MATTER AND VACUUM. A NEW APPROACH TO THE INTIMATE STRUCTURE OF THE UNIVERSE.

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SUMMARY

In order to describe and simplify the properties of material systems and their interactions a simple model, based on linear oscillators, is hereby presented. These oscillators define the space and time framework from which the length and time properties of material systems are derived. Matter and energy are postulated as the physical result of grouping and interaction among primary oscillators.

The length of material systems and the time required for the information to travel both ways (back and forth) change with the system's motion. The derived formulas coincide with the Special Relativity transformations for space and time.

Based on this model, the speed of light seems constant for all inertial systems. There is no contradiction with the Special Relativity Theory in the usual case of experimental results that imply two-way trips of the electromagnetic signals, but differences arise when only one-way phenomena are considered.

OSCILLATORY MODEL

Consider the phenomena taking place in the ocean, where the entire assembly of water molecules may be considered as a frame of reference. Waves, currents and tides take form within this frame. Simultaneously, sound waves, thermal phenomena, etc., are being transmitted.

Despite this internal molecular structure, when swimming, we usually consider the ocean waves as independent entities, over imposed on the huge body of water. It is possible to develop a good characterization of ocean waves analyzing them as independent phenomena. But only through the kinetic theory, which does consider molecules, we can understand the transmission characteristics of sound waves and, in general, all transportation phenomena occurring in water.

In the same line of thoughts, let us assume for a moment that there is a frame of reference in the universe. As water in the ocean, this frame of reference need not to be stationary.

Let's also assume that the frame of reference is formed by entities with oscillatory properties. These entities join together to create the basic constituents of what we generically call matter, waves, energy, etc.

Let us assume, in addition, that this connection is governed by interactions transmitted (in average) with the speed of light in a vacuum ("c").

The basic constituents of this primordial medium are postulated as one-dimension oscillators (like superstrings theory does (Green *et al.*1987). The basic difference with superstring theory is that the oscillators are not only considered as the basic constituents of particles. Linear oscillators are postulated as filling (and defining) all the Universe, while particles are only the physical manifestation of their coordinate interaction.

From both above mentioned basic assumptions the concept of subjective time for any observer, either stationary or moving with respect to this frame of reference, can be conjectured. From this subjective concept of time, the value of the speed of light, measurable for each observer, can be derived.

As suggested by our experience in other fields, the speed of interactions can be considered as constant within the frame of reference, as with sound waves in water or in air.

At this point becomes very important to clarify the concept of subjective time. Once postulated that any material or energetic manifestation is no more than a grouping of oscillatory interacting constituents, if by any reason these oscillators change their coupling frequency, all the processes associated to matter or energy will change correlatively. Take, for example, the variation of the speed of sound in the air at different temperatures. This

phenomenon should affect not only the biological clocks (e.g., aging) but also the mechanical ones.

As expressed, the assumptions for the model are:

- All material or energetic manifestations result from the interaction of linear oscillators, which not only cover entirely the space under study but define it.

- The average transmission speed of the information, between oscillators, is constant in the frame determined by the oscillators.

The question of how many oscillators are required to form an elemental particle (i.e., an electron) is similar to asking how many molecules are required to form a wave or a whirlpool. As envisioned in this model, a particle or an energetic manifestation is simply a stable grouping of the primary entities, which originate a differentiated phenomenon within the frame of reference. It is irrelevant to know how many molecules of water or which, among all those available, form part of a wave. The wave is a stable and differentiated phenomenon within the body of water, even if the molecules that originate such a wave do not move along with it. "Stable" means that the phenomenon propagates during a certain period of time, maintaining its identity.

In the following discussion, a length "L," refers to the "observable" physical results of the groupings and interactions of a large number of primary oscillators. Similarly, the changes in the observable length "L" or in the internal oscillation period "T" for the material system, is the "macroscopic" representation of the changes among primary oscillators.

No attempt is made to define physical concepts as mass. It is only assumed that macroscopic results or particle properties are derived from the intrinsic properties of primary entities and their coupling characteristics.

Defined in such a way, any "particle" is the result of the coupling of primary oscillators and must be considered as a macroscopic "observable" oscillator, which represents the result of the overall coupling.

In accordance with such assumptions, the measurable properties of particles are, as with classical oscillators, the result of the equilibrium between internal restorative forces and the kinetic energies derived from the coordinated displacement of primary oscillators.

Similarly to waves, the oscillators do not move with the particle. At all times the particle propagates its identity, incorporating and abandoning the oscillators as required.

During length measurements or any other interaction, any particle can be considered a simple linear oscillator that is the result of the summation of a huge number of elementary oscillators. Further references to "particles" in the following paragraphs must be considered as a group of coupled primary oscillators. In the proposed model it is not possible to talk about particles without primary oscillators in the same manner that it is not possible to obtain water waves without water molecules.

FIRST CASE: Stationary particle.

The equations for linear oscillators that are manifested as a stationary material particle, are derived in the following paragraphs. In this stationary case, sub-index "0" is employed.

During the following mathematical derivation, mass "m", is used only as an auxiliary variable, canceled at the end of the process. Mass "m" must be included in order to employ the classical physical formulas that describe the behavior of linear oscillators. For simplicity the mass "m" of the particle is assumed as the sum of the individual masses of the oscillators. As primary oscillators are postulated as interacting at speed "c", also mass "m", or the sum of primary oscillators mass, is displaced at speed "c" in one way or another. Plus (+) and minus (-) signs will be used to reflect opposite directions of the absolute magnitude, "c".

Within this explanation, mass "m" is not necessarily identified as the measurable mass of the particle. It must only be considered as an "internal" mass reflecting the addition of individual oscillators mass. As previously explained, no attempt is made to define the concept of mass associated with individual oscillators.

For a material particle (of "internal" mass "m"), assumed as a linear oscillator which reflects the coupling of a group of primary linear oscillators, the "internal" kinetic force ("F_0"), in equilibrium with the "internal" elastic restorative force, is:

F_0 = Momentum Variation / Oscillation Period

Where, with the "internal" mass "m" changing its speed from "+c" to "-c", it results:

Momentum Variation = 2mc **(1)**

and the oscillation period "T_0" is related to the length of the particle "L_0" by:

$$T_0 = 2L_0 / c \qquad (2)$$

leading to:

$$F_0 = 2mc / (2L_0/c) \qquad (3)$$

and "L_0" is determined through the elastic constant "*k*", in accordance with:

$$F_0 = kL_0 \qquad (4)$$

So, equating (3) and (4):

$$2mc / (2L_0/c) = kL_0$$

and

$$L_0 = (mc^2 / k)^{0.5} \qquad (5)$$

SECOND CASE: Particle in motion.

The case of a particle moving at a speed "v" (sub-index "1") with respect to the frame, can be calculated similarly. Once again, it must be emphasized that the fundamental linear oscillators do not move with the particle, as water molecules do not travel with the waves.

The time of a complete oscillation ("T_1") can be determined as:

$$T_1 = L_1 / (c+v) + L_1 / (c-v)$$

which, after regrouping the terms, leads to:

$$T_1 = 2L_1c / (c^2 - v^2) \qquad (6)$$

and the average force can be calculated as:

$$F_1 = 2mc / (2L_1c / (c^2 - v^2)) \qquad (7)$$

The equations are always expressed in accordance with observations collected from the stationary system. The variation of the momentum is the same as in the first case, since any elementary oscillator has an average speed "+c" or "-c" because it is stationary in the reference system (the oscillators are themselves the reference system). However, the system length "L_1" can not be determined beforehand.

As in the previous case, the elastic restorative force is related to "L_1" according to

$$F_1 = kL_1 \qquad (8)$$

and from (7) and (8):

$$L_1 = (m(c^2 - v^2) / k)^{0.5} \qquad (9)$$

while, dividing equations (9) and (5):

$$L_1 = L_0 (1 - v^2 / c^2)^{0.5} \qquad (10)$$

and dividing (2) and (6):

$$T_1 = T_0 (L_1 / L_0) (c^2 / (c^2 - v^2)) \qquad (11)$$

where, after replacing the length quotient, based on equation (10), we obtain:

$$T_1 = T_0 / (1 - v^2 / c^2)^{0.5} \qquad (12)$$

Equations **(10)** and **(12)** express the relationship between lengths and period, for a system in motion, with respect to the same values obtained for a stationary system. Both measurements are referred to the stationary system.

The results obtained are the same equations that govern coordinate transformation in Special Relativity (Einstein 1905), but the consequences differ notably. In general, the "it seems as if ... " of Special Relativity becomes "it actually occurs that..." and vice versa

As a consequence of this model, the moving clocks are in fact slower with respect to the stationary clocks. However, this is not evident in the moving system when carrying out experiments that involve length and cyclic time measurements. The explanation for this is that the observer's clocks and lengths are all affected in a same way as any material manifestation in the system.

The above analysis is a consequence of the fact that, indirectly, in the measuring process we use the property which is, in fact, what we intend to measure.

Even if the system velocity vary, the time for the light to cover the two-way path of a given distance, as measured by the observer, remains unchanged. This is not the case with the time employed for a one-way trip. It should be noted at this point that all accurate measurements of "c" (leading to the postulate of constancy of light speed) have been performed using two-way trips of electromagnetic waves. One way measurements like Römer's study on the eclipses of the moons of Jupiter and Bradley's determinations on aberration of light, are not accurate enough to detect absolute movement of the order of the Solar System local speed.

Even if the postulate of a frame of reference in the universe may be taken as a reference to the obsolete theory of "ether", it actually involves a basically different concept. This supporting media is not thought of as a fluid in which waves propagate and which is crossed - with or without friction - by the material particles. According with this

model, matter is an abstraction of the interaction of primary oscillators.

In this model the concept of "corpuscle" associated with material manifestations is meaningless. If such "corpuscles" were mere stable groupings of the supporting medium's components, it would not be convenient to think of them as being constituted by any other material, since this requires thinking that matter travels through the supporting medium (the old ether theory). In this model, corpuscles propagate through the supporting media. In a similar way, ocean waves do not travel across the water but propagate through it. Still waves are fairly stable groupings of the supporting medium particles (water molecules).

A practical difference between this model and the Special Relativity may be found when measuring the propagation speed of light by using one-way travels or the effect of one-way interactions. Such measurements are possible but not easily made. In fact, the "Dipole Anisotropy" on the Cosmic Microwave Background (CMB) (Smoot *et al.* 1977) is in better accordance with this model than with Special Relativity. The "Dipole Anisotropy" as determined by the NASA's COBE (Cosmic Background Explorer) satellite, is easily explained as a classical Doppler effect originated in Earth's movement through the background reference system. Doppler effect is the result a typical one-way interaction (there is no need for the return of the wave)

CONCLUSIONS.

The transformation formulas for length and time, which are obtained through the Special Relativity Theory, can be derived using a "classical" model of the Universe. The model presented here is simple and leads directly to the previously mentioned equations.

The speed of light, in accordance with the proposed oscillatory model, would actually be a fundamental property of the universe. It would not, however, be in the sense given by the Special Relativity Theory but because of being a manifestation of the intrinsic properties of what we call matter and/or energy. It would accomplish a role similar to that of molecule speed in the Kinetics Theory of Gases. It would be, in this case, the speed at which the primary components of the Universe interact.

Within this model the concept of "corpuscles" and "waves" as independent entities are meaningless. They are only the result of interactions between primordial components. The conception of wave-particle duality would turn meaningless as a consequence that, according with this model, differences in internal structure of waves and particles vanish

Absolute time would coexist with the times proper (other than absolute) of each inertial system. Each system would have its own "true" time, whatever the meaning of this expression may be.

Light speed would become a practical limit for the material particles we know, but it wouldn't be an absolute limit.

As previously expressed, the "it seems as if ... " of Special Relativity will become "it actually occurs that..." and vice versa.

Based on this model, although there may be a reference system under conditions equivalent to absolute repose, it can not be detected using experiments involving two-way travels of the electromagnetic waves.

This model does not imply the existence of an "absolute" reference system and mobile systems would only exist with respect to the basic frame that defines the space. This concept is analogous to the movement of waves and currents with respect to the extended mass of water of which they form part. There are not water molecules that can claim to be at absolute rest. Still the velocity of transportation phenomena becomes meaningful only when compared to the "stationary" local water extension.

The differences with Special Relativity would be evident only if performing experiments involving accurate measurements of the speed of light, using single way travels.

The "Dipole Anisotropy" on the Cosmic Microwave Background (CMB) is in better accordance with this model than with Special Relativity.

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