

Thoughts on the Existence of an Aether.

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Abstract.

Several neglected papers from the last century are resurrected and their contents analysed in order to revisit the question of whether or not there is an aether. The results of that query lead to suggesting possible new approaches to many fundamental ideas in physics. Negative energy and the primacy of thermodynamics in universal processes are discussed.

Introduction.

To many, the question of the existence, or otherwise, of an aether had been settled seemingly once and for all with the emergence of Einstein's theory of special relativity. However, the habits of a lifetime die hard and its possible existence was still a view harboured by many. It was against this background that Kenneth Thornhill produced two important, but sadly neglected, articles in 1983^{1,2}. The introduction to the first of these gives an excellent background to the arguments around at the time and indicates his approach to the problem. In it he says:-

“The question, whether or not there is a physical ethereal medium in which electromagnetic waves propagate, has been asked for many centuries. On the one hand, there have always been those who have maintained that it is not a sensible question to ask, since radiation is observed to have many physical properties and cannot, therefore, exist in a true vacuum or void which is, by definition, the total absence of anything physical. On the other hand, for about the last hundred years, it has come to be largely accepted that there is no physical ethereal medium, and the physical properties of radiation have been transmogrified into waves, and energy parcels or photons, in a space-time metric.

The arguments for the denial of a physical ethereal medium are manifold (see, for example, Whittaker³). One of these asserts that Maxwell's equations show that electromagnetic waves are transverse and that, therefore, any ethereal medium must behave like an elastic solid. This argument is invalid, since Maxwell's equations only show that the oscillating electric and magnetic fields are transverse to the direction of wave propagation, and can say nothing whatsoever about any condensational oscillations of any possible physical medium in which the waves are propagating. In fact, the deduction, from Maxwell's equations, that electromagnetic waves are entirely transverse, is no more than a restatement of an assumption that there is no

physical ethereal medium. On the contrary, if there is such a medium, one would deduce from Maxwell's equations, since electric field, magnetic field and motion are mutually perpendicular for plane waves, that its condensational oscillations are longitudinal, in exact analogy with sound waves in a fluid.

Another argument against the existence of a physical ethereal medium is that Planck's empirical formula, for the energy distribution in a black-body radiation field, cannot be derived from the kinetic theory of a gas with Maxwellian statistics. Indeed, it is well-known that kinetic theory and Maxwellian statistics lead to an energy distribution which is a sum of Wien-type distributions, for a gas mixture with any number of different kinds of atoms or molecules. But this only establishes the impossibility of so deriving Planck's distribution for a gas with a finite variety of atoms or molecules. To assert the complete impossibility of so deriving Planck's distribution it is essential to eliminate the case of a gas with an infinite variety of atoms or molecules, i.e. infinite in a mathematical sense, but physically, in practice, a very large variety. The burden of the present paper is to show that this possibility cannot be eliminated, but rather that it permits a far simpler derivation of Planck's energy distribution than has been given anywhere heretofore."

He undoubtedly achieves what he sets out to do in this paper and so removes one of the main objections to the existence of an aether. In the second, he attempts – seemingly successfully – to resolve the second problem he cites concerning the existence of an aether. In the introduction to that article, he outlines succinctly the argument to be employed in what follows:-

"It has been shown¹ that Planck's energy distribution for black-body radiation can be derived for an ethereal medium which behaves as an ideal gas with Maxwellian statistics. Electromagnetic waves may propagate in such an ether, and the oscillating electric and magnetic fields in such waves are observed to be transverse to the direction of wave propagation. On the other hand, electric field, magnetic field and motion are generally observed to be mutually perpendicular and coexistent, and this suggests that such waves must also comprise longitudinal oscillations in pressure and density. Thus, such waves would not merely have the duality of being electromagnetic, but rather the triality of being electromagnetic-condensational waves, and their condensational aspect would be analogous to that of sound waves in a material gas.

To justify such a concept of the ether, it is, therefore, necessary to establish such a triality of electromagnetic-condensational waves, by showing that all three aspects of the waves propagate together contemporaneously along precisely the same wave-fronts. In general, for three space-variables and time, the wave fronts are given by the characteristic hypersurfaces of the partial differential equations which govern the electric and magnetic field strengths and the motion of such an ether. All such hypersurfaces which pass through a given point in space-time have an envelope, the characteristic hyperconoid through the point.

It is the purpose here to derive the characteristic hyperconoid both for the equations of electricity and magnetism in a gas-like ether, and for the general equations governing the unsteady motion of a gas in three space-variables, and thus to show that they are, in fact, identical. Such a concept of the ether entails no transformation difficulties. For the equations of electricity and magnetism in a gas-like ether, the general equations of unsteady motion of a gas, and their common characteristic hyperconoid, are all invariant under Galilean transformation. Moreover, with such a concept of the ether, there is no dichotomy between the observed wave and particle properties of radiation, for these are essentially no different from the wave and particle properties of sound in a material gas.”

There can be no doubt that Thornhill achieves his aim in this second paper too. However, has he succeeded in proving the existence of an aether? Many would argue in the negative but, again, to many the argument is still open or resolved in favour of an aether. The purpose of this note is to link Thornhill’s neglected work with the recent renovation of the quaternion form of Maxwell’s electromagnetic equations as, in this approach, not only are there electric and magnetic fields present but also a scalar field which, by its very nature, can accommodate the required longitudinal oscillations to which Thornhill refers.

A review of more recent relevant work.

The above resume of Thornhill’s work would seem to indicate that he had advanced a possible solution to the age-old question concerning the existence of an aether. However, one question does seem to remain and that concerns the fact that the accepted form of Maxwell’s electromagnetic equations do not show any presence of the longitudinal wave introduced quite logically into Thornhill’s investigations. Following the work of Jack⁴, though, it is seen that, if the quaternion form of Maxwell’s equations is considered, a new factor is introduced into the theory. In this formulation, the Maxwell electromagnetic equations become

$$\nabla \times \mathbf{B} = \frac{1}{c} \frac{\partial \mathbf{E}}{\partial t} + \nabla T$$

$$\nabla \times \mathbf{E} = -\frac{1}{c} \frac{\partial \mathbf{B}}{\partial t}$$

$$\nabla \cdot \mathbf{E} = +\frac{1}{c} \frac{\partial T}{\partial t}$$

$$\nabla \cdot \mathbf{B} = 0$$

Here all the symbols retain their usual physical meanings but the T , which is the addition as compared with the normally accepted form, represents an extra temporal field and, as indicated, is a scalar field. However, it is apparent immediately that, if this T field is independent of both position and time, the above equations revert to the usual form of the Maxwell equations familiar to all. Nevertheless, in this special case, all that is assumed is that the T field is constant in time and space, not that it does not exist. Hence, these equations indicate the existence of another, albeit scalar, field associated with the model used to derive the well-known and successfully used Maxwell electromagnetic equations. Exactly the same

conclusions follow if the equations are modified to include the terms concerned with the charge density, $4\pi\rho$, and current density, $4\pi\mathbf{j}/c$, in their normal places in the equations.

As has been shown previously⁵, the normal form of the Maxwell equations yields a scalar wave even in the case of zero electric and magnetic fields and this wave possesses a superluminal speed. It seems that, although Thornhill achieved all he appeared to set out to achieve, this work utilising quaternions as a starting point seems to offer support to the conclusions he reached or, in other words, seems to offer support for the idea of the existence of an aether. At this juncture, it might be remembered also that, although Einstein's theory of special relativity did away with the need for an aether, earlier theories did not; that is, you can have relativistic theories which retain the idea of an aether. Also, if one draws on ideas of general relativity for further support for the abolition of an aether, it must be noted that all the reported tests in support of that theory have been explained without recourse to general relativity. Indeed, even as early as 1925, Temple⁶ raised serious qualms about the need for this widely accepted theory.

However, Jack⁴ first linked this new T field, quite sensibly and logically, with heat. He also noted that, in the above equations, the terms involving T could be identified as follows:

$$\nabla \times B_T = \nabla T \quad \text{and} \quad \nabla \cdot E_T = \frac{1}{c} \frac{\partial T}{\partial t}$$

and, if such an identification is inserted into the above equations, they again assume the form normally associated with Maxwell's electromagnetic equations. Hence, just as is the case when T is assumed constant, the influence of the T field is masked within the basic theoretical structure. Jack⁴ then proceeded to consider, with some success, several processes normally thought to be the preserve of traditional irreversible thermodynamics. In this, he followed the lead of Bridgman⁷ who built an acceptable theory to deal with many such processes via classical thermodynamics. Bridgman did this prior to Onsager's elegant treatment for irreversible thermodynamics but an elegant treatment which depended, and depends to this day, on the assumption of microscopic reversibility. As Bridgman pointed out, this assumption does not necessarily apply in all genuine physical cases which might need to be examined. In his treatment, Bridgman introduces a second electro-motive force and refers to the two emf's as a 'driving' emf and a 'working' emf. Jack speculates on whether or not his two emf's correspond to these but, considering his linking up of the T field with heat, one wonders if the second emf Jack introduces should be referred to as a T.M.F. or thermo-motive force such as Bridgman considers later in his book? This would seem to make sense but still leaves the question of what the T field is physically? The above appears at first sight to offer two alternative answers. Firstly, Thornhill links it with the longitudinal oscillations of the aether; that is, with motion. However, Jack links it with heat. A possible reconciliation of these two seemingly separate ideas might be offered by way of the Ettingshausen effect where a current applied along (say) the y -axis and a perpendicular magnetic field along (say) the z -axis result in a temperature gradient along the x -axis. This is due to the Hall effect leading to electrons being forced to move perpendicular to the applied current and this, in turn, leads to an accumulation of electrons on one side of a sample which causes the number of collisions to increase and, hence, heating of the material occurs.

The T field is, as has been seen, a scalar field and can transmit scalar, or longitudinal, waves. This is precisely where this theory of Jack links up with the work of Thornhill. As Thornhill

points out so lucidly, “the duality between the oscillating electric and magnetic fields, which are transverse to the direction of propagation of electromagnetic waves, becomes a triality with the longitudinal oscillations of motion of the ether, if electric field, magnetic field and motion are coexistent and mutually perpendicular.” As stated earlier, it seems Thornhill did succeed in proving exactly what he sort to establish and his end conclusion was in support of the notion of the existence of an aether. It seems that this work of Jack, based on the quaternion form of Maxwell’s electromagnetic equations may be seen to support this conclusion, especially when considered in parallel with other deductions from those quaternion equations⁵.

The Contribution of Whittaker.

All the above links in extremely well with the important, though little known, work of E. T. Whittaker⁸. In this cited paper from 1903 on the partial differential equations of mathematical physics, it is displayed quite clearly in the final section that gravitation and electrostatic attraction may be explained as modes of wave disturbance. It is this final development that links in so successfully with the ideas, due to Thornhill, discussed earlier. It is, incidentally, interesting to note the emergence of the notion of ‘gravity waves’ coming from a totally Newtonian background theory. However, from the present point of view, it must be noted that Whittaker’s theoretical results link up extremely well with Thornhill’s idea that the duality of the electric and magnetic waves becomes a triality when you include the scalar – or longitudinal – waves associated with the motion of the electromagnetic wave-front.

One may wonder why this work of Whittaker – a highly respected mathematician- has seemingly lain neglected by so many for so long but possibly the answer lies in the fact that, towards the end of the cited work, he concentrates on gravitational applications and only mentions electrostatic ones in passing. His advocacy of an undulatory theory of gravity would have required gravity being propagated with a finite velocity but one which need not equal that of light and could be much greater. He did not attempt to offer any cause for gravity but merely to show that in order to account for the propagation across space of forces which vary as the inverse square of distance, it is only necessary to suppose the medium capable of transmitting, with a definite though large velocity, simple periodic undulatory disturbances, similar to those whose propagation by the medium constitutes the transmission of light according to electromagnetic theory. Of course, this all presupposes the existence of a said medium and shortly after the appearance of Whittaker’s work, the physics community embraced Einstein’s special relativity with its lack of an aether or, in other words, lack of any such medium. The question now arises of whether, or not, this move was really justified and also raises the prospect of physics having been hampered ever since by this development.

Implications of aetherial theory

The question remains as to what implications are to be drawn and what insights gained through the addition of an aether to physical theory? Historically, although all remember Einstein’s role in disbanding the notion of an aether within accepted modern physics, few are as sharply aware of his position before his public refusal of an active aetherial medium. In an address delivered on May 5th, 1920, in the University of Leyden and also published again

elsewhere^{11,12} the value Einstein once ascribed to the theoretical addition of an aether is clearly seen - **“Recapitulating, we may say that according to the general theory of relativity space is endowed with physical qualities; in this sense, therefore, there exists an ether. According to the general theory of relativity, space without ether is unthinkable; for in such space there not only would be no propagation of light, but also no possibility of existence for standards of space and time . . .”**

It appears that at one time Einstein himself saw the value of an aether within working physical theory as did Tesla. A different and more fruitful theoretical picture for understanding Tesla’s views, which are now summarized, may be forthcoming in the light of the above mentioned work of Jack.

From **PIONEER RADIO ENGINEER GIVES VIEWS ON POWER**

by Nikola Tesla *New York Herald Tribune*, September 11, 1932

Tesla Says Wireless Waves Are Not Electromagnetic, But Sound In Nature, Holds Space Not Curved

“The so-called Hertz waves are still considered a reality proving that light is electrical in its nature, and also that the ether is capable of transmitting transverse vibrations of frequencies, however low. This view has become untenable since I showed that the universal medium is a gaseous body in which only longitudinal pulses can be propagated, involving alternating compressions and expansions similar to those produced by sound waves in the air. Thus, a wireless transmitter does not emit Hertz waves which are a myth, but sound waves in the ether, behaving in every respect like those in the air, except that, owing to the great elastic force and extremely small density of the medium, their speed is that of light.”

and later

“I hold that space cannot be curved, for the simple reason that it can have no properties. It might as well be said that God has properties. He has not, but only attributes and these are of our own making. Of properties we can only speak when dealing with matter filling the space. To say that in the presence of large bodies space becomes curved, is equivalent to stating that something can act upon nothing. I, for one, refuse to subscribe to such a view.”

It appears that a longitudinal wave might be the source of electromagnetic transverse expressions.

What is the explanation for the divergence of speeds between the electric field propagating at light speed and the electron drift velocity which is very slow by comparison? Tesla appears to imply that the causal source of the transverse electrical effects seen is attributable to the *T* field: as a longitudinal scalar wave set of electrical pressure waves, voltage over time propagating through the aether at light speed constituting the electrical field itself, and then due to gyroscopic effects, the electrons once impacted by those longitudinal scalar waves precess¹³, creating observed transverse effects.

The field then, not the slow moving electron, appears as the causal source, and that field is created from longitudinal perturbations in the aether, a standing quantity, the scalar *T* field. It

is interesting to note that Whittaker showed that the entire electromagnetic field may be derived from two scalar potential functions^{14,9}. As the T field expresses both positive and negative energy associated with negative and positive charge respectively, both positive and negative energies are seen all around, expressed in gravitation and electromagnetism alike. Resorting to conceptualizations such a curved space time may then be avoided and instead, thought might be directed along the lines of aetherial densities.

Positive and negative energies are aetherial densities.

Questions that have long remained unanswered could finally become accessible such as those of clean energy production and gravitational theory. Long ago Maxwell saw the untapped energetic potential of aetherial densities in relation to gravitation. “. . . every part of this medium possesses, when undisturbed, an enormous intrinsic energy . . .” (ref 15, p. 39) Our previous work¹⁶ has made plain the relationships between gravity and the T field of Jack in the context of current engineering as exemplified in government designs that are admittedly based on the presence of an aether^{5,17,18}. It may be deduced that many of the basic definitions of physical processes become available. As time is reversed in T field negative energy expressions a graviton is seen to emerge as a series of transient photon - antiphoton pairs. A physical definition of the graviton as being the transient coupling of a photon and antiphoton of positive and negative energy respectively is, therefore, proposed. Dependent upon any particular systemic energy component balance and interactive expression, the rate and direction of time may vary. This then, constitutes our basic definition of the cause of the rate and passage of time: the transient coupling and dissociation of the system expressed gravitons. Similar, although not identical, ideas have been expressed elsewhere^{17,18}.

It appears that a great deal of negative energy is functioning alongside positive energy as the mediators of gravitational expressions *and time* within physical systems, just as the name Temporal Field implies.

Recalling that positive charge and the proton are associated with negative energy and gravitational expressions, note how a magnet, composed of charge balanced matter exhibits less strength of repulsion between like poles, than it does attraction between opposite poles. It may be hypothesized that the mass difference between charge balanced electrons and protons leaves a residual of attractive (negative) energy due to the proton's larger mass and hence energy which are greater than the electron's. So, as gravitons emerge along with mass across T field expressions, the negative energy residual leaves less energy between massive bodies, creating the attraction of gravitation. The neutron is charge balanced with an electron bound within the proton⁵, but there is a neutrino needed, 0.782 MeV more positive energy and one-half spin are needed, the neutrino's positive energetic addition balancing energy, cancelling the negative energy gravitational residual in the neutron leaving a truly neutral particle energetically, once positive and negative energies are both taken into account.

In fact, the neutron itself may be best and most rightly understood through the model of Hadronic Mechanics¹⁹, an aether model which verifies its premises through experiments that make plain the inner construction and genesis of the neutron apart from the anomalies of accepted theoretical dogma. (ref. 5 and references therein) These theoretical alterations make available several proposed advances in physical theory stemming from the T field and its

⁹ see: Hadronic Journal , C. K. Whitney, Generalized functions in relativistic potential theory. vol 10, 1987, p. 289-290. and; T. Bearden, Gravitobiology, 1991, Cheniere press. p. 76.
4 such potentials are sometimes needed to replace classical EM with scalar interferometry in consideration of torquing in multi-bodied systems.

negative and positive scalar energies:

1. As negative T field energy is associated with positive charge, and positive T field energy with negative charge, the emergence of a graviton providing close atomic-range binding and orbital electron shell curvature across atomic structure between the electrons and corresponding protons is implied.
2. All binding energies in quantum chemistry are negative, implying negative energetic contributions bind molecular structures.
3. The electron hole within solid state physics is often characterized as a negative-mass valence band electron gone missing, implying that the top of the valence band functions as a negative energetic polarization yielding negative effective-masses²⁰.
4. As a possible causal source for observed transverse electrical wave effects and explanation for the divergence between electron drift velocities and field velocities.
5. As a heretofore unrecognized adherent, negative energetic contributor of positive charge accounting for like charge attraction, such as that demonstrated in clouds and bodily tissues.
6. Gravitational mechanics based in positive and negative energy theory.
7. Temporal mechanics based in positive and negative energy theory.

Within modern physics the idea of energy, although worked with in great precision and detail, has never actually itself been defined. To quote Feynman: "It is important to realize that in physics today, we have no knowledge of what energy *is*." [Six easy pieces, R. Feynman, p.71]

Energy itself may now be defined as differences in positive and negative energetic densities within an aetherial medium that allow work to be carried out.

Think of positive and negative temporal energies as aetherial densities that exist along a bivalent temporal scale with an atemporal equilibrium point between those opposing energetic expressions. As each energy type exerts its effects and is expended upon the system in the production of work, some additional portion of inefficiency and corresponding entropy is typically incurred leading in the case of both energy types to an overall systemic dynamism toward atemporal equilibrium. It is concluded that:

"Energy itself may now be defined as differences in positive and negative energetic densities within an aetherial medium allowing work to be carried out within a general propensity toward systemic equilibrium."

The causal thermodynamic basis?

Tesla states (Martin, 1995 p. 149)²¹:

"But of all the views on Nature, the one which assumes one matter and one force, and a perfect uniformity throughout, is the most scientific and the most likely to be true."

Jack states that the T field is invariably associated with a quantity of heat. We note in working government applications of the two T field energies that cooling is always associated with negative energy just as heating is always associated with positive energy^{5,17,18}. We note again that the T field appears in all systemic interactions, although it is only observable when time or motion is present. It is proposed that, just as one may infer from the work of Whittaker which demonstrates the electromagnetic field itself may be created entirely through the interference of scalar potential functions¹⁴, the T field is the causal field yielding the rest of physical and dynamic expression as an effect. It is proposed also that the T field itself is but

heat within aether yielding the capacitance, the electrical potential needed to create the remainder of physical expression and observable temporal dynamics. Here is an electrical system based in thermodynamics. Note that vacuum is potentially a dielectric insulator²², and that vacuum is in fact aether. Due to its uniform simplicity it is thought, as Tesla implied, that this is the model most likely to be true. Heat creates the magnetic field and electric fields within an aether. This proposition explains the anomalous thermomagnetic Seebeck effect where a magnetic field is created through heat²³. As is known, such a magnetic field can easily be the source of electrical field effects just to add motion to conductors. The thermomotive force mentioned above contributes this motion and it may be seen that a single force emerges as causal, a thermoelectric motive force gained through capacitance fostered by heat within aether. This is a thermodynamic, and so, an electrical, motive, temporal system. The work of Jack and analysis of government work and weaponry seems to indicate that time itself is exactly that: *heat*.

It may be concluded that all universal effects inclusive of gravity⁵ are themselves electrical and magnetic effects, and, electrical and magnetic effects are a function of the interference between scalar potential functions as Whittaker has proved—and so, are all based in scalar T field heat. The background temperature of space within the aetherial medium sets the stage for time and the electrical and magnetic expressions that are physics and reality. Thermodynamics is the primary electrical and magnetic basis of time and physics.

Further Thoughts.

All the above points strongly towards the reintroduction of the idea of an aether into the subject of physics. Thornhill certainly seems to have shown that the objections to such an existence as outlined so eloquently by Whittaker³ are not well founded. Also, Whittaker's own earlier work⁸ would also appear to support this assertion. On top of this, the recent work by Jack⁴ in causing the quaternion form of Maxwell's electromagnetic equations to resurface seems to add even more weight to the assertion. This, together with the revelations publicised recently⁵ concerning work covered in CIA documents recently made available again suggests a reworking of some long-held beliefs about the basis of much of physical theory.

If Thornhill is to be believed, an aether particle would weigh approximately 0.497×10^{-39} kg. It might be speculated that this would then be the basic constituent of all matter with the electron mass being roughly 2×10^9 times that of a unit aether particle. In one article¹, Thornhill proceeds to speculate on other important consequences, among which he notes that, if there is such a medium, the Universe must consist of an expanding flow of aether in which matter is suspended. In this case he notes that, if there are no aetherial shock waves, what are called 'world lines in unsteady fluid dynamics, but are really 'Universe lines' here, will be isentropic and, if further, the entire aetherial flow of the Universe is homentropic, one of the constants he introduces into his calculations, $c_0 h_0$, will be a universal constant. Here c_0 is the wave-speed obtaining in our galactic neighbourhood, at the present epoch, in the background radiation field and h_0 , or Planck's constant, is the present value in our galactic neighbourhood of a quantity which may vary with both time and position in the Universe.

All this indicates an urgent need to review much of the basis for modern physics as presently accepted and this is surely supported by the recent review⁹ of the present position concerning

the real position of the view expressed in the famous paper by Einstein, Podolsky and Rosen¹⁰ as long ago as 1935.

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