effect, the electron itself acts as a particle and it also compels light to act as a particle. It is definitely clear that electrons are particles.

Modern physicists had performed three experiments to examine the behavior of electrons:
1. Fig. 1 shows the results of the experiment with bullets of gun.
2. Fig. 2 shows the results of the experiment with waves of water.
3. Fig. 3 shows the results of the experiment with electrons.

The graphs of single slits in the fig. 1 & 2 show similar behaviour of particles and waves, while graphs in which the two slits are opened, show that the behaviour of particles is different from that of waves.
Fig. No. 3 shows when the electrons pass through slits, like bullets from the gun, they are detected in No. 1, 2, 3, ... etc.

In spite of all this, surprisingly the experimental results obtained from both slits with reference to electrons and waves are similar to each other.

The experiment shows that the electron behaves in the form of a particle, when one slit is opened, while it behaves in the form of a wave when two slits are opened.

The question: ''Is an electron a particle or a wave?'' therefore, remains unsolved from the view-point of modern physics.

Jain scriptures clearly explain this phenomenon. Jain religious treatises state that áabda (sound), Andhak¡ra (darkness), Udy°ta (cooling, soothing light i.e. moonlight), Ëtapa (hot light i.e. sun-light), Prabh¡ (irregular spread reflection, interference etc. of light) are modifications of prime matter. All the aforesaid phenomena are constituted of microscopic particles (param¡¸us) of a matter.

There are infinite types of param¡¸u-units, Varga¸¡s in the universe but there are only eight classified types of Varga¸¡s, which are useful to living beings. From eight Varga¸¡s photons of all types of visible and invisible light rays belong to the Taijas Varga¸¡. Taijas means light or electricity. Since all electromagnetic waves are created with electricity, they also belong to Taijas Varga¸¡.

Jain philosophy absolutely accepts light in the form of corpuscles. I give an explanation of the phenomenon of interference of light with the help of the corpuscle theory only. Of course, when light, propagate in space, their path is serpentine. Thus there is no difficulty about acceptance of the corpuscular theory of light.

In the phenomenon of interference when the path difference between the two waves, is 0, l, 2 l, 3l,....hl then the crest of one wave falls on the crest of the other wave and also trough of one wave falls on the trough of the other wave and as a result constructive interference takes place. If the path difference between two waves is, $\frac{\lambda}{2}, \frac{3\lambda}{2}, \frac{5\lambda}{2}, \ldots\ldots (2\eta - 1)\frac{\lambda}{2},$ then crest of one wave falls on the trough of the other wave as a result destructive interference takes place.

In modern physics the intensity of light or waves depends upon the amplitude of waves. It is directly proportional to the amplitude. In the phenomenon of constructive interference, amplitude of resultant wave becomes double, and intensity of a wave is directly proportional to the square of its amplitude.

I a a^2 (I denotes intensity, a denotes amplitude)
I' a $(2a)^2$ (I' denotes resultant intensity)
I' a $4a^2$
$I' = 4\ I\ (a^2 = I)$

According to this equation the intensity of the resultant wave in constructive interference becomes four times greater than the original single wave intensity.

While in destructive interference the resultant amplitude of the resultant wave becomes zero, hence the resultant intensity also becomes zero.

When the crest of one photon interacts the crest of another photon or a trough of one photon interacts a trough of another photon, there is a collision between the photon particles that are coming from two separate slits at the same time. Hence after collision, both photons propagate in the direction of resultant vector according to the law of parallelogram and therefore, the intensity of light increases.

While in the interactions of the crest of one photon with the trough of the second photon, both photons do not collide with each other. As a result along the straight lines, showing the interactions of the crest of one photon with the trough of the other photon, photons will be absent and, therefore such type of interactions form the fringes of darkness.

According to Jain physics, intensity of light depends only upon the number of photons per unit area, per unit time. Here, it is applicable.

The area in which the photons are incident becomes half the original area and all the photons coming from both slits, fall on this half area. Hence the number of photons becomes double and area becomes half. As a result, the number of photons per unit area per unit time becomes four times greater than that of a single wave coming from any single slit. And the intensity of dark fringes becomes zero due to destructive interference.
Doppler's Effect: According to Special Theory of Relativity, Einstein gave a formula for the frequency of moving lightening objects as follows:. $f' = f\frac{1 - \cos\theta v/c}{\sqrt{1 - v^2/c^2}}$

This is Doppler's principle for all velocities. When q = O the equation assumes the perspicuous form $f' = f\sqrt{\frac{1 - v/c}{1 + v/c}}$.
This Doppler's principle can be also proved with particle theory.

A total energy per unit area does not only depend upon frequency of each photon but also it depends upon number of photons per unit area per unit time. Hence, if intensity increases total energy also increases.

Only when they are in motion, they have imaginary frequency depending on their serpentine paths and energy depending on their velocity that might be equal to Newtonian Mechanics

$K.E. = \frac{1}{2}mv^2$ or $K.E. = \frac{1}{2}mc^2$,

Though scientists believe that photon has zero rest mass yet in calculation of momentum p = mv, (p = mc), they consider that a photon has rest mass.

Photoelectric effect also proves that the photons are in the form of the most micro particles. Photon could be divided into 1 electron and 1 positron.

Solar deflection of starlight is also able to prove that photons have some mass.
Due to strong gravitational force of the Sun, the deflection of starlight and apparent position of the star strictly prove that the light is made of material particles. And they must have some mass, whatever it may be. It is explained in my other article, which related with research of Dr P. C. Vaidya, regarding gravitational force of radiating star.

The modern physics believes that according to the excessive gravitational force of the Sun etc. and of the stars with a very great mass, the space around it contracts. Really speaking, according to the Jain philosophical contention, space is a single whole substance, it is non-material and inert and it has no qualities.

आकाशादेकद्रव्याणि।। निष्क्रियाणि च।। (Ref Tattvartha Sutra, Adhyaya - 5, Sutra - 5, 6).
Therefore, the gravitational force of an object has no influence at all on the inert space. But its gravitational force influences material object which is in its gravitational field and if the object, the Sun or a star is radiating, its radiation reduces the gravitational force of the object. This reduction proves that the energy emitted by stars or the Sun in the form of light/photons, also has a mass. If light particles have zero mass, according to the equation, a strong gravitational force of any kind could not at all influence it.
From all these scientific facts and the references found in Jain philosophical treatises, we can say that in the whole universe only Paramanus are dominant.