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THE CONCEPTS OF GRAVITY AND MASS IN THE VETHATHIRI MODEL OF UNIVERSE

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ABSTRACT

Newton considered gravity to be an inherent property of every particle in the universe. This view of Newton was modified by Einstein to mean that gravity is due to the action of a particle on the surrounding space. Modifying this view of Einstein, we obtain a new model called Vethathiri Model of the Universe, wherein gravity is the action of space on the particle. In the light of this Model, certain fundamental concepts are critically reexamined. We show that mass is the dynamic differential of the compressive gravity and the net resistance to it. A striking feature of this work is that the direct proportionality between the 'inertial mass' and the 'gravitational mass' emerges from the theory. The recently advanced Quasi-Steady State Cosmology of Hoyle, Narlikar, et.al. is briefly discussed with a view to modifying the same by using our definition of Inertia.

1. *Introduction*

The study of the laws governing the evolution of the observable universe constitutes Science. The evolution comprises a series of causes and effects. The description of the link between a given cause and its effect, expressed in mathematical terms, becomes a theory. Normally, a theory starts with an effect and ends up in unraveling the cause for it. Newton thus declared: "The aim of my science is to find the cause for every effect I observe until I arrive at the ultimate cause which is certainly non-mechanical."

Every theory has three stages: axioms, mathematical logic and predictions. When the predictions do not agree with experimental evidence, axioms must be suitably modified. Let us briefly discuss in this paper how the axioms of the Newtonian model of the universe were modified by Einstein to arrive at a new model, and how Einstein's axioms need further reexamination in order to remove certain fundamental difficulties of modern science and thus bring us into closer agreement with the perceivable truth of Nature.

2. *Newtonian Model*

In the Newtonian model the universe is considered as a composition of four independent entities: space, time, matter and energy. Absence of precise and clear definitions for these four is a severe limitation on the Newtonian model. In such an absence, people have been led to mistake them for what they are not! The failure of the Newtonian school of thought in the realms of atomic dimensions and high velocities demonstrated that there are axiomatic errors in the Newtonian scheme. This demonstration came about a century ago and gave the scientific community the requisite courage and motivation to modify the Newtonian axioms. This led to the propounding of quantum concepts in the atomic dimension and attempts at unification of the four entities – space, time, matter and energy.

3. *Einstein Model*

Einstein's theory brought out the inter-dependence of space/time and matter/energy by the following relations:

$$T = (t - vx/c^2) / \sqrt{(1 - v^2 / c^2)} \qquad (1)$$

$$E = mc^2 \qquad (2)$$

By the above relations, Einstein reduced the four independent quantities to two: space and time united to become space –time continuum and matter and energy united to form matter-energy by equivalence. This unification is the greatest gift of Einstein to the people of the twentieth century. However, the Einstein model retains the limitations of the Newtonian model in the sense that the ultimate

explanations of the radical nature of space and mass have not been provided.

With the Vethathiri Model the unification scheme initiated by Einstein is brought to its logical conclusion and the explanations so far lacking have finally been given.

4. *Vethathiri Model*

This model [1] is fundamentally based on the revelations of Vethathiri Maharishi obtained in states of deep meditation and introspection over a period of several decades. Hence, metaphysical terms may be unavoidably mingled with those that are of conventional scientific relevance. The essential feature of the Vethathiri Model is that it defines matter, energy and time as the manifestations of the space itself, which is plenum, primordial, omnipotential and total consciousness. The entire universe is of and by space. Space is defined below both in physical as well as metaphysical terms. However, in this paper we will specifically concentrate on the self-compressive character of space.

Space itself is Gravity: it is everlasting, singular, almighty, all-penetrative, highly transparent, imperceptible, dark, fluid matter, characterized by quivering, kinematic, inexhaustible, self-compressive, surrounding force, which results in automatic repulsion in its intensification and emerges as the infinitesimal energy particle. Gravity is identified as unified force, the source of all forces, with the inherent and inseparable attributes of force and consciousness.

Time: time is the progressive and regular manifestation of the quivering of space

Energy: energy is the manifest dynamic state of the potential energy of space.

In the Vethathiri model *space*, *time* and *energy* are the three physical realities of Nature; matter is a limited, localized, perceivable function of space, time and energy, and its parameters are *pattern, precision and regularity* – all governed by *consciousness.* The smallest such function is the fundamental individual particle, which is actually an infinitesimal quantum excitation of space – an energy packet. This is called "Vethon" in the Vethathiri model. All supposed varieties of particles that constitute matter are this same Vethon particle with varied functional parameters.

5. *Certain Basic Concepts of the Vethathiri Model are:*

1. The universe has manifested from, of and by the Primordial Totality, and this everlasting Totality is referred to in this model as the Primordial State (P.S.). Inherent quivering potential energy, consciousness and "self-compressive force" characterize the P.S.
2. Due to the combined action of the potential energy, consciousness, and the self-compressive force, the P.S. gives rise to infinitesimal

whirling wave–packets. These whirling wave-packets are hereafter referred to as Vethon particles. With the emergence of the Vethons, the cosmological, irreversible time started and with that the evolution of the universe.

3. The Vethons thus produced are compressed at all times by the self-compressive force of the P.S. to a bounded region and this bounded region defines the physical universe. Thus, the physical universe is embedded in the primordial state. As more and more Vethons are created, the extent of this region enlarges.

4. Due to its spin each Vethon produces a repulsive field around it and the quanta of this field are called Yogons. The Yogon field is referred to in this model as magnetic field.

5. Given two Vethons, the self-compressive force acts to decrease the distance between them, and the repulsive Yogon field acts to maintain a distance between them. Mass of a body is the dynamic differential of the compressive gravity and the net resistance to it.

6. The Vethons evolve into various elementary particles and these elementary particles combine to form systems like elements, molecules and compounds. The number and configuration of Vethons in the system determines its size and structure, and the intensity of the Yogon field between them determines the quality (i.e. the properties) of the element or compound.

7. As the P.S. is endowed with consciousness, every Vethon and hence every system is endowed with the same consciousness, manifesting as the order of function of the system.

8. The Yogon magnetic field in the system gets transformed into the various electrical, chemical and physical properties of the system.

6. *Gravity:*

Though gravity was the first known force, it is yet the least understood. Newton considered gravity to be an attribute of the particle. “Every particle in the universe attracts every other particle”, declared Newton. If a particle were to be created at an instant, he asserted that it would exert its gravitational influence on every part of the universe instantaneously. For Newton, gravity is “action at a distance” due to and among material particles.

Modifying Newton, Einstein had a different idea about gravity: he asserted that gravity arises due to a particle’s effect on the space surrounding it. Any other particle within the ambit of that distorted space gets affected accordingly. Previous to this, space had been considered as a passive background wherein particles move;

Einstein was the first to realize and declare the dynamic and active nature of space.

Modifying Einstein further, Vethathiri model asserts that gravity is solely due to the constant, self-compressive surrounding pressure of the space. The self-compression of the space tends to decrease the distance between any two given particles.

Gravity, or in other words, self-compression, is the essential feature of the all-pervading space and it is this self-compression which is responsible for the formation of fundamental particles from and by space. On each and every individual particle the self-compressive gravity emits a radial pressure convergent on its center. Further, the same self-compressive gravity exerts constant pressure on any system that these particles form; that is: the self compressive pressure acts not only on the whole system but also on its constituent sub-systems, down to each individual particle.

7. *Inertia:*

In Vethathiri model space is primary and individual, fundamental particles evolve from it. Due to its own self-rotation each fundamental particle produces a repulsive field in the ambient space and the quanta of this field are termed "Yogons". This Yogon field is referred to in this model as magnetic field.

A given Vethon is acted upon by the space through the self-compressive surrounding pressure, as well as by the configuration of matter surrounding it, through the magnetic field.

Let us consider first the effect of the compressive force on a given Vethon, say 'A', in the absence of surrounding matter.

If C is the constant compressive pressure exerted on the Vethon A and R_s represents the repulsive pressure of the individual Vethon due to its spin, then $(C-R_s) = U_I$ represents the net gravity acting on the Vethon. The greater the value of U_I is, the greater would be the difficulty for an applied force to move the particle. This difficulty is interpreted classically as the inertia of the particle. We call the inertia U_I the intrinsic inertia of the Vethon A.

Let us now consider the effect of the surrounding matter on the inertia of the above Vethon A. The surrounding matter is a collection of spinning Vethons. Of them, let us consider the effect of a single Vethon B on A. Considering A and B as a system, let us discuss the interaction between A and B. The compressive gravity exerted all around and on the system as a whole tends to minimize the distance between them; the repulsion due to their spins tends to create and maintain a distance between them. This gives an interaction between A and B, creating a kind of dynamic equilibrium. Due to this interaction let **f** (C,R) be the effect of B on A. The effect **f** (C,R) gives an inertia to A which we call the extrinsic inertia of A due to B.

Extending this principle, due to every other Vethon of the surrounding matter there is an effect on the inertia of A. The sum of these effects on A, i.e. Σ **f** (C,R) = U_E , is the extrinsic inertia of A due to the entire surrounding matter. Hence, the total inertia of the Vethon A is given as:

$$U_T = U_I + U_E$$

$$= (C - R_s) + \Sigma \mathbf{f}(C,R) \qquad (3)$$

Extending this argument to a body of n Vethons, the inertia of the body will be:

$$U_B = \Sigma U_T \qquad (4)$$

The inertia U_B of the body corresponds to its inertial mass.

The discussion thus far explains the nature of "Inertial Mass" which the conventional physics attributes to a body. Let us now clarify the meaning of the so-called "gravitational mass", which conventional physics defines as the strength of the body to attract any other body. Going back to the two particle system of A and B, let r be the distance between them. Suppose the spin of A decreases. Then, its repulsion R_s decreases accordingly and as a result U_I or the intrinsic inertial mass of A will increase. Concomitant to the decrease in the repulsion between A and B the gravitational compression forces A and B closer together and hence r decreases. From this follows a direct proportionality and a possible equivalence of inertial mass and gravitational mass. As inertia of A increases, r decreases leading to the apparent fact that A has more strength to attract B. Actually however, it is the surrounding compressive gravity of the space that forces A and B closer.

The equivalence of gravitational and inertial mass is the marvelous truth of Nature. It was demonstrated by Galileo, admired and wondered at by Newton, exploited by Einstein to build a new theory and is now truly explained by the Vethathiri model.

Eq.(3) contains within it the ideas of great physicists of history, and at the same time holds promise for the understanding of future generations. As a case in point of historical relevance, Mach's principle may be related to the Vethathiri model.

8. *Mach principle*:

Ernst Mach was a German philosopher, acknowledged by Einstein [2] as his mentor and motivator. Einstein, in his autobiographical sketch mentions that the critical reasoning required for his discovery of Special Relativity was decisively furthered by his reading of Mach's philosophical works.

One of the earliest observed qualities of matter was its inertia. Galileo interpreted inertia of matter as the resistance that a body would give to a force applied on it. Following Galileo, Newton obtained the inertia or mass (m) of a body as a constant of proportionality between a force applied on it and the acceleration thus produced. Hence, in his scheme, Newton considered the mass of a body as absolute. Mach challenged the absoluteness of inertia of the body, and argued that the inertia of a body is a measure of its interaction with the ambient matter and hence depends on the configuration of matter surrounding the body. This principle of Mach includes the Equation (3). The term Σ **f**(C,R) represents the interaction of a particle with its surroundings, which Mach speaks of. Thus, Eq.(3) contains Mach but it goes further. Since Mach did not have the idea of the potential of space, he never mentioned the interaction of a particle with surrounding space. Eqn.(3) enlarges Mach's principle by introducing an intrinsic inertia for the particle, which is the differential of the self-compressive gravity and the particle's own repulsion. With this extra dimension, Vethathiri Model asserts: The inertia of a body arises due to its interaction with surrounding matter and also due to the effect of its own repulsion in contrast to the self-compressive pressure of Gravity exerted on it.

Mach's concept of inertia of a body being attributed to the interaction with the rest of the matter in the universe had a profound influence on Einstein. He expected his equation for the gravitational field to incorporate Mach's principle. Accordingly, when he wrote the equation:[3,4,5]

$$R_{\mu\nu} - g_{\mu\nu} R + \lambda g_{\mu\nu} = - bT_{\mu\nu} \qquad (5)$$

$$T_{\mu\gamma} = \rho U_{\mu} U_{\gamma} + P \delta_{\mu\gamma}$$

for the gravitational field, he asserted that the above equation will not admit a solution for the case when the density of the universe $\rho = 0$ (i.e. matter-free universe). However, right after his paper appeared, the cosmologist de Sitter did find a solution for the above equation with $\rho = 0$. A highly disappointed Einstein looked for ways to rule out de Sitter but soon realized that he could not.

Now, what are the implications of the de Sitter solution? The de Sitter solution shows that a body can have inertia even in the absence of matter surrounding it. The de Sitter solution thus supports the concept of intrinsic inertia introduced in this paper.

9 *Quasi-Steady State Cosmology*

It is highly interesting to note that Hoyle, Narlikar, et.al.[6] have recently advanced a "Quasi-Steady State" cosmological model wherein they introduce a 'creation field' out of which matter is ejected. Their concept of this creation field is fairly similar to the P.S. mentioned in this paper. The Q.S.S.C. mainly depends on the Machian theory of gravity in which the origin of inertia is linked to a long-range scalar interaction between matter and matter.

The mass of a particle (a) at A on its world line arises from all other particles (b) in the Universe.

$$M_a = \sum M_b \, (A) \qquad (6)$$

Where M_b (X) is the contribution of inertial mass from particle b to any particle situated at a point (X). The scalar mass function M_b satisfies the confirmally invariant wave equation:

$$\square M_b + 1/6RM_b + M_b^3 = N(b) \qquad (7)$$

which leads to the field equations: (8)

$$R^{ik} - 1/2R\, g^{ik} + \wedge g^{ik} = -8\pi G/c^2 \, [T^{ik} - f\,(C^i\, C^k - 1/4 g^{ik}\, C^l\, C_l)]$$

In the Vethathiri Model the conventional Mach concept has been extended to include the interaction of a particle with the space, resulting in an intrinsic inertia which, when taken into account, modifies the above three relations accordingly. We will be addressing the task of obtaining such modified relations in a future publication.

10. *Discussion:*

Salient features of this paper:

1. Conventional physics defines the mass of a body as the amount of resistance that it offers to a force applied on it. However, it doesn't throw any light on the source of this resistance. In the absence of a clear understanding of this source, the inertia and hence the mass came to be considered as inherent property of the body.

   Soon it was realized that a body not only offers a resistance to an applied force, but also effects a force on another body due to gravitation. So, there came a different definition for mass in terms of the gravitational force that the body effects on another mass. Accordingly, one talks of inertial mass by the former method and gravitational mass by the latter method. Surprisingly, there is no compelling theoretical reason for the equality of the two masses, which is taken for granted in contemporary physics due to experimental reasons.

   In sharp contrast to the above, this paper throws light on the source of the resistance and hence defines mass not in terms of its

effect but in terms of its source. The definition given here is of mass, as such, *in itself*. Mass is the dynamic differential of the compressive gravity and the particle's resistance to it.

2. Contrary to Newton's assumption, gravity is shown to be an attribute of space and not of particles.
3. Einstein attributed gravity to the effect of particles on space, whereas here gravity is shown to be the effect of space on the particle. In the Vethathiri Model an altogether radically different explanation for the source of gravity is offered.
4. Introducing an intrinsic inertia for every particle enlarges the Mach principle and this extension receives a theoretical support in the deSitter model. This intrinsic inertia also suggests a possible improvement of the Q.S.S.C. Model. Regarding the nature of interactions of a given particle with the surrounding matter, leading to the extrinsic inertia, this model offers an altogether different explanation from that of Mach.
5. Since inertia of a system is nothing but the net gravity on the system, there is no need to talk about two kinds of masses for a body, or any kind of permanent 'mass' at all. The so-called 'mass' is nothing but the dynamic differential of the compressive gravity and the net resistance to it.

.Science progresses only through constant review and updating. The necessity to revise or update a given theory arises from new experimental results or from the demands of aesthetic or philosophic logic. Instances of both of these are abundant in the history of science. Vethathiri model is another instance of the latter case.

Vethathiri model begins from the radical Beginning itself, and hence has a philosophic base. It is this base which is missing throughout contemporary science, which begins from the stage of fundamental particles but does not even conceptualize the origin nor the essential nature of these particles. The fact that Vethathiri model begins with and consistently proceeds from the radical, primordial state is its strength and gives us a holistic cosmology. So far science has been piecemeal and hence is riddled with inconsistencies and unanswerable questions. Only a holistic theory can reveal the fundamental truth. It is in this context that Vethathiri model is significant and valuable. It is not a superficial modification of Newton's or Einstein's concepts, but a radically different view which has finally brought cosmic monism into scientific thinking and thereby the concept of Effect is seen as inherent and inseparable from Cause.

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