Resonance Theory: The unification of relativity and quantum physics through the electromagnetic and mass properties of empty space

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Electromagnetic radiation is shown to consist of an interconversion over time between electromagnetic fields and a mass field, according to the law of conservation of mass-energy. The required inverse geometry modes of this mass wave allow universal energy state equations for velocity, momentum, and energy which are valid for all velocities from 0 through c. Special and General Relativity describe special cases of these equations, which also show quantum characteristics in terms of wave nodes. The energy state equations are shown to derive from the physical properties of empty space. The properties of charge, time, rest mass, and spin are predicted by this physical interpretation, and its wave geometry provides a functional description of symmetry relations and the relation between gravitational, electric and magnetic forces. Electromagnetic radiation is a resonant activation of empty space, and the properties of physical events are determined by the physical properties of empty space. An absolute frame of reference is proposed.

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Introduction. A history of apparent experimental contradictions has tended to isolate the theory of sub-wavelength parameter measurements from the theory of relativistic velocity parameter measurements, simultaneously isolating mathematics for the gravitational force from that of the electromagnetic, weak and strong nuclear forces. The Special

Theory of Relativity uses c as a numerical reference frame and physical limit; Planck's constant h serves the same functions within quantum mechanics.[1] Electromagnetic radiation, with velocity c and energy hν, contains a physical structure which connects these ranges. The assumptions that c is a velocity and h an energy package in Joule-seconds (per cycle)[2] are demonstrable but perhaps insufficient: c is nonrelative, and h cannot yet be made to fit into a specific physical model.[3] In fact the velocity term in the Maxwell field equations has its origin as the velocity of the moving charge, and we may say that while frequency is measured along the path of propagation, energy must be measured transversely in accordance with the direction of the energy vectors. This suggests that c and h may exist at right angles to each other, and that a theory must be found which can accommodate the relative physical properties of these constants.

The mass wave. While all successful statistical descriptions of electromagnetic radiation must be capable of generating the Maxwell field equations, these field equations must be used from a carefully chosen frame of reference. The two most obvious frames are the plane of transverse energy vectors (which does not include time) and the three-dimensional space in which this plane appears to move along the path of propagation over time. Both frames are subject to the law of conservation of mass-energy, while the time-derivative conservation of momentum laws will apply only to relations along the propagation path.

According to Maxwell's equations, electromagnetic radiation (e-m) consists of self-inducing electric and magnetic fields (E and B). These fields may be described over time or propagation distance as being in phase, transversely oscillating, and geometrically related in the x,y plane at a particular right angle determined in reference to z, the propagation path. Here z may be taken as either distance or time, as the velocity of e-m radiation is non-relative.[4] If these waves are taken in a classical three-dimensional frame as sine functions

$$(E,B)= (a,b)\sin_{yz,xz}(\Theta) \tag{1}$$

such that the direction of propagation along the z-axis is geven by $\vec{E}\times\vec{B}$, and if

E_T= total energy= E_E+E_B, then $E_T= f(\sin(\Theta))$

and may be described as a function of d or t. In this frame, conservation of mass-energy requires that $E_T= k_1$ (a given constant) for the closed system of the self-propagating wave, however, and to avoid violation the function E_m may be described such that mass-energy is conserved:

$$E_T=E_E+E_B+E_m=k_1, \quad E_m=E_T-(E_E+E_B)= E_T- (a \sin(\Theta) + b \sin(\Theta)). \tag{2}$$

The total E_m along the z-axis is given according to the photoelectric effect, the Compton experiments and Special Relativity:[5]

$$\text{for } E_E+E_B= E_e, \quad m=E_m, \quad E_e= h\nu \quad \text{and } E_m= E_e/c^2= h\nu/c^2. \tag{3}$$

This mass wave is the arithmetic complement of the E and B waves at any given point on the z-axis, such that $E_T=k_1$ for all values of E_e and E_m in the x,y plane, and that $k_1= h\nu$ for all such values considered cumulatively along the z-axis (the axis of the photon).

The time differential of the mass wave is $dE_m/dt=-dE_e/dt$, showing it to be a continuous sine-like function for all values of θ except 0° and 180°. The mass wave is discontinuous along the z-axis at each of these maximum mass values, at which points it changes sign. These two half-waves bracketed by 0-values of the E_e function will be called the inversion modes of the mass wave. They are quantitatively equal and geometrically opposed relative to the z-axis.

In the x,y plane, mass-energy conservation predicts a symmetry in reference to the $\vec{E}$ and $\vec{B}$ vectors with which it interconverts. If we further define E as electric field intensity and define H as magnetic field intensity, the above symmetry is given by $E_E=E_H$, which is here taken as y=x. Considered over time, conservation of momentum indicates there should also be a symmetry around the z-axis, however, which forms the locus of the center of mass for serial x,y planes. As $dE_m/dt\neq0$ at any point along the z-axis, the conservation of momentum in this axis requires that the vector E_m not only have its center of mass along the axis, but that it be bidirectional within its plane of x,y symmetry. (This vector can also be written as two equal-magnitude, oppositely-directed mass vectors in the x,y plane joined at the z-axis (origin), and representing a single wave over time.)

The following vector direction components therefore must pertain to the mass wave symmetry in the x,y plane:

$$\text{for } \sin_z(\theta)_{(0^\circ \text{ to } 180^\circ)},\quad E_{m(x,y)}:\ y=-x,\ = 135^\circ \text{ and } 315^\circ$$

$$\text{for } \sin_z(\theta)_{(180^\circ \text{ to } 360^\circ)},\quad E_{m(x,y)}:\ y=x,\ = 45^\circ \text{ and } 225^\circ \quad . \qquad (4)$$

The above symmetry requirements are satisfied for either pairing of the mass wave angle with the $\sin_z(\theta)$ angular domains, and no specific pairing shall be assumed. The mass wave planes are described by $y=\pm x$, where this sign is determined by the sign of the $(\vec{E}+\vec{B})$ vector. It should be noted that this dual symmetry with respect to both $(\vec{E}+\vec{B})$ and the z-axis requires that opposite inversion modes exist with opposite geometries relative to the $(\vec{E}+\vec{B})$ vector.

In addition to satisfying the conservation of mass-energy and momentum, the mass wave provides a necessary cause for the mass properties of e-m radiation. In Einstein's words, "Mass is energy, and energy has mass."[6] E_m and E_e are equivalent but not identical: only E_m displays the properties of inertia and momentum, and so must be considered to be distinct from E_e. This distinction is also present in the propagation of e-m radiation at 90° to the direction vector component of an accelerated charge, during which momentum can only be conserved if radiation mass is produced through E_e/E_m interconversion. This interconversion therefore is required in either of the above reference frames.

The mass wave is numerically consistent with the deBroglie equation for matter waves, which is itself a special case of the Schrödinger wave equation. In this sense, it fits all quantum theoretical statistics treatments. The particle-like behavior of e-m radiation in collision experiments is a function of the momentum carried by the mass wave (only observed for the z-axis reference frame), and its quantization would be predicted by momentum nodes at the mass wave nodes.[7] The mathematics of particles applies to wavelengths of E_m because E_m displays momentum and kinetic energy in discrete amounts, whereas the mathematics of waves applies to both E_e and E_m. There appear to be no real particles in e-m radiation, as all particle-like behavior can be described by the mass wave when observed along the z-axis.

The General Theory of Relativity predicts that there will be a curvature of spacetime along the path of e-m propagation which is a function of the E_m.[8] As mass is recognized solely by its properties, and as particles are not necessary to this model, it is also unnecessary to consider E_m to be anything other than curved spacetime. The General Relativity problem of describing gravitational energy and particulate mass with a single set of continuous functions (without singularities) was based on the assumption of a mass surface boundary of some similar vehicle for concentrating E_m at a spacial locus.[9,10] There is no evidence, however, that 'surface' is a mass property, and mass field equations are thereby expected to be continuous from gravitational distances through the domain of the mass wave. The related difficulty of describing the concentration of E_m reduces to a function of E_e/E_m interconversion wavelengths, which are themselves determined for given events by the permittivity and permeability of empty space and the total energy E_T, as thus far applied to e-m radiation.

This mass-energy interconversion now provides the opportunity for a clearer definition of the energy forms E_e and E_m: E_m is the energy of curved space, and E_e is the energy which curves it. Here Faraday's capacitance acquires the physical property of the elasticity of empty space.

Numerous experiments showing the particle and wave properties of e-m radiation[11] are theoretically explained by the three-wave ensemble outlined above. Additional e-m properties predicted by this theory include strong mass characteristics at the E,B wave nodes along the z-axis, and a plane polarization of the mass wave at 45° to the (yz,xz) planes of the E and B waves. These predictions should be verifiable by the use of any detection equipment which is differentially sensitive to E_e and E_m. As explained in the following section, this theory further predicts such differential detection to occur in the behavior of time-stable rest mass (such as an electron) with $v>0$, with E_e and E_m entrained at the appropriate deBroglie wavelength.[2,12]

Polarization experiments[13] indicate the passage of e-m radiation through a serial arrangement of three polaroids placed at increasing 45° angle increments relative to each other, a behavior which formed the basis of the lattice structures and quantum logic proof developed by von Neumann and Birkhoff.[14] Described in quantum mechanics through the resulting 'superposition theorem,' this phenomenon is directly predicted by the existence of the mass wave inversion modes at the appropriate 45° angles, and the above quantum mechanical theories and techniques mathematically represent the behavior of the four planes of polarization occupied by the E_e and E_m waves throughout one wavelength. In this way von Neumann's four-singlet subset of the identity doublet can be described in classical logic as two two-singlet subsets of E_e and E_m.

<u>Matter, antimatter and charge</u>. The inversion mode characteristic of the e-m mass wave predicts the capacity of the mass property to exist in two quantitatively equal left- and right-handed mirror image forms relative to the z-axis; it further predicts that these modes have opposing geometries relative to the $(\vec{E}+\vec{B})$ vector axis. These are exactly the properties of matter and antimatter, and the geometry of the inversion modes provides a classical model for the mathematics of quantum electrodynamics. Opposite inversion modes are predicted on a geometrical basis to show opposite behaviors in relation to E and B fields, which is an exact description of the property of charge. These modes will now be referred to as charge inversion modes (c.i.m.), and charge may be completely defined as one of the inversion modes available to the mass wave in otherwise-empty space. The concept of e-m photons serving as their own antiparticles is physically explained by the presence of both c.i.m.'s in each wavelength of radiation. In this sense matter-antimatter annihilation and pair production are simple, real events involving the coupling and uncoupling of opposite charge inversion modes.

The relationship between matter, antimatter and e-m radiation also provides a definition of the difference between mass waves with and without rest mass. A mass wave having the property of rest mass is a mass wave occupying only a single c.i.m. The success of the deBroglie matter wave equation in describing the properties of e-m radiation indicates that the Schrödinger waveform must equally well describe the single inversion modes of rest mass, as individual modes contain no discontinuities along the z-axis. The Fermi-Dirac statistical interpretation of the Principle of Indeterminacy may again be considered as it once was: that the Uncertainty relations describe (incompatible) variables which are linked through wave energy interconversion, and that this mathematics therefore describes the effects of measurement upon what Schrödinger termed "a real wave in real space."[15,16] Both e-m radiation and rest mass are real waves in space: they are determinate functions of the deformation of spacial geometry. Pair production and matter-antimatter annihilation can no longer be considered in terms of the conversion of energy to mass and vice versa, but appear to represent different system geometries produced by the dissociation and coupling of charge inversion modes, each of which contains fixed proportions of E_e and E_m. As the total E_m along the z-axis of the e-m mass wave is equal to the annihilated rest mass, it must also be true that rest mass contains E_e equal to that of the e-m radiation it produces through annihilation.

Rest mass is a standing wave in space composed of an equilibrium between E_e and E_m and having the geometrical form of the Schrödinger equation.

A comparison of the classical properties of rest mass with those of e-m radiation mathematically verifies the c.i.m. concept. In the coupling of matter with antimatter to produce e-m radiation, E_m is conserved, the resultant radiation energy $Nh\gamma$ containing $Nh\gamma/c^2$ mass (E_m). This is in contrast to the concept that mass is converted to energy via mass-energy conservation and the Special Theory of Relativity; such a 'nuclear' reaction is well described by the addition of inversion modes. This treatment thereby provides a physical cause equating kinetic energy (KE) of 'photons' and the nuclear energy (NE) of rest mass, an equivalence related to (and perhaps as crucial as) that which Einstein detected between inertial and gravitational mass. The properties of charge and spin are also conserved in such a reaction, although charge conservation can now be expressed as a property of mass conservation through use of the c.i.m.'s.

According to the Feynman world line interpretation of matter and antimatter, opposite c.i.m.'s with equal E_m display opposite time behavior.[17] The coupling of two opposing c.i.m.'s produces the only event in physics which has a non-relative velocity, i.e., e-m radiation 'travelling at the speed of light.' The c.i.m. interpretation of this phenomenon is simple: the addition of the time-behavior (time-direction) properties of opposite c.i.m.'s produces an event with 0-net time-direction. Electromagnetic radiation must, in any reference frame, be considered to be devoid of time-direction, which appears to be the crux of the Lorentz transformations. Rather, it must be said that c represents a fixed proportion of the parameters distance and time-magnitude, and a more universal definition of velocity seems necessary.

Continuous functions for velocity, momentum and energy. In the quest to unify relativity theory with quantum mechanics, much attention has been focused upon the question of continuous versus discrete properties in nature.[18,13] Additionally, there has been the difficulty of having different equations for different velocity and size domains. Clearly one would wish to obtain equations which are continuous (of the same form, and without singularities) throughout the range of all sizes and velocities, and this can be done if all functions are written solely in terms of energy and the inversion modes which this energy occupies. Beginning with the discontinuous functions for kinetic energy:

$KE=mv^2/2$ (Newton) for $v<c$;

$KE=mc^2-m_0c^2$ (Einstein) for discontinuous v and c, m and m_0; and which reduces to $KE=mc^2$ for v=c. The discontinuities represented here reflect the difference in energy states (E_e/E_m configurations) between coupled and uncoupled inversion modes, and may be written as a continuous function:

$$KE=E_m v_{cl}^2 I/2=E_e \quad \text{for I= number of c.i.m.'s occupied by the } E_m,\ v_{cl}=\text{ classical velocity, including c.} \tag{5}$$

Similarly, velocity may be written:

$$v_{cl}=(2E_e/E_mI)^{\frac{1}{2}} \quad (6), \text{ and momentum: } p=mv_{cl}=E_m(2E_e/E_mI)^{\frac{1}{2}} \tag{7}$$

These equations are inherently relativistic (through their E_m terms) but unfortunately continue to use the relativistic definition of velocity. Since it is clear that $E_e\neq0$ for $v_{cl}=0$ (the case of nuclear energy), we can now eliminate two relativistic concepts at once (KE and v_{cl}) by the following equation:

$$v^*=v_{total}=v_{cl}+v_w, \quad \text{for } v_w=\text{ wave velocity of the mass wave}$$

with the result that these energy state equations are no longer limited by the rather artificial and unique importance[19] attached to $v_{cl}=0$ in classical and even relativistic functions. (The equation for v* may also be written in vector form; a separate paper will investigate its applications to several physical events.) These energy state equations may now be written

$$v^*=(2E_e/E_mI)^{\frac{1}{2}}_{cl}+(2E_e/E_mI)^{\frac{1}{2}}_{w}=(2E_e/E_mI)^{\frac{1}{2}*} \tag{8}$$

and, similarly,

$$p^*=(E_m(2E_e/E_mI)^{\frac{1}{2}})^* \quad (9) \quad \text{and} \quad E_e^*=E_m v^{*2} I/2 \quad (10)$$

$$(\text{for } p^*=p_{cl}+p_w=p_{tot},\ E_e^*=E_{e_{cl}}+E_{e_w}=E_{e_{tot}})$$

These equations describe all of the energy states of the inversion modes. The kinetic energy and nuclear energy equations are seen to be special cases of the E_e^* equation. The discrete properties of quantum mechanics are represented by I; the continuous properties of relativity are extended for v*, and over this domain quantization can only be proven for time-stable (c.i.m.-occupying) events. (Time-unstable events are not expected to be quantized.) The above energy state (E.S.) equations are accurate for all domains of size and velocity (except, perhaps, the superluminal).

Velocity may now be considered an energy state, so that v=dx/dt has meaning only insofar as x and t represent the geometrical properties of the inversion modes. The Lorentz transformations, effective only locally in General Relativity, describe the difference in energy states of two events. Not surprisingly, the above E.S. equations return classical terms to the General Relativity assumption that all events can be described using a common function (here given as E_e/E_m). It should be noted that General Relativity, however, treats only the effect of E_m upon spacetime curvature; the energy state equations include both energy forms. The energy state equations are thereby expected to yield unified equations for the electric, magnetic and gravitational forces, through the differential contributions of E_e and E_m. The geometry of these velocity vector components should also provide a functional cause for the division of d by t in v_{cl}, and for the opposite signs of space and time metrics in Hamiltonian and Minkowski functions.[20]

Symmetry: c, spin and time-stability. It is clear from the above relations that c is the 'velocity' of coupled charge inversion modes, which explains why a single inversion mode cannot be 'pushed' (accelerated) to this 'velocity'; the Lorentz transformations describe the energy distributions available to single c.i.m.'s. The Maxwell equations and the E.S. velocity equation relate the properties of empty space to all of the E.S. parameters:

$c = (k/k')^{\frac{1}{2}} = (\Gamma_e/\Gamma_m)^{\frac{1}{2}}$ for k, k' = the electric and magnetic force constants of space, respectively. (11)

This same equation can be written in terms of permittivity and permeability.

If stable rest mass is defined as that which does not decay over time, it is immediately clear that no such standing mass waves are neutral in charge, as each must occupy a single c.i.m. This should provide a basic criterion by which to recognize elementary particles: they occupy a single c.i.m. Neutral events must be neutral wave aggregates of these standing mass waves if they are stable over time (i.e., neutrons) or spacial deformations not occupying a c.i.m. if they are unstable over time (i.e., mesons). An examination of the symmetry characteristics of the inversion modes should therefore yield a physical definition of spin in terms of real wave parameters.

A given charge inversion mode has the following properties: it is a real standing mass wave of the Schrödinger form in real space; it has quantum time-direction denoted solely by its charge sign; it has a quantum spin amount of ½. Spin occurs in quantum amounts as + or - (up or down, etc.), which is experimentally indicated by these two properties: that opposite-spin c.i.m.'s may occupy the same energy state (the Pauli Exclusion Principle), and that they will display opposite behaviors in a (high-gradient) magnetic field. If the axis of the c.i.m. is chosen to be congruent with the z-axis of propagation acquired when it is coupled and observed in a three-dimensional ($v_{c1} < c$) frame of reference, the standing mass wave may first be seen to represent a given spacial deformation at a given time. According to classical theory, this standing mass wave is the product of the interference of two transverse waves moving along the z-axis with + and - v_w, where v_w is the wave velocity determined by the properties of the medium. At the moment of the above configuration, one and only one second wave configuration of equal energy can be spacially fitted opposite to the first along a common z-axis; the energy of the assemblage will be twice that of the individual standing waves. For all points along the shared z-axis, the transverse spacial deformation $E_{m_1} = -E_{m_2}$ describes the position of these opposing waves. They are symmetrical through the z-axis, and their behavior relative to a magnetic field can be described on the basis of the Biot-Savart law and $v_{w_1} = -v_{w_2}$. This appears to explain why two 'particles' can only occupy the same energy state when they have opposite 'spin.'

Conversely, the single-spin configuration above, examined half a period later, will be its spacial opposite such that $E_{m_{t=0}} = -E_{m_{t=T/2}}$; for the two component waves of this configuration, again $v_{w_{t=0}} = -v_{w_{t=T/2}}$. This appears to explain not only spin contribution to particle behavior in a magnetic field, but the quantum distribution of spin vector states for both single and grouped events. In fact, the phase angle between the two opposite-moving component waves has a period equal to ½ the period of both the standing and individual component waves, a well-described characteristic of the property of spin. This interpretation appears to fit the descriptions of opposite spins in phase space.[21,22] It also is inherent to the nature of these opposing component wave velocities that a 1/1 distribution of spin states will occur over time for any individual time-stable event, or at a given moment for any population of events, unless otherwise spacially restricted by magnetic or physical disturbances. And finally, it provides physical cause in a classical context for the quantum incompatibility of the x and y components of particle spin (which are mutually exclusive for such plane-polarized waves), and for the existence of only up and down states in non-polarized event groups.

Spin therefore shows mirror-image symmetry through the z-axis; c.i.m. symmetry, as earlier stated, must be expressed in the context of coupled c.i.m.'s, or (for single c.i.m.'s) in terms of the time-direction vector component along the z-axis. The c.i.m. asymmetry with respect to the E_e fields provides a physical interpretation of the asymmetric causes behind parity, CP and CPT violations. The three-wave ensembles (E, B and E_m) of opposite c.i.m.'s are asymmetric relative to each other, leading to a number of asymmetries between these waves and, on a larger scale, between opposing inversion mode wave ensembles. This inherent asymmetry between opposite ensembles recalls Wolfgang Pauli's comment upon confirmation of parity violation:" I am shocked not so much by the fact that the Lord prefers the left hand as by the fact that He still appears to be left-right symmetric when He expresses Himself strongly."[23]

The proposed geometry of charge inversion modes requires that parity be conserved only in the limited situations involving consideration of single-function geometries outside the context of the larger geometry of the three-wave ensemble. Spin shows parity conservation through the z-axis symmetry, if the E_e fields (and resultant forces) are ignored; charge shows mirror symmetry of the same order, also for both 2- and 3-vector reference frames, but again only if E_e fields are ignored; E_e fields contain this same mirror symmetry, but only when E_m fields are ignored; and time shows it as well, but only when E_e fields are not included. As these fields are interconversion fields, we can therefore only describe the mirror symmetry of isolated field properties; it does not exist at the level of complete ensembles.

The overall asymmetry between the three-wave ensembles of opposite c.i.m.'s provides a physical model not only for the above symmetry relations, but for the Biot-Savart vector cross product term $(Q\vec{v}_{cl}\times\vec{B})$, which also geometrically describes the Feynman world line interpretation of time-direction vs. charge. The 'right-hand rule' of the magnetic force is a function of time-direction asymmetry in the context of inversion mode geometry (specifically, the E_e fields), and a new definition of time is made possible. Time direction is determined by the asymmetry of the inversion mode wave ensembles, such that all ensembles of a given E_e-E_m symmetry will have the same time vector direction component. More specifically, this component is determined by the angle getween the mass wave and the $(\vec{E}+\vec{B})$ vector, which can take the value of 0° or 90° in the x,y plane. The magnitude of the time vector is relativistically determined by the Lorentz transformation, pointing to the necessity for a choice of reference frame. The prior definition of v* now provides that choice, which can be taken independently for v_{cl} or v_w components as well as for v*.

In the frame of $v_{cl}<c$ (single-c.i.m. symmetry relations), c is not relative and yet 'c=2.9979 m/sec' defines the magnitude of the time vector. This may be expressed in geometrical terms as E_e and E_m vectors, or algebraically as a function of k and k', indicating that even for a frame $v_{cl}=c$, e-m radiation will retain the time magnitude vector component while the direction component equals 0. The speed of light is the perfect clock because it is non-relative, and in frame $v_{cl}<c$ it is non-relative because its time magnitude vector component is at right angles to its time direction vector component. Inversion mode ensemble geometry determines the classical

velocity vector direction component, which is congruent to time direction and at right angles to time magnitude. In fact, all of the events discussed in this paper (except the v vectors and d along the z-axis) occur perpendicularly to the time direction vector component; all occur at right angles to the path of propagation or movement. According to the Lorentz transformations, parameters at right angles to the z-axis (E_e, E_m, T-mag.) now appear to increase with increasing v_{cl}; those parameters congruent with the z-axis are inversely diminished (d, all v in this treatment), and this affirms the concept of an absolute reference frame which can be geometrically determined for v_{cl}(apparent)=c. It must now be stated that, in a very real and geometrical sense, $v_{cl}=0$ when v_{cl} (or v*) =c, as the velocity vector for $v_{cl}=c$ is perpendicular to that of $v_{cl}<c$. In vector form, the velocity of rest mass is at right angles to the velocity of light; in energy terms, there is a negligible coupling energy difference between two opposite c.i.m.'s of equal mass-energy at rest and the photons moving at c resulting from annihilation (coupling). This same relation may be algebraically reinforced by writing v in terms of d/t via the Lorentz transformations, which produces

$$v=d/t=(d_*(1-v^2/c^2))/t_* \qquad (12)$$

and which has the same solution; and by evaluating equation (10) for nuclear energy ($v_{cl}=0$).

There is not a violation of conservation law when e-m radiation is emitted at right angles to the direction vector of an accelerated charge, nor is it a coincidence that the speed of light has the same value as the ratio of spacial field constants k/k'. Nothing but the signal moves along the z-axis, and in all dimensions nothing is moving but space itself through an x,y plane interconversion of E_e and E_m in a proportion fixed by c^2 (equation (11)).

The forces. In the frame of reference of $v_{c1}=0$, E_e and E_m occur in the above fixed proportion for all time-stable events, and the proportions of E_E and E_B can likewise be considered to have fixed proportional value for all cases in which $v_w=\pm k_w$ (a given constant; this stipulation is required for the special case of free particles). As in General Relativity, it is assumed that the nature of a force can be described as a geometrical function of space and time, with the present understanding that the time vector components must be considered orthogonal to each other, requiring that space and time be considered separately.

The gravitational force is compounded from the total amount of stable mass = $(E_m(NI))$/c.i.m. (13) and the physical effects of inversion mode geometries upon each other. These geometries are perfectly symmetrical if the E_e vectors are ignored, and consist of two perpendicular bi-directional vectors centrally intersecting in the x,y plane at the z-axis (origin). This single symmetry represents the single (positive) force of gravity. If time-unstable mass is defined as spacial deformation (E_m) not occupying a complete inversion mode, it may be noted that stable mass and its gravity appear to be quantized according to equation (13).

The consideration of the E_e vector in the geometry of the inversion mode three-wave ensembles introduces the aforementioned left- and right-handed asymmetry of these same modes relative to the time direction vector component. This asymmetry describes the physical effect of quantum charges = NI (14) upon each other, which is + or - electric force.

Insofar as the wave velocity vector v_w is congruent with the time direction vector component and the other velocity vectors (for $v_{c1}=0$), any v_{c1} imposed upon the standing mass wave will appear to increase the magnetic force. For $v_{c1}=0$, the magnetic force remains non-relative, showing the same symmetry relations between c.i.m.'s as for the electric force, and thereby provides a physical model for Faraday's Law of self-induction.

The quantization of charge is a direct result of the quantization of symmetry of the charge inversion modes, and it is now possible to propose general rules governing the nature, strength and sign of forces between modes as a function of their geometries. For a given property (E_e, E_m, spin, etc.) shared by two separate events, the sign of the related force between these events can be determined on the basis of the symmetry resulting from the union of these events at their z-axes. If the superposition of the z-axes of these events results in a symmetrical configuration for any property, the force between these events for this property will be attractive. Conversely, if such superposition results in an asymmetrical configuration for a given property, the resulting force can be predicted to be repulsive. This z-axis, as has been mentioned, is the axis of the time-direction vector component; time-direction provides the axis of superposition for the determination of force interactions between physical events.

Charge is a property of mass because time-stable mass is contained in charge inversion modes; E_e and E_m cannot exist separately, except in the sense of the complementary interconversion over time, and there appears to be no event composed of only one of these energy forms. While the forces may be evaluated separately, they cannot exist separately: each force is the measure of a different level of symmetry between the three-wave ensembles of the charge inversion modes.

The relative strength of the forces (and therefore the relative values of the force constants) must reflect the relative contributions of their respective symmetries and wave magnitudes to the overall symmetry characteristics of the wave ensemble. For $v_{c1}=0$, the geometries and relative forces of the electric and magnetic force are equal and perpendicular, as would be expected on the basis of experiment. If we separately consider the symmetry levels of the following ensemble components: (E_m+T-dir.), (E_e+ T-dir.), (E_m+E_e+ T-dir.), these components may be seen to represent two-, three- and four- vector symmetry levels, and the relative strength of these force-symmetry levels should occur according to the same heirarchy. This is obviously the case for the first two ensemble components, as the gravitational force is a function of E_m and the electric and magnetic forces are a function of the E_e vectors. Although a similar analysis of the relative strengths of the weak and strong nuclear forces is not attempted here, it seems quite possible that the symmetry of the weak force occurs on the level of (E_E+T-dir.) or (E_B+T-dir.) (subcomponent symmetries of the (E_e+T-dir.) component), and that the hierarchical position of the strong force is accounted for by the above third ensemble component (E_m+E_e+ T-dir.). This explanation matches the relative force heirarchy determined by experiment, and with the present unification of the weak and electromagnetic forces by other approaches.[24,25] Here the distance dependence of the nuclear forces may be expressed in the c.i.m. ensemble as a function of the d_z vector.

While the above geometrical approach predicts force heirarchies, the absolute numerical comparison of force strengths must, according to this interpretation, be determined by the actual physical interaction of these wave ensembles. As each of these waves is here considered to be real and dynamic over time, it is hoped that the actual force strengths can be described in terms of the wave amplitudes of the above ensemble components. It is already clear that these interactions will be attractive or repulsive depending upon the physical fit of their geometries, which can be literally interpreted as the manner in which real waves in space physically interact.

Using the prior equations (13,14) for amount of mass and charge, the classical equations for gravitational and electric force can now be written in energy state terms:

$$F_G = Gm_1m_2/R^2 = G(E_{m_1}NI)(E_{m_2}NI)/R^2(c.i.m._1)(c.i.m._2) \quad (15)$$

$$F_E = kQ_1Q_2/R^2 = k(NI)^2/R^2 \quad (16)$$

$$F_G/F_E = (E_{m_1}/c.i.m._1)(E_{m_2}/c.i.m._2)(G/k) \quad (17)$$

which allows these forces to be mathematically and functionally related. The (E_m/c.i.m.) factors represent the size of the inversion modes, and the (G/k) factor indicates the relative numerical contributions of the ensemble component symmetries.

This procedure should apply equally well to other quantum numbers, conservation laws and forces.

Discussion. The Resonance model appears to contain geometrical and numerical properties which are consistent with both relativity and quantum experiments, and which can be reduced to the permittivity and permeability values of empty space. The E.S. equations reduce to Newtonian, Relativity and quantum equations, but serve the additional function of describing a physical mechanism and thereby expressing a function which is common to all physical events.

The geometries of the wave ensembles thus far described show symmetry and asymmetry characteristics which are inherent to the properties of time, charge, spin, mass, velocity, momentum, energy, and the electric, magnetic and gravitational forces. The nature of the time vector is different from that of the space vectors, which explains its mathematical treatment in velocity equations. The orthogonal nature of the time vector is not apparent in isolated E_m functions (such as General Relativity) except as an opposite metric sign, because the time vectors of all c.i.m.'s share the same symmetry as the E_m vectors. The magnitude of the time vector (the rate of time) is given in E.S. terms through the velocity equation, and its constant value for v=c predicts T-mag.=c=$(E_e/E_m)^{1/2}$ (18). For a closed system, time rate is the result of the proportion of energy to mass.

The velocity of light is non-relative because its vector is perpendicular to the velocity vector of rest mass; and c cannot be achieved by rest mass for the additional reason that only light is composed of coupled charge inversion modes.

The four dimensions of Minkowski spacetime can be represented in a reference frame with only three dimensions in real space, and this geometry predicts the basic patterns of physical laws. The combination of the E.S. equations and this geometrical frame appear to provide a basis for the unified mathematical expression of physical events. The General Theory or Relativity, in particular, appears to be conceptually and mathematically compatible with this model, if appropriate distinctions are recognized for the time vector.

While the further elucidation of the geometry of the wave ensemble is hoped to include the strong and weak nuclear forces in more detail, the next stage of this work appears to be the development of a mathematical system which incorporates geometrical and numerical aspects of the above reference frame. It presently appears that this mathematics will make use of complex numbers and three-dimensional symmetry, and may well, on the basis of Resonance vector geometries, benefit from the Twistor mathematics developed by Penrose.[26] The greatest challenge in such an effort appears to be the transformation from non-relative ('absolute') generalized coordinates in a complex number system to those of a relative, real number system. In this pursuit, the charge inversion mode concept and the fixed proportion of E_e and E_m for time-stable events should provide such transformations.

Both e-m radiation and rest mass can be described as the resonant activation of space according to its fixed permittivity and permeability properties, which recalls the historical use of the Fitzgerald-Lorentz transformations as a mathematical description of ether effects upon the Michelson apparatus for measuring the speed of light in ether. Empty space may be empty of particle events, but it is most certainly not a void, any more than light itself is a void. Empty space may be devoid of energy, but even in this case contains the potential of inherent geometry and physical properties which during activation can be accurately described for all values of velocity and size.

The vital question of 'locality,' long a matter of concern to Einstein, Bohm and others,[27] may perhaps now be expressed in terms of a real, three-dimensional space. Whether this space is continuous when not activated remains an open question, although the directional behavior and velocity of light certainly indicates that it has the potential for being so. More practically, there now seems no manner by which to define a closed system for the purpose of state preparation, as any spacial perturbation at any location must be considered to affect the spacial geometry within any closed system at a second location. The prior explanation for the mechanism of 'action-at-a-distance' requires neither real nor virtual particles, and this model should apply equally well in its geometrical aspects to physical interactions and events which are not time-stable. This may eventually be seen as a real mechanism for the apparent non-locality expressed in Bell's inequality,[28] the Einstein-Podolsky-Rosen gedanken experiment,[29] and Bohm's Implicate Order.[30,31]

The final conclusion of the theory must be that the properties of physical events are the properties of space.

A special acknowledgement is owed to Dr. David Bohm, Birkbeck College, University of London, and to Dr. Roger Penrose, Mathematical Institute, Oxford University, for their comments and criticism of various conclusions of this work, but who share no responsibility for the accuracy of these ideas. This project was completed under a private grant.

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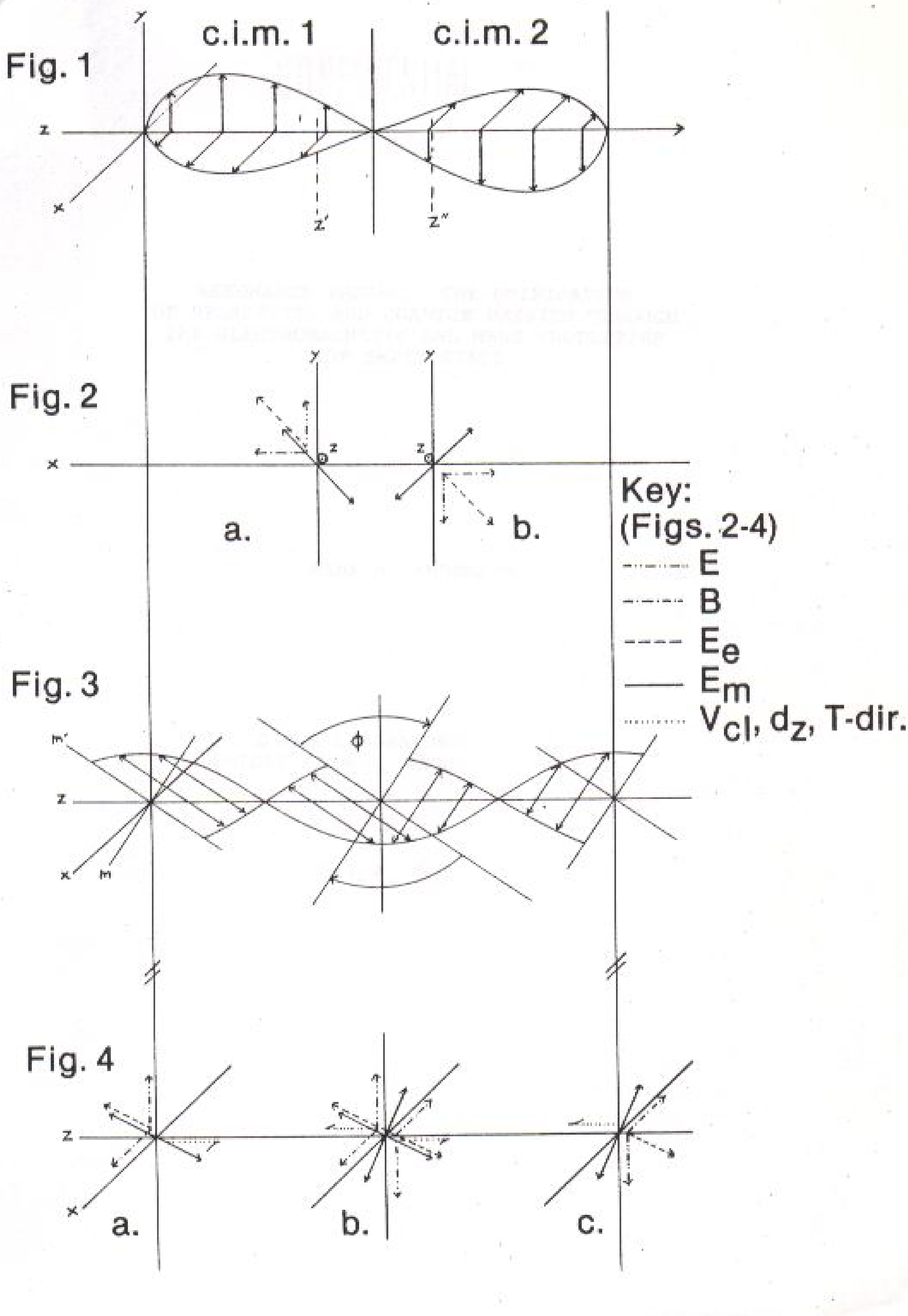

A-1

AL2056

Resonance Theory: The unification of relativity and quantum physics through the electromagnetic and mass properties of empty space

Mark R. Anderson

Oikos Laboratories, Inc., Friday Harbor, Washington, 98250

(RECEIVED [illegible] NOVEMBER 1981)

Electromagnetic radiation is shown to consist of an interconversion over time between electromagnetic fields and a mass field, according to the law of conservation of mass-energy. The required inverse geometry modes of this mass wave allow universal energy state equations for velocity, momentum, and energy which are valid for all velocities from 0 through c. Special and General Relativity describe special cases of these equations, which also show quantum characteristics in terms of wave nodes. The energy state equations are shown to derive from the physical properties of empty space. The properties of charge, time, rest mass, and spin are predicted by this physical interpretation, and its wave geometry provides a functional description of symmetry relations and the relation between gravitational, electric and magnetic forces. Electromagnetic radiation is a resonant activation of empty space, and the properties of physical events are determined by the physical properties of empty space. An absolute frame of reference is proposed.

PACS numbers: 12.20 Hx, 4.50 th, 11.30 Er, 11.10 Qr

Introduction. A history of apparent experimental contradictions has tended to isolate the theory of sub-wavelength parameter measurements from the theory of relativistic velocity parameter measurements, simultaneously isolating mathematics for the gravitational force from that of the electromagnetic, weak and strong nuclear forces. The Special

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5 January 1982

Dr. Mark R. Anderson
Oikos Laboratories, Inc.
P.O. Box 1304
Friday Harbor, Washington 98250

Re: Resonance theory: The unification of relativity and quantum physics...
By: Mark R. Anderson

AL2056

Dear Dr. Anderson:

The above manuscript has been reviewed by one of our referees.

Comments from the report are enclosed. We are returning the manuscript for your consideration of these comments.

Yours sincerely,

Carol B. Kraner
Assistant to the Editor
Physical Review A

F2

Review of RESONANCE THEORY, MS AL 2056

There are significant errors in this paper which detract from the originality and thought invested by the author. These errors are in matters that are fundamental and often considered elementary.

The author fails to distinguish between total energy and energy density. Energy obeys a conservation law, energy density a continuity law. Thus energy density may vary along the axis of a light wave, and does in linear polarization (like $\sin^2 z$) and in light pulses, without any violation of energy conservation. The author mistakenly interprets this variation as a violation of energy conservation and invents new energy distributions and mass distributions to compensate for this variation.

This mistake at the beginning (after equation (1)) unfortunately vitiates the entire work.

From the view-point of the average PR reader, the whole work is at an elementary level. The author appears naive in supposing the Maxwell theory of light is vulnerable at such a basic point, and in not checking his work more with other physicists before submitting it for publication.

March 5, 1991

The Editor(s)
Physical Review A
1 Research Road
Box 1000
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Dear Mssrs. et Dames,

I am enclosing various materials originally accepted by you for active consideration for publication in Physical Review A on November 30, 1981. I have not made any changes in these materials in the hope that they might be published with the original submission date.

I am also enclosing a copy of the referee's original notes. The referee's comments are the classical view of electromagnetic propagation for wave structures larger than one wavelength. The whole of this paper deals only with electromagnetic structures of sub-wavelength dimensions. It is, in fact, the primary point of the paper to propose a new sub-wavelength structure for electromagnetic radiation.

As with a standing wave in a string, energy may indeed be zero at discrete points along the axis of propagation. And, as with a physical string, energy is a more useful term than energy density.

With a propagating (non-standing) wave in a string, the (kinetic) energy values are non-zero (in fact are maximal) for points where the string crosses the axis of propagation; whereas energy values calculated by means of any classical technique using Maxwell equations (including the integral of energy density) results in zero energy within a wavelength at the same points.

The point of the paper is that this discrepancy may be eliminated by the superposition of a mass wave in energy contraposition to the electrical and magnetic field waves.

At the time this paper was submitted, very few physicists (and therefore, I would imagine, referees) were intellectually familiar with, or politically comfortable with, Michael Green's work in London. (I myself was unaware of it, and indeed, much of it had yet to be published.) His work on the unification provided by superstring theory was not published until 1984.

Today, of course, superstring theory is arguably the most popular unification theory among physicists. By retaining the original date of submission, I would hope to make it clear where Resonance Theory lies in the chronology of superstring theory.

As for the comments by the referee that the general level of the paper is elementary, he(she) is of course correct. It is the point of the paper to present a simple description of a straightforward application of conservation theory in a universal geometry defined by the axis of electromagnetic propagation.

I would not propose that the language of the paper is as current in jargon or even scientific politics as might be expected of an author seeking to be published in the Review, but the ideas in this paper are not in any way naive. I say this having discussed these ideas at the time with Roger Penrose, David Bohm, David Boulware, Joseph Cronin, John Cramer, William Bender, William Matheson and others, some of whom I have acknowledged on p. 24.

I do not, of course, know who the referee was, but I assumed that the credibility of these individuals was such that he (she) would give greater credence to the ideas expressed in this paper than the simple rejection of physical string mathematics for the propagation of electromagnetic radiation.

I would like to add that I understand how strange this approach must seem when compared to the classical model, although the progress made in superstring theory in the last ten years has turned this from a revolutionary concept to a (more) politically correct one. In addition to the above discussions of the ideas contained in the paper, I have submitted the paper in its entirety to Bill Matheson for review, and spent many hours discussing these and derivative equations with William Bender, professor emeritus of physics at Western Washington University. Fairly stated, their opinion was that the theory was successful from the point of view that 1) it did not contradict any current experimental knowledge, and 2) that it was internally consistent. I have left the third theoretical test of providing experimental predictions for a later paper on the application of this approach to thirteen major applications of force laws.

In other words, I have done considerable additional work beyond the scope of the current draft to assure that this is indeed a practical and worthwhile path to follow. Contrary to the referee's comments, I would state in the most confident manner that the Maxwell equations are indeed 'vulnerable' on this and other issues. (As I am sure you are aware, Jim Brittingham of the Lawrence Livermore Nuclear Lab provided a radically new set of Maxwell solutions in 1987.) I would add that there are additional benefits to be drawn from the definition of mass wave and charge as defined by this Resonance Theory, not the least of which is an improved physical definition of empty space.

If there are true deficiencies in the logic or physics of the paper, I of course would like to be apprised of this in order to make the required changes.

I realize that this is an unusual situation, and would appreciate your assistance in completing the process of bringing this material to publication.

Thank you.

Sincerely,

Mark R. Anderson

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Resonance Theory: ~~The~~ unification of relativity and quantum physics through the electromagnetic and mass properties of empty space

Mark R. Anderson

Oikos Laboratories, Inc., Friday Harbor, Washington, 98250

RECEIVED 14 MARCH 1991

Electromagnetic radiation is shown to consist of an interconversion over time between electromagnetic fields and a mass field, according to the law of conservation of mass-energy. The required inverse geometry modes of this mass wave allow universal energy state equations for velocity, momentum, and energy which are valid for all velocities from 0 through c. Special and General Relativity describe special cases of these equations, which also show quantum characteristics in terms of wave nodes. The energy state equations are shown to derive from the physical properties of empty space. The properties of charge, time, rest mass, and spin are predicted by this physical interpretation, and its wave geometry provides a functional description of symmetry relations and the relation between gravitational, electric and magnetic forces. Electromagnetic radiation is a resonant activation of empty space, and the properties of physical events are determined by the physical properties of empty space. An absolute frame of reference is proposed.

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22 March 1991

Dr. Mark R. Anderson
Oikos Laboratories, Inc.
P.O. Box 1304
Friday Harbor, WA 98250

Re: Manuscript No. AC4589

Dear Dr. Anderson:

I am returning your paper "Resonance theory: Unification of relativity and quantum physics through the electromagnetic and mass properties of empty space". Physical Review A primarily publishes papers reporting on new results in experimental and theoretical physics. Apart from the fundamental criticisms contained in the original referee's report, your paper does not satisfy this criterion, and I am accordingly returning it to you as being inappropriate for Physical Review A.

Sincerely yours,

Benjamin Bederson

Benjamin Bederson
Editor a
Physical Review A

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Mark R. Anderson

August 20, 1991

Dr. Benjamin Bederson
Editor
Physical Review A
1 Research Road Box 1000
Ridge, NY 11961

Dear Dr. Bederson,

Thank you for your letter of March 22, regarding my paper "Resonance Theory: Unification of relativity and quantum physics through the electromagnetic and mass properties of empty space" (AC4589). After reviewing your letter and our past correspondence, however, and discussing these matters with several other physicists, I must confess to remaining confused on two specific questions. A friend and colleague of mine, Dr. Fred Alan Wolf, suggested that I should write to you for clarification.

When re-submitting the paper for consideration this year, I wrote a cover letter addressing points about energy conservation and density which had been raised by the referee; in the same letter I also asked for retention of my original submission date (30 Nov. 1981, AL2056).

Without other comment, I received a new date of 14 Mar. 1991.

In your following letter, you referred to the original referee's concerns, but not to my response to those concerns. Additionally, you noted that, in addition to the referee's criticisms, the paper "does not satisfy this criterion (of reporting new results in experimental and theoretical physics)."

If I am to construe this to mean that this theory is today not considered to be "new", would it be possible to ask for a reference to other works you have in mind which might precede it ? I am not aware of any works proposing mass distributions via energy conservation along the direction of travel of electromagnetic radiation, nor of the resulting definition of charge (inversion modes).

If it turns out that this theory remains new, I would of course be pleased to rewrite the paper to fully address any current (or remaining) referee concerns.

I appreciate your attention to this matter, and look forward to your reply.

Sincerely,

Mark R. Anderson

Telephone (206) 363-7955 Fax (206) 378-3431
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4 September 1991

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Re: Manuscript No. AC4589

Dear Dr. Anderson:

This is in response to your letter of August 20, 1991 concerning your paper "Resonance theory: Unification of relativity and quantum physics ...". To elaborate slightly on my statement concerning the types of papers appropriate for Physical Review A, we often receive papers that attempt to cast some aspect of fundamental theory into a new light, perhaps to enable one to obtain better insight into what, after all, are very deep and even unsatisfying understanding of natural phenomena. When I stated that we primarily publish papers reporting on new results in experimental and theoretical physics, I did not mean to derogate such attempts at arriving at a deeper understanding of natural phenomena; I simply meant that our journal cannot take on the job of hosting such papers.

There are a number of excellent journals that address issues involving fundamental concepts. Your paper falls into this category, in my opinion, and is therefore inappropriate for Physical Review A. I suggest you attempt publication in one of these.

Very truly yours,
Benjamin Bederson
Benjamin Bederson
Editor
Physical Review A

BB/soc

Mark R. Anderson

November 4, 1991

Dr. Ben Bederson
Editor
Physical Review A
1 Research Road Box 1000
Ridge, New York 11961

Dear Dr. Bederson,

Having read your letter of September 4 several times, I must confess to confusion regarding the status of manuscript # AC4589 and the policy of Physical Review A on dates of submission, priority, and content. To be sure that I was not reading it incorrectly, I asked several colleagues for their own reading, and all were left equally unclear regarding the meaning of your letter.

Specifically, I had written to you to ask to retain the original submission date of the above manuscript (11/30/1981, ms #AL2056), as the peer review comments had been proven incorrect; I included specific reasons for this. This matter has not been addressed.

Insofar as your earlier letter stated that the journal "only published new theories," I understood that you were rejecting the work as not being new. Since neither I nor the several other physicists I have spoken with know of papers that would have priority, I asked for your mention of any such papers. This matter also was not addressed in your letter, and I therefore continue to assume that there is no paper with priority.

You did state in your letter, regarding "papers that attempt to cast some aspect of fundamental theory into a new light --- arriving at a deeper understanding of natural phenomena" that "our journal cannot take on the job of hosting such papers."

Certainly the work of Hal Puthoff, who has published numerous papers on related subjects in your journal in recent years, would fall into the same definition.

In summary, I believe that the paper submitted to you in November of 1981 contains an original and correct theory of physics which would be of interest to the community at large. The theory is internally consistent and testable, and the paper contains specific geometric and mass distribution predictions. The theory presents a unification of general relativity and quantum mechanical principles which derives from the physical characteristics of the vacuum, and which is testable through measurements upon electromagnetic radiation.

The original peer review objection, essentially that electromagnetic radiation is not properly described by string-like mathematics, must now be put aside, as most physicists today accept the beauty of a family of string mathematical approaches as suitable for the unification of all interactions, including the electromagnetic.

I look forward to your response on this matter.

Sincerely,

Mark R. Anderson

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