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# Unified Concept of Energy for All Domains

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## Abstract

The cosmos and everything in it are inherently dynamic. Energy must play a part in this dynamic. Therefore, in relation to some frame of reference, every existence is connected to some kind of energy. According to macro domain physics, matter always possesses energy as a result of many state properties (such as temperature, pressure, velocity, etc.). The idea of energy in micro particles, which include atomic and subatomic particles, is derived from quantum mechanics. When it comes to light particles, energy is quantized without mass in the finer (micro-micro) domain. It is challenging to envision a single energy standard for all of nature's domains as the idea of energy is so varied throughout them. We find that the light particle (photon) has mass if its mass is measured in the photonic mass unit (PMU), which escapes our inspection when measured in the atomic mass unit (AMU). However, via their interactions, the energy contained in these particles makes their presence known. The photon is reduced to a quantized energy if its mass is disregarded. A part of mass is transformed into nuclear radiation (photons), which release energy, in a nuclear reaction. We are led to conclude that "mass is converted to energy in nuclear reaction" by our conception of light particles as having zero mass. The mass-energy conversion is justified by the well-known equation  $E=MC^2$ . Some believe that energy is the foundation of all physical reality. Assuming that the universe's energy was concentrated in one place before the explosion, the Big Bang theory describes how the physical cosmos came into being. In light of the aforementioned, the idea of energy in modern science varies depending on the field. It is difficult to create a unified theory of energy for the macro, micro, and micro-micro domains as it necessitates conceptual adjustments at the fundamental level of science. A new path for the transformation of the energy scenario has been made possible by the updated understanding of matter as a mass-space integral system with a mass-space structure and the new understanding that light particles have mass in photonic mass units. The newly adjusted energy parameters offer the potential to address energy from a single notion across all domains.

**Key words:** Unified concept of energy, energy in micro particles, modes of energy in photons, mass-space structure, and duality of light. Mass of Photon.



## Discussion

In macro concept energy is always possessed by matter and energy without mass has no self-existence. Hence matter inherits energy by virtue of some state property of matter. This concept of energy is free from ambiguity. On the other hand, entering into finer domain we made deviation from the macro concept of energy. For example, the thermal energy in macro domain is understood through kinetic energy in micro domain. Again, entering into micro-micro domain, we are made to believe-1) energy can have self-existence without matter; 2) energy is quantized to different energy density giving rise to different energy levels including high energy states and the high energy state of energy is equated with mass. The way we interpret energy differently for macro domain and micro domain gives a feeling, as if, something is wrong somewhere in our understanding for which we conceptualize energy in two different manners in two different domains of nature. Exploring harmony between the concepts of energy in macro domain and micro domain doesn't appear feasible with the prevailing concepts of science. The understanding of light through duality and understanding the tunnelling of electron are not in the true spirit of science. Hence, we need further study for unravelling the secret of energy. Vedic science is helpful in augmenting the concept of space in modern science with its rich concepts. But we cannot borrow the concept of energy from Vedic science because significance of energy in Vedic interpretation is not clear and lacks quantitative evaluation.

We find the concept of energy in macro domain is better expressive in different forms. This author feels the macro concept of energy with different forms is close to reality and the same can be extended to other domains. Therefore, the concept of energy in micro domain has scope for modification in the light of the concept of energy in macro domain. This is not easy but not impossible. Despite differences, all sciences are univocal in accepting energy as the capacity to do work. This author is hopeful in realizing the classification of different forms of energy in micro domain by identifying the missing parameters of energy.

We have different forms of energy possessed in matter such as, kinetic energy by virtue of velocity; thermal energy (heat energy) by virtue of thermal charge potential (temperature); electrical energy by virtue of electric charge potential (voltage); gravitational energy by virtue of mass and position in a given gravity field; magnetic energy in magnetic material by virtue of magnetic field potential, pressure energy by virtue of pressure potential, potential energy in elastic membrane by virtue of strain potential etc. The above classification of energy corresponds to different forms of energy in macro domain. Entering to micro domain (micro particles) only kinetic energy and the field energies are taken into consideration. The thermal energy of micro particles is conceptualized through kinetic energy of micro particle and gas temperature



expressed as the average kinetic energy of molecules. The temperature of ion and electron in low pressure plasma is expressed as kinetic temperature of corresponding particles. How far it is justified to consider the thermal energy of a particle is nothing but the kinetic energy of micro particle? If molecules in gas are not making random motion then kinetic theory of gas is not a reality [1]. Hence, we need to modify the significance of temperature of gas from different aspects of its structure. This author has described elsewhere [2] the new concept of temperature and new interpretation of the laws of gas from the mass-space structure of gas where space is a physical entity. According to the new concept, matter in any domain is a mass-space integral system [3] hence macro bodies and micro particles can have different mass to space ratio giving rise to different states of matter. Temperature being the thermal state of a body can be justified from the nature of mass-space structure. We need not consider the random motion criterion to express the thermal state of a body. In this new concept an atom can have different thermal state (temperature) and can possess different level of thermal energy independent of its kinetic energy. A hot atom is in motion can possess both thermal and kinetic energy and not the total energy in the form of kinetic energy. Interpretation of temperature from mass-space structure differentiates the two forms of energies (thermal and kinetic energies) in micro particles similar to that in macro bodies.

In the new concept, light particles are matter particles having mass in photonic mass units [4]. Hence, they have mass-space structure and can have different thermal state of matter in different association of mass & space and possess kinetic energy by virtue of its motion. The light particles also carry non-electric charge (photonic charge) in the state of non-equilibrium mass-space structure with respect to the mass-space structure of particles in its surrounding [5]. The micro-micro particles (light particles) having mass in photonic mass unit can have its mass-space structure. Hence both micro particles and micro-micro particles can have different forms of energy similar to that possessed by macro bodies.

Each form of energy has an energy level. Energy is possessed in matter by virtue of the state property of matter. Higher is the potential of the state-property of matter higher is the level of energy. For example, higher is the velocity of a body higher is the level of kinetic energy and higher is the temperature of a body higher is the level of thermal energy. One can increase the kinetic energy of a body by increasing the velocity as well as the mass. Body A can have higher kinetic energy at lower velocity than that of body B when body A has a higher mass. Even though the kinetic energy of body A is higher than that of body B, the energy level of body A is lower than that of body B. Energy level is an important parameter that decides whether the available energy can overcome a field barrier. Therefore, the energy level parameter of energy is instrumental in deciding whether the available energy is able to perform a work in overcoming the barrier of the work function. If energy level is capable of performing a work function then the available



energy comes into picture for evaluating the extent of work that can be done by the available energy.

Light is considered as a particle as well as a wave. The energy of light wave is given by  $h\nu$  where  $h$  is Plank's constant and  $\nu$  is the frequencies of light wave. We know from photo electric effect that a bundle of light particle (photon) carrying energy in excess of ionization potential knocks out an electron. Only ultraviolet ray and x-ray is able to produce ionization. If energy is the only criteria in knocking out an electron from atom then low frequency light at high intensity could have performed the photo ionization. But this does not happen. By increasing the intensity of low frequency light increases the light energy but not the energy level. Hence the term  $h\nu$  corresponds to energy level and not energy. Because the energy level of light has a say on the feasibility of the work function. If the energy level is satisfied for the work function then the quantity of such light (at same energy level) collectively having the energy of ionization potential can knockout an electron.

A body having mass possesses energy by virtue of its state property. The energy per unit mass of the body corresponds to specific energy or energy level. How can we think of energy and energy level for a mass-less particle? Light particles are no more mass-less [4]. If light particles have mass in photonic mass unit, then it is most likely that the mass of photon have a range like the mass of atomic particles, stars and galaxies in other domains. Now it is possible to perceive the energy and energy level of photons having mass in photonic mass units. Consider a photon of mass  $n$  in photonic mass units (PMU). The energy level of photon of mass  $n$  is equal to  $E/n$  where  $E$  is the energy of photon. Scientists consider energy of light particles and they are silent about the energy level of light particles. What we know from macro domain physics, every mode of energy has an energy level where the energy level is responsible for the feasibility of work function. In the existing science we consider the energy of electron while overcoming any field barrier but not the energy level. Likewise, we also consider the energy of a photon while knocking out an electron from atomic structure (Photo electric effect). Hence, the author considers, what we call energy unknowingly, in reality, refers to energy level since the said energy has a say on feasibility of work function.

If we disturb the equilibrium of a system in a given surrounding then the system comes to a state of non-equilibrium. The system in non-equilibrium state being unstable comes to equilibrium by auto-action. Whereas one has to spend energy to bring an equilibrium system to non-equilibrium state. A system in non-equilibrium state has energy with respect to its surrounding. If some obstruction is put on the way of the system approaching equilibrium then the system would overcome the obstacle and comes to equilibrium. The disturbed system while overcoming the obstacle does work.



The obstacle can be designed to perform a useful work. Any form of energy obeys this phenomenon of nature.

In the new concept any system in any domain is a mass-space integral system. Likewise, all other systems in its surrounding are also a mass-space integral system. The equilibrium of system and surrounding means the mass-space equilibrium between system and surrounding. An atom in a gas has same space holding per unit of mass as that of the atoms in its surrounding where the atom as the system and atoms of the surrounding are in the state of equilibrium. If certain amount of extra nucleus space associated with the nucleus of an atom is removed then the atom with non-equilibrium space holding comes to active state to acquire space from its surrounding. Matter in active state possesses energy relative to the neutral matters in its background. The mass-space structure of atom is discussed elsewhere [6]. However, for convenience of readers the mass-space structure of atom is described below in brief.

The universe comprises mass and space as its only physical constituents [3]. There exist three basic interactions in mass and space. The basic interactions are-1) mass-space attraction. 2) space-space repulsion and 3) mass-mass repulsion. These basic interactions are the primary cause of all fundamental forces of nature operating in different domains of including gravity, electromagnetic, strong nuclear and weak nuclear forces [3]. Coming to new mass-space structure of atom, the dense mass of nucleus of atom attracts space from its surrounding and builds a space density (space content per unit volume) graded structure. The space structure surrounding the nucleus does not collapse onto the surface of the nucleus as the space-space repulsion resists the compaction of space. The space density graded space structure contains space matter particles of finer domain due to mass-space attraction. The number density of space matter particles is proportional to space density. The extra-nuclear space structure also contains orbital particles. The space holding per unit of mass has different value for nucleus and for orbital bodies. The space holding per unit mass of space matter particles have different values depending on their location in the extra nuclear space structure. The space holding per unit mass of atom is subject to change with loss or gain of associated extra-nuclear space content, orbital bodies (electrons) and space matter particles. A change of space holding of atom from its equilibrium space holding brings the atom to non-equilibrium state with reference to atom in its surrounding. The said atom with non-equilibrium space holding is a source of energy with respect to its background. The loss or gain of pure space from equilibrium space structure causes pressure energy; the loss or gain of space matter particles changes the thermal energy state and loss or gain of electron changes the electric energy state of atom. Loss of space rich component matter from a neutral matter makes the matter mass rich i.e. the mass content per unit of space holding becomes higher than that of neutral matter where it is positively charged. With higher and higher percentage loss of space from



neutral matter the positively charged matter has higher and higher percentage of deficiency of space. Higher the degree of positive charge in matter higher is the acute shortage of space content in matter and the interaction of matter with matters of background become stronger & vigorous with more and more shortage of space content. This is like the hungrier man struggles more vigorously to acquire food.

The mass rich particles carry positive charge and the space rich particles with deficiency of mass carry negative charge in a relative charge scale by taking zero charge of neutral matter. The positive charge potential goes on increasing with increase of mass component in matter and negative charge potential goes on increasing with increase of space content. The values of relative charge potential can be converted to absolute charge potential by considering the absolute zero charge potential of pure compact space without mass (a hypothetical condition) to 100% absolute charge potential for pure mass without space (another hypothetical condition) because matter exists as mass-space integral system. In the absolute scale all values are positive. There is no existence of a negative value in absolute scale. The charge is electrical when the matter is atomic or subatomic particle. The charge is thermal or photonic when the particle is a photon. Again, the charge becomes celestial for a celestial body. Exchange of electrons and photons between celestial bodies changes the mass/space ratio of the celestial bodies hence the celestial charge state of a celestial body is changed.

We know a macro body has macro structure with macro phases. This is well revealed from the macro structure of concrete block with distinct phases of stone-aggregate, sand particles and the cement matrix. Each of the macro phases is known to have microstructure composed of micro atomic matter. We are not aware of matters of finer domain below micro domain. Though finer existences of light particles and different field forming particles are well known in science but they are not regarded as particles of matter as their mass is zero. This author argues that photon particles have mass in photonic mass units (PMU) even though their mass is not revealed in atomic mass units (AMU). If we accept the matter value of particles in micro-micro domain then each micro constituent can have its structure comprising micro-micro particles. Thus, a macro body has macro structure, micro structure and micro-micro structure [7]. Hence a macro body can have thermal energy possessed by the mass space structure of unbound photons and electrical energy possessed by mass space structure of free electrons, gravitational energy due to mass of the body and kinetic energy due to motion of mass. When photons are released from a body, the first assumption one would make is- photons were present in the structure of the body and they came out when the structure was disturbed. If we do not accept the rest existence of photon in matter then we are left with the option that photons are created by electron.





Light is considered as a particle as well as a wave. Even though the dual nature of light is well accepted, nothing prevents one to wonder for whether the duality is a reality of nature or a manmade conclusion in helpless condition! According to Veda, *Satyam eka Bahudha Badanti Bipre*. Fact can be interpreted in many different ways by experts but the truth (reality) remains as one. To understand the reality of light one has to accept any one concept i.e. either the particle nature of light or the wave nature of light and then improve the concept to understand all phenomena of light from the concept. In particle concept, the light particles move through the medium by displacing the medium whereas in wave concept light is propagated through waves in the medium. Thus, in particle concept of light both particle and medium has a role to play in propagation of light but in wave concept, the propagation of light is a sole function of medium. The rectilinear propagation of light is fully satisfied when light is a particle. The wave concept of light fails to justify the rectilinear propagation as waves spread in a medium. The reflection of light is more convincing through particle concept of light. The photo electric effect of light is feasible in particle concept of light. But the particle concept of light has limitation in explaining the phenomena of refraction, interference and polarization. However improved understanding of structure and features of light particles and the structure of vacuum/space medium has scope of understanding all phenomena of light through particle nature of light. The particle nature of light is conceptually acceptable. On the other hand, light as a wave without medium is unrealistic and no less a wonder. Again, velocity of light wave in water remaining unaffected in moving water questions the validity of very wave concept of light. For example, the velocity of a wave in stationary medium is given by  $v\lambda$  where  $v$  is the frequency and  $\lambda$  is the wave length. If the medium is moving in the direction of motion of light at velocity  $v$  then the expected velocity of light wave in the above moving medium would be  $v\lambda+v$ . But Fizeau's experiment on effect of moving water carrying the light wave gave negative result [8]. Again Michelson–Morley made experiment and compared the speed of light in perpendicular directions to detect the relative motion of matter through the luminiferous ether. The result was negative [9]. It is evident from above experiments that the wave concept of light does not yield the expected result hence the wave concept of light should have been rejected without compromise. Instead the wave concept was retained with the hypothesis that light waves do not require a medium [10]. One may wonder as to what is the significance of a wave without a medium! At this juncture, one feels, the particle theory of light is close to reality and the wave theory is based on hypothetical construct. Therefore, the particle theory of light could have been improved to understand all phenomena of light but this was not done. The concept of space medium has been changing and it is now accepted as a physical entity. Simply presence of a medium (physical space) is not enough to propagate the light wave. Propagation of high frequency waves requires a medium of high stiffness. It is well known that the space medium cannot provide the required stiffness property for propagation of light wave.



Hence under no circumstances the space medium can transmit the light waves. This author has proposed elsewhere the new mass-space structure of light particle by identifying the mass of light particles in photonic mass units and further identified the presence of non-electric charge (photonic charge) in light particles [5]. The author has explained all phenomena of light from particle nature of light. It looks, we can dispense with the wave concept of light thereby remove the duality of light.

Einstein's famous equation  $E=MC^2$  made us to know mass is equivalent of energy. This made us clear as to how energy is created by loss of mass in nuclear reaction. We are used to the macro concept that energy is always possessed in matter by virtue of some state property of matter. To conceptualize quantized energy without matter (mass) looks unrealistic. We are not sure of the zero rest-mass of light particle simply because we have not explored the photonic mass scale. It is something like concluding the mass of atoms as zero by weighing it in a way bridge. May be in future we would know that the mass of photon is not zero. The rest mass of neutrino is so small that it was long thought to be zero [11]. The rest mass of neutrino is much smaller than that of other known elementary particles. Like the neutrino, the photon, at present, though considered to have zero mass in atomic mass units (AMU) but would be found to have mass in photonic mass unit. The new non-zero mass concept of light particles (photons) has scope of building harmony with the concept of energy in macro domain. It is easy to say 'matter converts to energy' but difficult to perceive the mechanism of conversion in a path function. If light particles have tinny mass in PMU then the energy produced in nuclear reaction can be conceptualized as energy produced by disintegration of dense mass of the nucleus where the nucleus breaks to some mass bearing known particles and less known debris (light particles having mass in PMU). A stone breaker breaks when breaks stone with the impact of a hammer he makes stone chips and, in the process, some fine debris (stone dusts) is also produced. It is necessary to account for the debris to make the mass balance before and after crushing of stone. Similarly, the lost mass in nuclear reaction can be accounted for by the masses carried by the chipped off photons and the energy of nuclear reaction is produced by disintegration of dense mass forming nuclei of photons and their extra-nuclear space structure.

## Conclusion

Uniformity of the norms of nature is well perceived in macro domain physics. There is no reason why should there be a break of the uniformity of structure, feature and the laws in finer domains of nature unless it is postulated differently. A strong faith on uniformity of nature can help to modify our domain specific understanding of energy to one comprehensive unified understanding of energy and energy level irrespective of domain. Again, the manner in which matter possesses energy by virtue of some state





property can be generalized for all domains by conceptualizing matter value (mass) in all existences in finer domains below micro domain. This new understanding would modify our existing concept that 'matter converts to energy' to a natural concept that energy is liberated when a part of dense mass is disintegrated to fine debris forming nuclei of photons where the nuclei forms the mass-space structure liberating energy. The new understanding of mass-space structure of light particle has scope to explain the nonelectric charges in mass-space non-equilibrium state. The light particles having mass in PMU and carrying non-electric charge (photonic charge) has scope to explain different phenomena of light without duality. Duality is never a reality of nature. Nature is always consistent with its basic constituent with basic interaction norms (laws) which we discover by exploring nature but at times we deviate away of nature. The deviation from nature can still yield result by making further unnatural assumptions. The new concept of energy would help to read nature in a natural manner. The author is also hopeful in developing harmony between the concepts of energy in Vedic science and modern science.

This article is a part of the original work published in the book "Universal Mystery Unfolded", Volume-3 of the series "Dynamics of universe; interplay of matter, space and charge", 2012 by the same author.

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