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## **Modified Field Theory**

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**Abstract:** A semi-classical approach to analyze the transformation properties of a material particle into field quanta, based on both the relativistic dynamics and Newtonian dynamics, is proposed. The new concept is useful to understand the intricacies of the micro-world - short-lived particles, anti-matter, sub-atomic particles, gamma rays and cosmic rays.

**Keywords:** Relativistic Mechanics, Special Relativity, relativity, gravitational theory.

### **Introduction**

I follow the line, suggested by Einstein but with a reinterpretation of his special theory of relativity and reanalysis of his famous mass relation  $m = m_0 / (1 - v^2/c^2)^{1/2}$  [1] so that a constant and ubiquitous relatedness of the matter and the field is achieved. The results obtained from the revised formula are the same except in a case where  $(v^2/c^2)$  is equal to unity. At this stage instead of an infinity catastrophe we get an indeterminate form signifying the transformation of material particle into field quanta. The new concept is helpful particularly to study the nature of short-lived particles, anti-matter sub-atomic particles, gamma rays, and cosmic rays.

### **1.1 Relation with Einstein's Theory**

In the rest frame of any system, in any form of "classical" energy, has a mass associated with it. Mass is not conserved; nor is the sum of classical energies. What is constant (i.e., conserved) is the system rest-frame total energy [2]. We refer to the Einstein's famous mass relation  $m(v) = m_0 (1 / (1 - v^2/c^2)^{1/2})$  [1],  $m$ , the relativistic mass and  $m_0$ , the rest mass are not two different entities as long as the body is at rest, it is the same as the Newtonian mass. Let us briefly consider the fact that  $m > m_0$  is a clear indication for a decrease in  $m_0$  with respect to  $m$ . This process is termed as Relativistic Decrease ( $R_D$ ) in rest mass. Even the Newtonian dynamics supports this viewpoint where acceleration 'a' is inversely proportional to mass 'm' i.e.  $a \propto 1/m$  [3]. In such a case for an observer acceleration manifests the decrease in mass  $m$  however; there is a strict prohibition that no material particle can have a mass less than its rest mass proper. And it is not violated since the relativistic mass of a particle is always more than its rest mass proper at higher velocities. It signifies that the relativistic increase is more than the relativistic decrease. How the two converse processes (increase and decrease in rest mass) are possible simultaneously within a process is discussed in detail in section 1.1.2.

Relativistic decrease is only a substitution with the field in mass, which does not occur at low velocities. But if  $v$ , the velocity of particle is close to  $c$  (the velocity of light)  $m > m_0$ . Relativistic decrease in rest-mass is  $m_0 = m(c^2 - v^2)^{1/2} / c$  according to the Einstein's mass relation. It is clear from the relation that the more  $m$  increases the more  $m_0$  decreases. If  $v = c$  then  $m_0 = 0$ . But since  $m$  is not an independent factor rather it does not exist without  $m_0$ , certainly it is  $m_0$  which decreases itself in term of  $m$  thus  $m_0 (c^2 - v^2)^{1/2} / c$  is the more appropriate expression in place of  $m(c^2 - v^2)^{1/2} / c$  for the rest mass. This is an approach of relativity within relativity.

### 1.1.2 Interaction with the Field

The process of influencing the field by a body during its motion gives birth to force, which represents interaction, in the final analysis the action of a field. [4]. No interaction can take place without mutual sharing. Obviously matter transfers some part of it to the field but field reciprocates it with a bigger portion as a result the relativistic mass always remains increased. Einstein's prediction of convertibility of energy into mass of the body at higher velocities has a double effect on the acceleration since there remains no energy left to accelerate the body besides the body increases its mass. Now the force is not sufficient even to enable the body to maintain its constant velocity by which it was in motion before the application of such force. The body will face retardation. If another force of a greater strength will be applied to it, again the same process will be repeated. Perhaps, that is way Einstein predicted an infinite mass with zero force (any definite force before infinite mass would be zero) at  $c$ . Then the stages should have been: 1. Acceleration, 2. Retardation, 3. Halt. However the observation shows that the acceleration does take place even at much higher velocities, i.e. 1. Acceleration, 2. Acceleration with low intensity, 3. Still to be known.

According to a new concept, the moment the energy is convertible into mass of the body the same moment even some part of the matter is also convertible into energy which avoids the retardation tendency. However the same relativistic forces (the forces of much greater strength than expected in non-relativistic) are required to keep accelerating the body at higher velocities because the portion of energy into mass is more than the portion of mass into energy. This indicates how the two converse processes (increase and decrease in rest mass) are possible simultaneously within a process. It has been mathematically expressed in section 1.1.3.

Though a particle's self preservation instinct instilled in it by nature does not wish to lose its individuality and furiously resist any such build up [5]. But possibility of any such resistance is valid for a finite level of buildup and not for an infinite one. For infinity particle is non-resistant, which denotes an absolute domination of field.

### 1.1.3 Modified Mass Relation

Since both the decrease and increase in the rest mass are the part of the same process. Now in order to get the same Einstein's mass relation back rest mass expression i.e.

$$m_0(c^2 - v^2)^{1/2} / c$$

**is multiplied by  $c^2/(c^2 - v^2)$ .**

Thus relativistic mass of a moving particle which is:

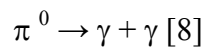
$$m(v) = (m_0(c^2 - v^2)^{1/2} \times c) / (c^2 - v^2)$$

This relation can further be reduced as  $m = m_0 / (1 - v^2/c^2)^{1/2}$  but we do not reduce it since  $m = m_0(c^2 - v^2)^{1/2} \cdot c / (c^2 - v^2)$  is more appropriate. It demonstrates  $R_D$  while relativistic mass (total mass) is incremented. Obviously the results obtained from this relation and from Einstein's mass relation are exactly the same. And when  $v$  is very close to  $c$  the mass of the particle increases immensely. But if  $v = c$ , at this stage according to Einstein's relation  $m = \infty$ , whereas in the new relation it is  $0/0$  or  $(0 \times \infty)$  which means  $0$  is the rest mass but the relativistic mass is  $0/0$  (indeterminate) and not infinity i.e. transformation of material into field quanta.

Even from the Dirac's perspective  $2mc^2$  the energy height sufficient for transformation of matter into field is a finite energy level.[6] Then what prevents matter from transforming it into field when it possesses infinite level of energy in a system where its velocity is equal to  $c$ .

The new relation resolves the situation very amicably since the moment a body attains infinite mass, the same moment its rest mass comes down to zero to change the result from infinity to indeterminate ( $0/0$ ) or  $(0 \times (1/0))$  or  $(0 \times \infty) =$  indeterminate. Here  $0$  represents the rest mass of the particle and  $\infty$  represents the field buildup thus the product of them is relativistic mass, which is indeterminate. And as we know indeterminate could have any value whatsoever large or small [7]. That is exactly the case as we see the mass of photon at  $c$  could be anything large or small but it exists only when  $v = c$  [7]. The rest mass of photon is strictly equal to zero but its inertial mass, which exists at  $c$  is certainly not equal to zero. Since if it is not so a photon can exist at any velocity lower than  $c$ , which is not true. Photon does possess some relativistic mass, which is indeterminate in material terms because it is in the form of energy. The relativistic mass of the body at  $c$  is an infinite field buildup with no rest frames hence an indeterminate form and that is the proposed concept. And only a Photon can have that mass which is indeterminate at  $c$  [7], Einstein's Photoelectric Effect and Compton's effect support this view point. Thus a body whose velocity is equal to  $c$  will certainly transform it into field.

Observations show that the natural pion (symbol  $\pi^0$ ), an unstable, short lived particles that may be produced by collisions in particle accelerator and they are accelerated up to  $0.99975c$ , a little short of  $c$ . It is however seen that finally in the process they decay into two gamma ray photons.



It seems in the process that the velocities of the particles finally equate  $c$ , which is less noticeable for the transition takes place instantaneously.

There are also evidences where an electron encounters a positron and they convert into a pair of gamma-ray photons observed by Blackett and Anderson in an experiment to see the phenomenon in Wilson Cloud Chamber in 1932[9]. In fact in such an encounter (annihilation), the resultant velocity of both the particles becomes equal to that of light and thus conversion takes place.

### 1.21 Impact of Mass on the Transformation

Transformation in all the cases is not of the same order it entirely depends upon the mass of the particle without regard to its charge. Let us refer to the de Broglie relation  $\lambda = h/mv$ , where  $m$ , mass and  $v$ , the velocity of the particle are the variable factors, which

determine the wavelength ( $\lambda$ ) of the particle and  $h$ , is a Plank constant. For instance, in a case where electron has a velocity equal to  $c$ , its wavelength according to de Broglie relation would be  $10^{-10}$  cm and according to proposed concept electron at velocity  $c$  should transform it into field quanta having no rest frame. Since both the events occur at a single 'point' in space and also in time, therefore, the emerging photon will find itself associated with the wavelength last achieved by the electron. The photon associated with this wavelength would certainly be a gamma ray photon of a very high energy. Likewise a proton on its transformation into field will produce much more energetic gamma ray photons because the proton is at least two thousand times heavier than electron and it will accordingly inherit much shorter wavelength to the emerging photon.

We are now convincingly in a position to state that every material particle, which transforms it into photon, will inherit its latest wavelength to the photon on its emergence and this is how the gamma rays with different wavelengths comes into being. The heavier is the particle, the shorter it generates the wavelength on its transformation into field.

### **1.22 Concept in Antimatter**

This concept strongly supports to the Dirac's postulate of the state of negative energy (antimatter)[10]. The process, in which an electron jumps in an atom from higher energy level to the lower one releasing its energy in the form of photon, is different from the process where positron emerges. Precisely because a positron is not merely a form of energy furthermore it also inherits the property of matter and that too as equal and perfect as that of an electron. Likewise antiproton and antineutron were discovered when a series of gigantic accelerating machines were put into operation racing protons to close-optical velocities.[11]

All of this indicates that a proton or any other material particle interacts with the field, in a manner proposed in this paper - by receiving a greater part from the field and transferring comparatively smaller amount of its rest mass in reciprocal. When half of the rest mass is transferred to the field, the mirror image of proton appears for it is complete in all respects. It is worth noticing that despite the transfer of its half of rest mass, the relativistic mass of the proton will appreciably be higher than its rest mass proper. Refer to the newly derived relation in sec.1.1.3. The mirror image in actual fact is no other than an antiproton since the process is a reverse one i.e. matter in the field instead of field in the matter, consequently having an opposite charge of that of proton. This significant process demonstrates how the antimatter comes into being and how the negative energy exists. Similarly short-lived particles like pi-meson, mu-meson etc will take birth at different stages in this process. However a separate paper is needed for such a detailed discussion.

### **1.23 Conclusions**

Conclusively it can be stated that no material particle can have a velocity equal to  $c$  since only the field has the right to have that velocity. And if any matter possesses this velocity it will have to transform it into the field. A remarkable mathematical relation indicates the growing mass with a growing velocity and the increment in mass becomes immense when velocity is close to optical velocities but quite interestingly mass becomes zero with an infinite field buildup at  $c$ . Thus the mass of particle calculated at  $c$  is indeterminate which signifies the transformation. Since the transformation occurs at particular velocity, this relation with the help of de Broglie's relation is capable to predict even the wavelength by which the photon will find it associated at its emergence. Thus particle of different mass will

produce gamma rays of different wavelengths on their transformation into field and this is one of the important aspects of this theory. Likewise, short-lived particles and antimatter also manifest their existing properties in the process. The mathematical relation is free from partial differential equations, the reduction of which to mechanical elements remained always problematic. All the assumptions successfully correlate the experimental observations obtained by eminent and renowned scientists in the past.

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