# NATURE OF LIGHT

According to 'MATTER (Re-examined)'

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*Abstract:* Light is sensed by rational beings. Only real entities can produce sensory perception. Matter alone provides the substance needed for objective reality in space. Hence, light or its components are essentially made of matter. Universal medium (formed by matter), under suitable conditions, creates components of light from itself. For existence, it is essential for light's components to move at the highest possible linear speed, at which the universal medium can move them and spin at a frequency proportional to their 3D matter-contents. The flow of these components constitutes radiation of light or similar radiation. This essay very briefly describes the mechanism of creation and development of light's components, as envisaged in an alternative concept presented in the book 'MATTER (Re-examined)'. For details, kindly refer to the same [1].

*Keywords:* Universal medium, light, photon, corpuscles of light, speed of light.

## Introduction:

Light is an entity with physical attributes. It exists and moves in space. Only real objects can exist and move in space. To have objective reality and positive existence in space, light has to be a physical entity. Substance provides objective reality to all physical entities. Hence, light should have substance as its content. Matter alone provides the substance with objective reality and positive existence in space to an entity. Therefore, light or its components have to be made of matter. As light can be simultaneously observed in more than one plane, it has to be constituted by three-dimensional matter. Light, being constituted by 3D matter, has to have all associated physical attributes (mass, inertia, quantity, size, etc) of 3D matter, like any other 3D matter-body.

Light, being a physical object made of 3D matter, has to have a certain structure and definite process and mechanism of creation and sustenance. Nothing can be made out of nothing. 3D matter, for the creation of light, has to be provided from pre-existing matter in space. There has to be an agency that provides matter for the creation of components of light. The same agency, through a natural process, should create and regulate various parameters of the created light. This agency should exist outside the components of light, and because light can be created and exist anywhere in space, the agency should fill the entire space outside light-particles. An entity that fills the entire space outside the components of light is a universal medium. The universal medium, which fills the entire space, cannot provide matter from an external source but from itself. Hence, the universal medium should be made of matter. Under suitable conditions, the universal medium should provide a sufficient quantity of matter for the creation of components of light from itself and provide a logical mechanism for their creation and sustenance.

Since the universal medium fills the entire space, outside corpuscles of light (or similar radiations), there can be only two types of real entities in nature – universal medium and corpuscles of light, made from and by the universal medium. All other material bodies, larger than corpuscles of light, have to be constituted by corpuscles of light. The mechanism for their development has to be provided by the universal medium. Corpuscles of light are the smallest and only stable (basic) 3D matter-particles in nature. Under suitable conditions, complementary corpuscles of light (of appropriate parameters) should be able to constitute larger composite 3D material bodies, under natural processes, to form all other fundamental matter-particles and macrobodies. The same mechanism should account for diverse properties of macrobodies and various physical phenomena related to them.

Light is observed to have a linear motion in space at a constant speed. Matter is inert. It has no ability to move or act on its own. Therefore, light, being a composite 3D material body, it has to have an external moving agency. Since light is independent of all other known agencies and moves anywhere in space, the moving agency of light has to exist in and fill the entire space. The universal medium is the only such agency. To act on light and produce its motion, the universal medium has to be a real entity. To be real, a universal medium has to be made of matter.

Since an observer or a source-body of light may move at any speed in any direction, the constancy of light's speed cannot be related to them. Another entity that is present everywhere in space (and acts on light to move it) is the universal medium. Therefore, the universal medium should be the agency that moves light, and the motion of the light should always be in relation to and through the universal medium. Universal medium should not only move light, but it should also stabilise any variation and maintain its linear speed at a constant magnitude, irrespective of any influence that may tend to vary the linear speed of light. The universal medium should provide mechanisms for all other properties of light as well.

Light is observed to have many similarities with electromagnetic waves. In fact, in most theories, light is currently considered a pure electromagnetic wave. Light is also understood to exhibit certain properties of corpuscles under certain conditions. To satisfy these diverse properties, particles of light should exhibit both these properties simultaneously. These two characters, together, provide light (or similar radiation) with its dual nature.

## Alternative concept:

An alternative concept, presented in the book 'MATTER (Re-examined)' is based on a single assumption that 'Substance is fundamental and matter alone provides substance to all real entities'. Matter, in its unstructured state, exists in the form of minute particles, called quanta of matter. Unstructured matter in a quantum of matter tends to reduce its spatial dimensions to a minimum. Free quanta of matter tend to form quanta-chains in straight lines. Quanta-chains in perpendicular directions in a plane form two-dimensional lattice structures, called 2D energy-fields. Each 2D energy-field extends infinitely in its plane, in all directions.

2D energy-fields in all possible planes, together, form a universal medium in space. 2D energy-fields are able to coexist at their intersections and thus fill the entire space, outside 3D matter-particles. Due to its latticework structures, the universal medium has all properties of an ideal fluid. Structural distortions in the universal medium constitute 'work', and the stress due to work (distortions) is the energy. Frequent local breakdowns of universal medium ensure the availability of free quanta of matter and ample opportunities for them to migrate back into the latticework structures of universal medium. This keeps the quanta-chains of the universal medium under compression, even without a definite container.

Local breakdown, in any part of the universal medium, releases quanta of matter from latticework structures and forms a gap. Universal medium from all around (being under compression) moves towards the centre of the gap to re-establish continuity of its latticework structures. Due to the inward radial movement, the universal medium presses on any disturbance (3D matter-particle) present in the gap and compresses it. The presence of a disturbance in the latticework structure of a 2D energy-field breaks its continuity. As far as the 2D energy field is concerned, the space occupied by the disturbance remains a gap in it. 2D energy-fields from all around continue to thrust themselves into this space and keep the disturbance under compression. The application of pressure by the universal medium on a disturbance is gravitation. Latticework structures of universal medium impose certain restrictions on gravitational actions. Gravitation is unable to act on flat surfaces or straight perimeters of disturbances. The magnitude of gravitational action on a disturbance is proportional to the extent of the 2D energy field, in the direction away from the disturbance and the magnitude of convex curvature of its perimeter.

Gravitational action tends to reduce disturbance(s) in the universal medium to a minimum. This is achieved either by combining the disturbances present or by ejecting them from the 2D energy-fields of their existence. The side of a disturbance, with larger convex curvature, experiences greater gravitational effort compared to the side of the same disturbance with lesser convex curvature. The resultant of these efforts tends to move the disturbance in the direction of greater gravitational effort.

## Creation of 3D matter:

Stable disturbance, in a plane, has a critical radial size, determined by the gravitational capabilities of 2D energy-field of its existence. If the number of quanta of matter in the disturbance is more than that is required to create a critical radius-sized stable disturbance, in any plane, gravitational compression compels its quanta of matter to grow into the third spatial dimension. This is the 'creation of 3D matter' (real 3D matter-particle). A 3D matter-particle exists, simultaneously, in more than one 2D energy-field, and it is a disturbance in the universal medium. Gravitational compression, in each plane, acts against the natural tendency of quanta of matter, within the disturbance, to expand.

The magnitude of gravitational action depends on the shape of a disturbance's perimeter. Variation in a 3D disturbance's shape, from a perfect circle in a plane, produces unevenness in gravitational compression on it. The major part of gravitational action on a 3D disturbance is limited to the circular periphery of its 3D matter-core. Its disc-faces receive only slight gravitational actions, appropriate to their very small curvatures and sufficient to sustain their inherent movements. 3D matter-core, being a disturbance in the universal medium, is ejected out of each of the 2D energy-fields of its existence. Gravitational actions from the universal medium maintain its constant (highest possible) linear speed and spin speed proportional to its 3D matter-content.

3D matter-core, created by gravitation, is stabilized and moved as required by mechanical interactions between it and the structurally distorted region in the surrounding universal medium. In its stable state, 3D matter-core (created by gravitation) is disc-shaped, spins about one of its diameters, and moves at constant linear speed with respect to a steady universal medium. They have uniform radial size and thicknesses proportional to their 3D matter-contents.

## Photon:

The core of a 3D disturbance and associated structural distortions in the surrounding universal medium, together, form a basic 3D matter-particle, called a 'photon'. A photon is a corpuscle of light or similar radiation, whose spin speed (frequency) is proportional to its 3D matter-content. All aspects of a photon are regulated, stabilized, and sustained by gravitation from the universal medium.

Most fundamental properties of a photon are its linear motion at constant linear velocity and spin motion at an angular speed proportional to its 3D matter-content. This 3D matter-particle, in conjunction with structural distortions in the surrounding universal medium, becomes a photon only when it has stabilised its shape and other parameters required for a corpuscle of radiation. A photon exists in a stable state only because of its motions with respect to the surrounding universal medium. It is a necessity of the universal medium to maintain photons' movements at critical constant values. Moving photons are practically isolated from the universal medium, so that the universal medium can maintain its serenity and stability. Variations in a photon's movements are stabilized by continuous gravitational actions from the universal medium. [Here, movements are assigned directly to the photon for clearer understanding. A photon, being a corpuscle of 3D matter, is incapable of any actions or movements on its own. In reality, it is the inertial actions by the universal medium about a photon that move the photon's 3D matter-core].

The 3D matter-core of a photon has a segmented spherical (disc) shape that spins about one of its diameters. Quanta of matter, constituting the 3D matter-content of a photon, are held together to form an integrated 3D matter-particle, by all-around gravitational compression. Gravitation is effective only on convex curved surfaces of a 3D disturbance. Gravitational actions around the circular periphery of the photon's 3D matter-core maintain the matter-core's radial size at constant magnitude. The difference between instantaneous convex curvatures at the front and rear surfaces of the 3D matter-core determines the resultant gravitational action that moves the photon in a linear path and spins its 3D matter-core.

Structural distortions in the universal medium about the 3D matter-core of a photon are its 'inertial pocket' (distortion-field). The inertial pocket of a photon contains enough structural distortions (work) in the universal medium to sustain the integrity, instantaneous shape, and movements at constant speeds. Inertial pocket of a photon continuously moulds its (spinning) 3D matter-core, so that the magnitude of convex curvature of the forward-facing surface is always less than that of the rearward-facing surface. Gravitational actions on the spinning 3D matter-core of a photon regulate its instantaneous shape, so that the latticework structures of 2D energy-fields are not damaged, and at the same time, external and internal pressures about the 3D matter-core remain in balance. Under this condition, a photon moves at a critical constant (maximum) linear speed through the universal medium (space). The linear speed of a photon is a critical constant because that is the highest linear speed at which the universal medium can move a 3D matter-particle, without causing its own breakdown.

Electromagnetic waves are the transfer of periodically varying structural distortions through the universal medium. Spin motion of the photon's 3D matter-core creates cyclically varying structural distortions about it. Structural distortions in the inertial-pocket of a photon, in any transverse (perpendicular to its spin axis and the direction of its linear motion) plane, have many similarities with EM waves. Hence, they may be considered the electromagnetic wave-part of a photon. A single pulse of the corresponding electromagnetic wave and the spinning disc-shaped 3D matter-core, together, form a photon. Rotating distortion-field about the photon's 3D matter-core, in the transverse plane, appears as wave motion in space, which is the same as an electromagnetic

wave. 3D matter-core provides matter-component, and associated structural distortions in the universal medium provide the electromagnetic wave-component of a photon. This accounts for its dual nature – simultaneously being a 3D material body and an electromagnetic wave. Unfortunately, in current theories, these characters are acknowledged but used separately for different purposes.

Stress produced in the universal medium due to the structural distortions in the inertial pocket is the energy-part of a photon. Hence, this part of the photon may be understood as a segment of an electromagnetic wave of frequency corresponding to the photon's spin speed.

The 3D matter-core of a photon is a spinning disc of 3D matter. Because of disc-shaped 3D matter-cores, gravitational attraction between two photons (or between photons in different 3D material bodies) occurs only when their disc-planes coincide. If the disc-plane of a photon's 3D matter-core is intercepted by 3D matter-core of another photon, whose disc-plane is different, the first photon experiences partial gravitational attraction towards the second photon, and the second photon does not experience gravitational attraction towards the first photon. This phenomenon is the reason for the very weak gravitational attraction between macrobodies, despite the enormous strength of gravitation.

The axis of the photon's spin is one of its diameters passing through the center of the 3D matter-core. The direction of the spin axis with respect to an external reference is the 'polarity of the photon'. End points of the spin axis are the photon's 'poles'. Spin motion of a photon, about its spin axis, may be in either direction, clockwise or anti-clockwise, with respect to a reference. For convenience, we may classify photons according to their direction of spin with respect to an external reference into 'clockwise spinning photons' and 'anti-clockwise spinning photons'. Depending on the chosen reference, the class of a photon may change. The polarity of a photon is set during the formation or re-formation of its 3D matter-core. External efforts may change it during the photon's unstable (by its 3D matter-content) state. Photon's 3D matter-core is most unstable at the instant of reflection from a reflecting surface. By producing structural distortions in the universal medium at the point of incidence, the polarity and direction of spin of a photon can be changed during its reflection. A strong magnetic field applied at the point of reflection is found to change the polarity of the photon.

In its unstable state, the spin axis of a photon may develop independent turning motion in any plane under the action of external efforts. The spin motion of a photon provides its 3D matter-core with rigidity in space (gyroscopic inertia). An external effort on its axis is likely to precess the axis instead of turning it.

Due to the combination of linear and spin motions, the speeds of segments of the photon's 3D matter-core with respect to the universal medium differ. The difference in their relative speeds compels the photon's 3D matter-core to lose its 3D matter-content (gradually) during long passages through space. This is one of the reasons for the reduction in its frequency that leads to the phenomenon of 'red shift'. As and when a photon loses all its 3D matter-content and its 3D matter-core becomes non-existent, its residual low-frequency inertial-pocket in the universal medium appears as a low-frequency EM wave (background radiation) in space.

3D matter-cores of all photons are of the same radial size. There are no basic 3D matter-particles with radii larger or smaller than the 3D matter-cores of photons. Photons may have different quantities of 3D matter-contents, indicated by their frequencies. Under suitable conditions, universal medium compels complimentary photons in various combinations to form diverse fundamental particles. Further developments into superior 3D matter-particles and macrobodies and their sustenance are guided and accomplished by gravitation from the universal medium.

In a stable state, photons move in linear paths. During reflections and refractions, their 3D matter-cores and inertial pockets become unstable, and the universal medium stabilizes them by natural processes. However, when high-frequency photons form binary systems to form superior 3D matter-particles, their 3D matter-cores remain stable, while their inertial-pockets are unstable due to their curved paths. In this state, interactions between the structural distortions in their inertial-pocket give raise various types of 'natural forces'. Different types of 'natural forces' originate from the universal medium's gravitational efforts. Hence, basically, there is only one type of effort.

The current concepts of a photon are quite different from what is explained above. A photon is usually considered a quantum of energy or electromagnetic wave or particle (?) with zero rest mass. The mass of a material body depends not only on its 3D matter-content (rest mass) but also on its linear speed. Hence, a photon moving at the speed of light should have infinite mass. In order to overcome this illogical result, it has become necessary to arbitrarily assume a photon as a massless entity. Its mass should always remain zero irrespective of its linear speed.

The momentum of a material body is related to its mass. Momentum is essential for a material body to do work. Yet, photons are found to do work on collision. In order to overcome these contradictions, even though they possess no rest mass, in mathematical equations, a photon is also considered (simply) to possess certain momentum (in some cases, enough momentum to knock out orbital electrons from atoms!). A photon is assumed to have no 3D matter-content but carries only (undefined) energy, which can do work. Contemporary theories also assume that matter is vested only in subatomic particles and larger material bodies, which have rest mass. How or from where this matter came into being is not explained. Hence, the search for mysterious particles, which may endow the property of mass to material bodies continues.

Photon, in this concept, is a basic 3D matter-particle that has definite 3D matter-content, indicated by its rest mass. It also has associated work (energy) that was instrumental to its creation and sustains its 3D matter-core, which can do external work on a photon's disintegration. This part of the associated energy is considered the mathematical equivalent of an electromagnetic wave of the same frequency as the spin speed of the photon's 3D matter-core.

Structural distortions (equated to an electromagnetic wave), associated with a photon, exist within the surrounding universal medium but are coupled with the matter-core of each photon. The 3D matter-core of a photon is made of 'real' 3D matter. 3D matter-core of a photon and its associated inertial-pocket (structural distortions in the surrounding universal medium) are developed and maintained by mutual actions.

A photon is the smallest 3D matter-particle that can exist independently and in reality. It is a physical (materialistic) entity that has objective reality in space. It is a corpuscle of light or any other similar radiation. All other 3D matter-particles and macrobodies are made of combinations of photons.

## Light:

Light (or similar radiation) is constituted by numerous 3D matter-corpuscles moved by associated (electromagnetic wave-like) structural distortions in the universal medium. Therefore, light exhibits all characteristic properties of photons. The number of photons per unit time indicates the amplitude of light. The frequency of photons in a ray of light shows its intensity and color. The direction of spin of photons in a ray of light indicates its polarity.

Structural distortions, formed in the universal medium, to maintain and move a photon's 3D matter-core, are transferred at (highest) constant linear (and angular) speeds, which the universal medium can provide, without causing its own breakdown. The 3D matter-core of a photon is carried by the moving structural distortions in the universal medium. Magnitudes of the speed of transfer of structural distortions depend on the nature of the universal medium in any region of space.

Continuous flow of corpuscles of light (photons) is a ray of light. It consists of 3D matter-particles as 3D matter-cores of photons and associated distortion-fields. As it is the 3D matter-content that is transferred in a light ray, the process may be called radiation of matter. All similar radiation, by means of displacement of photons in space, is radiation of matter. Depending on the quantity of 3D matter in constituent photons of a radiation, radiation of matter may be classified into: heat rays, infrared rays, visible light, ultraviolet rays, x-rays or cosmic radiation. The quantity of 3D matter a photon contains is indicated by its spin speed (frequency). The frequency of a photon is directly proportional to its 3D matter-content.

## Conclusion:

A beam of light is a continuous flow of photons (3D matter corpuscles accompanied by their inertial-pockets in the universal medium. Structural distortions in a moving inertial-pocket carry the 3D matter-cores of photons at constant linear speed. The linear speed of light is constant because that is the highest linear speed the universal medium can move 3D matter. Corpuscles of light, like any other 3D material body, obey all laws of physics, including the laws of gravitation.

## Reference:

[1] Nainan K. Varghese, *MATTER (Re-examined),* https://www.matterdoc.in/

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