Energy Ether

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I come before you this morning not with the usual type presentation, for I have no experimental data nor any sophisticated mathematical formulations to present. I come only with a simple idea. In fact, the thought I wish to discuss with you this morning is but the fetal skeleton of a concept that I hope to bring to maturity, even as I myself approach intellectual maturity.

At an Indiana Central College Faculty Discussion in January of 1958, Dr. Konstantin Kolitschew, Chairman of the Physics Department at Indiana Central College presented a paper entitled "Boundary of the Unknown." In this discussion he presented a Time Energy Aggregate or Manifoldness made up of a mixture of free quanta and time.

A little over three years ago I had the opportunity to read this paper, and it is from this discussion that the energy ether hypothesis stems.

Since I first began to consider the energy ether concept you are about to hear, it has undergone the evolutionary process of re-evaluation and reconsideration in almost every aspect. It is quite probable that it will be subjected to an even more critical analysis in the future.

According to Auguste Comte man passes through three phases of history as he begins to uncover the secrets of Nature; the Theological phase, the Metaphysical phase and the Scientific phase. In the theological phase, men attempt to explain the natural phenomena they do not understand by gods or supernatural forces. In the metaphysical phase they are explained by "abstract" forces, that is by those forces that may not be observed. An example is Newton's "action at a distance" which he introduced in his discussion of the nature of gravity. Finally, in the scientific phase, these same natural phenomena are explained in terms of those things which may be directly or indirectly observed. The method of this final phase is in essence, of course, the scientific method.

Without totally disregarding the possibility of some complementary telelogical explanation, it appears to me that the scientist must attempt to view all aspects of natural phenomena in accordance with the scientific method if he hopes to maintain his intellectual integrity. This has been accomplished to a very great extent by modern science; however, the concept of "empty space" has yet to be considered in anything more advanced than a metaphysical mode of thought.

When Albert Einstein introduced his special theory of relativity he did not define what he meant when he referred to a space-time continuum, he simply postulated that this entity had certain properties. Among them he included the ability to propagate electromagnetic radiation. Just recently in the meter-kilogram-seconds-ampere rationalized system of units, empty space was assigned two properties, mag-

netic permeability and electric permittivity, which are related by the expression:

$$C = \frac{1}{\sqrt{\varepsilon_0 \gamma_0}}$$

If we simply accept that space has these properties, and indeed electromagnetic radiation is propagated, life is very simple for the man of physics. However, if we attempt to understand how this medium supports electric and magnetic fields, we are led to some interesting conclusions.

The following hypothesis is an attempt to analyze this entity, empty space, in a more realistic manner and put our knowledge concerning it on a more stable foundation.

Energy may be transmitted only by the motion of particles or waves, and as DeBroglie and Bohr have pointed out these are essentially the same; all particles having a wave characteristic and all waves having a particle characteristic. These two are related by DeBroglie's equation $mv = \frac{h}{\lambda}$. For wave motion to be transmitted by a medium it is necessary that the medium be elastic, (i. e. have a discrete structure). The question is then raised what constitutes these discrete particles in the Space-time continuum, and then, what is between the discrete particles.

It was in answer to this question that Kolitschew suggested that the mysterious entity "space" be replaced by the well-known entity energy, which may not only be discrete and elastic, but may also be a true continuum. This energy-time continuum which accounts for everything the Einstein postulated space-time continuum included, I have chosen to call energy ether.

A cursory glance at the following presentation would lead the observer to believe that this is a return to the all-pervasive ether originated by Rene Descartes early in the 17th Century. This however, is not the case. The ether of which I speak, is like Descarte's ether, a hypothetical "substance" filling the universe, inclusive of those volumes occupied by ordinary matter and serving to transmit all electromagnetic radiation. This ether, however, is of an energy nature, and does not consist of matter as did Descartes'.

As stated by the laws of thermodynamics, all processes naturally produce heat, and this heat diffuses, tending to equalize the temperature of our entire universal system. All energy processes terminate as heat energy and we might therefore say that heat energy is the "ground state" of energy. After these processes have reached the ground state the "latent" heat energy diffuses throughout the universe.

It follows from the principles of quantum theory that all energy is emitted and absorbed only in multiples of a definite small amount, the quantum. This suggests that the "latent" heat which diffuses throughout the universe does so as quantum or bundles of energy. These bundles of energy naturally seek their lowest energy level (again according to the laws of thermodynamics), and find it as individual

quanta, or as the lowest possible multiple of the before mentioned definite small amount.

The numerical value of this elemental unit of energy is given by Plank's constant, and the energetic mass of it may be calculated by reversing Einstein's equation for the transformation of matter into energy. It is found to be 7.36×10^{-48} grams.

$$E = mc^2$$

$$6.62 \times 10^{-34} \text{ joule} = m(3 \times 10^8 \text{ m/sec})^2$$

$$\frac{6.62 \times 10^{-34}}{(3.\times 10^8)^2} = m$$

$$7.36 \times 10^{-48} = m$$

The latent heat quanta with such an energetic mass, form the energy ether.

While I have been referring to the ether as being composed of latent heat energy, I do not wish to project an image of a static ether. In fact, because the quantum is inherently an energetic entity, the ether would be of necessity a dynamic medium. We must further assume the individual quanta which compose the ether are in random motion; otherwise we would be able to detect a sizeable fringe shift in experiments similar to the Michaelson-Moreley experiment.

If the quanta are in random motion the velocity of propagation of the electromagnetic radiation through this medum would be the root-mean-square velocity of the components of the medium. We are therefore able to determine the velocity of these component quanta quite simply by choosing a distribution function of $\frac{dn}{dv} = KNV$

$$\bar{V}^2 = \frac{\int_0^{vmax} \frac{v^2 dn}{dv} \, dr}{\int_0^{vmax} \frac{dn}{dv} \, dv} = \frac{\int_0^N r^2 dn}{\int_0^N dn} =$$

$$\frac{\int_0^{vmax} (KNV) V^2 dv}{\int_0^{vmax} (KNV) dv} = \frac{KN \int_0^{vmax} v^3 dv}{KN \int_0^{vmax} vdv} = \frac{\frac{V^4}{4}}{\frac{V^2}{2}} =$$

$$\frac{V^2 m}{2}, \quad \frac{Vm}{\sqrt{2}} = .707 \, Vm = \sqrt{\bar{V}^2} \, C = \sqrt{\bar{V}^2}, \quad 7.36 \times 10^{-48} = m$$

$$\frac{C}{.707} = Vm = 4.24 \times 10^8 \text{ m/sec.}$$

That this velocity is well over that of light should not cause too much consternation, for although this seems to be a contradiction of Einstein's theory of relativity at first, it is on the contrary, a reasonable explanation of the presence of phase velocities greater than the speed of light which are encountered in the study of the transmission of electromagnetic radiation and also explains why no energy may be transmitted at a velocity greater than that of light.

Absolute zero is usually defined as the condition at which there is a complete absence of heat. We have just discussed the "latent" heat nature of energy ether and might therefore logically conclude that absolute zero would be the only condition at which there would be a complete absence of energy ether. With no ether present, we would not expect electromagnetic radiation to be propagated. Continuing our reasoning still further we find that energy ether hypothesis predicts that as the density or the energy level of the ether decreases (the temperature decreases) the intensity of electromagnetic radiation will decrease also. If we do not pursue the analogy too far we may find it helpful to consider the demonstration of the ringing bell which is placed under a bell jar. As the jar is evacuated the intensity of sound decreases proportionally.

The preceding paragraph may suggest one manner in which the energy ether hypothesis may be tested empirically. Namely, by measuring the intensity of a source of electromagnetic radiation as its surroundings are made to approach absolute zero. If the intensity is shown to decrease, the energy ether hypothesis will be supported.

Recently I have been doing a limited amount of research reading in low-temperature physics in an attempt to analyze this hypothesis further. The energy ether concept is consistent with much of the data and offers an explanation for a number of the observed phenomena.

It has ben observed that every metallic conductor opposes the passage of electrical charges through it. This opposition is due primarily to the collisions of the moving charges with the vibrating atoms in the crystal structure of solids. As the temperature decreases the resistance decreases correspondingly. If the random motion of the quanta cause atoms to vibrate due to a Browian type bombardment we can see that the energy ether concept is in agreement with this observed phenomenon.

If a permanent magnet is dropped into a dewar containing a lead plate immersed in liquid helium it will not fall to the plate. It will remain suspended some distance above the superconducting lead. This phenomenon, termed the "floating magnet effect," is explained by the fact that as the magnet nears the surface, electric currents are generated in the lead plate's surface and the resultant magnetic field just counter-balances the field of the magnet. However, if the strength of the magnet is increased it penetrates the plate and destroys the superconductivity. Postulating that a magnetic field is a standing wave in the ether one would expect just such a result, due to the interference between the standing waves and the atoms of the superconductor. It has been observed also that the lower the temperature the more magnetic force needed to destroy the superconductivity. This too, is predicted by the energy ether hypothesis.

It may well be asked what the importance of this hypothesis is to the field of physics. In a recent issue of Scientific American, Mr. P.A.M. Dirac, one of the foremost theoretical physicists of our day, discussed the impasse with which modern physics is confronted due to the extreme complexity and abstract mathematical nature of many of our

current theories. At one point he remarks, "There will have to be some entirely new development that is quite unexpected, that will take us still further along the road of knowledge." He later suggests three ideas he feels might lead to this new development. The first is to ". . . . introduce something corresponding to the luminiferous ether, which was so popular among the physicists of the 19th Century."

Whether any aspect or aspects of the energy ether hypothesis are correct or not is a question which must be answered in the future after more experimentation and study have been done, but it seems foolish to me that, an entity as potent in physical properties as this unknown aggregate is, should continue to be considered as "empty space" when the energy ether concept would allow us to consider it in a more scientific mode of thought. I feel that the historical term ether should be retained for this entity and its nature analyzed further.