

The Generalization of Mechanics & Electrodynamics

Walter Babin

P.O. Box 433, Rodney, ON, Canada, N0L 2C0

e-mail: physics@wbabin.net

An analysis of the basic principles, laws, formulas and pivotal experiments of physics leads to a new understanding which allows a surprisingly simple generalization of mechanics and electrodynamics. The formulas of special relativity are applied within this new context. While speculative theories of the last century may have value, they must necessarily be modified or abandoned when they are proven to have no basis in reality.

1. Introduction

I don't think anyone would argue against the idea that theoretical physics has morphed into a form of a mathematical science. In the last few hundred years we have had countless repetitions of a mode of thought used by Euler in his alleged debate with Diderot: [1]

"(a+b^n)/n = x: Therefore, God exists."

This may make perfect sense to mathematicians, but leaves the rest of us scratching our heads. The fact that numbers exist and behave in a predictable manner may well be an indication of the existence of God, but it leaves us feeling that an excessively symbolic representation of the quantitative, has allowed it to become overwhelmingly qualitative in its interpretation.

The current mathematical idiom has spilled into philosophy and metaphysics, introducing a level of incoherence that was best expressed by Bertrand Russell: [2]

"...Thus mathematics may be defined as the subject in which we never know what we are talking about, nor whether what we are saying is true."

Mathematics is not concerned with meanings. This observation must be acknowledged if we are to understand the almost total indifference to fundamental principles in the mathematical expression of physics. This, in my opinion, has become its hallmark. As Sir Oliver Lodge observed: [3]

"In such a system there is no need for Reality; ... absolute fact is inaccessible. We have no criterion for truth; all appearances are equally valid; physical explanations are neither forthcoming nor required..."

In the following, I wish to show that acceptance, knowledge and **understanding** of fundamental principles allows physics to be expressed in simple terms readily understood by everyone.

Special and general relativity have taken on a life of their own and the debate rages unabated today. The best critique is to ignore them completely and see what may be derived from experiment. Quantum mechanics is also ignored. While it may have practical applications, by its nature it explains little. Indeed, it contradicts its own principles.

2. The Michelson-Morley Experiment

From a historical perspective, the break with classical mechanics and electrodynamics came with an experiment designed to prove the existence of a universal aether.

The experimenters concluded that light has a constant speed and the aether was entrained. This was abandoned in favour of variable space-time and constant light speed. This precludes **any relative speed whatever**. A relative term cannot manifest as an absolute. The first hypothesis is accepted as being the simplest and most probable. If correct, there should be no conflict with experimental results. The experimentally-proven Sagnac effect complies, as does the Doppler effect for light, stellar aberration, and the calculation of the de Broglie "matter wave". [4]

Underlying all of this is the tacit assumption that light is discrete rather than continuous. Of course, we have confirmation of discontinuity in Huygens' wavelets, and the photon concept, but can probe further.

3. Particle-Wave Duality and Invariance

The discrete aspect of electromagnetic radiation may be drawn from an analysis of the spectral series of the hydrogen atom.

The photoelectric effect gives an experimentally confirmed "quanta-fication" of angular momentum, where h equals the mass, velocity and circumference of the first Bohr orbit of hydrogen, $2\pi mvr$. What is not made explicit is the presence of an invariant time factor. The Rydberg formula is:

$$k = R_H (1/n_f^2 - 1/n_i^2) \text{ where } R_H = (1/4\pi\epsilon_0)^2 m_e e^4 / 4\pi h^3 c \text{ (MKS)} \quad (1)$$

which reduces to $RH = v/(4\pi\lambda c)$ at infinity (CGS). [5] k = inverse wavelength, v = velocity, $v/2\pi\lambda = 1/t$ = inverse duration of first Bohr orbit, n_f and n_i = quantum integers of final and initial orbits.

The energy of a photon is expressed as frequency times Planck's constant, hf . By introducing $1/t$ as the radiation frequency, an "angular momentum-kinetic energy" expression emerges,

$$2\pi mvr/2ct \equiv hf/2c \equiv mv^2/2c \quad (2)$$

Electricity and magnetism give no reason for equating frequency with mass. There is no explanation on how this can be done. There is also a problem with dimension. If all components are invariant and the photon is in motion, its momentum, energy, etc. are also invariant. A photon moves at c , indicating it has a kinetic energy equal to that of an electron in the first Bohr orbit.

The radiation emitted is due to the deceleration of the electron. Obviously, the induction laws of Faraday apply. Only incremental energy is available for emission, since the electron is in no way modified when brought to rest. If we assume an electron-electron collision and **separate** couplings of the primary and induced B and E fields (fundamental units, absolute terms),

$$B_p = +ev/c \text{ and } B_i = ev/2c, \text{ therefore } B_p B_i = |e^2 v^2 / 2c^2| \quad (3)$$

$$E_p = -e \text{ and } E_i = ev^2/2c^2, \text{ therefore } E_p E_i = |e^2 v^2 / 2c^2| \quad (4)$$

The fields are equal and the classical sum is,

$$E^2/2 + B^2/2 = T^2 \quad (5)$$

where T^2 represents the total available for emission.

(Note that an accelerating particle does not radiate. Maxwell's radiation formula requires a universal continuum which is precluded by our initial hypothesis.)

We can see why the photon γ is considered a stable "particle" having a spin of one. Furthermore, it has precise north-south, east-west alignment; a natural coordinate system. Being electromagnetic, the field would offer no impedance, allowing it to cover vast distances with no loss of energy. On the other hand, the speed of propagation may be a property of the field, since there is a series of radii advancing progressively from the "classical electron" radius through the Compton wavelength, the first Bohr orbit and the inverse Rydberg Constant, with the ratio $\lambda_{1,2,3} c/v$, and the velocities are inverted. The progression might well indicate the existence of dual orbitals with motion in opposite directions. This will be confirmed in the following. Finally, it is obvious that photon-electron collisions are equivalent to electron-electron, the only difference being proximity

There is a considerable amount of information that has still not been made explicit. Lenz's law has not been addressed. Also, the fields are independently generated. If we assume a sinusoidal motion for the electron, the magnetic field would brake at both the positive and negative poles sequentially, the emission would be double and have opposite sign. Energy, hf , varies with frequency (impulse), and in a collision there is no way to measure since there is no series. If the wave aspect of radiation is used, then its frequency is measurable. But a wavelength is measured from peak to peak, incorporating the trough, so we can conclude; the traditional measurement of photon energy incorporates two photons of opposite sign. Either these are Dirac's magnetic monopoles or they do not exist.

4. The Compton Effect

This is viewed as an elastic collision between a photon and a free electron. Since we are dealing with electric, magnetic and massive elements, this also appears to be simplistic. If the target is an electron in a tightly bound orbital state, or the photon's energy is decreased, the recoil approaches a Rayleigh scattering. The photoelectric effect infers total absorption. Collisions with photons and free particles fall between.

Where the energy release in spectral radiation is incremental, the formulation of the Compton Effect suggests a continuous range. Resolution is totally dependent on continuity or discontinuity of frequency. In any case, we have an independent mechanical, electrical and magnetic component for the interaction.

In Compton, the scattered radiation undergoes a shift in wavelength,

$$\lambda_f = \lambda_i - \lambda = h/mc (1 - \cos \phi) \quad (6)$$

where the final wavelength is the, initial minus the Compton wavelength This infers interaction with the magnetic moment of the electron as identified in the previous section. Based on fun-

damental units and a 90 degree angle for simplification, this is equal to the following representation.

$$\delta_i \delta_o / \delta_i + \delta_o \quad (7)$$

where δ_i is the initial photon's "mass equivalent" and δ_o , is the mass-equivalent of the electron's intrinsic magnetic moment (at rest). This is a direct analog to the classical "reduced mass" of mechanics, and the Rydberg constant is modified to accommodate this difference. Lenz's law has not been considered and may apply in this situation, or it may be a loss of kinetic energy to equate with an increase in potential.

The increment added to the magnetic moment mass-equivalent of the electron is,

$$\delta_i + \delta_o - \delta_i = \xi \quad (8)$$

where ξ equals the so-called mass increase of special relativity, m/β , and is shown only for that reason. The **total** magnetic photon energy transmitted is the initial minus the final,

$$\gamma_i - \gamma_f = \xi v^2 / 2c^2 \quad (9)$$

This is precisely the magnetic configuration derived for emission, as applied to absorption. It is also the classic summation of energies, $K - C = T$ (kinetic, constant, total) **where T is positive**. This represents a **positive** vector product perpendicular to the direction of motion.

$$\xi c^2 - \delta_o c^2 = \xi v^2 / 2, \text{ and } \xi / \delta_o = 1 / (1 - v^2 / c^2) \quad (10)$$

We have duplicated the relativistic equations for what was erroneously ascribed to kinetic energy, using the fundamental equations of induction. Our earlier assumption that two photons equal one wavelength, and our analysis regarding magnetic monopoles suggests a parallel calculation for the negative pole.

The relativistic equation $\beta = (1 - v_m^2 / c^2)^{1/2}$ contains the velocity associated with relativistic momentum. From Eq. (3), we see that it is in fact the base charge and indeed, the momentum. From this we must conclude the electrical energy is kinetic and equal to the magnetic, so the relationship is

$$(1 - v_m^2 / c^2)^{1/2} = 1 / (1 - v^2 / c^2) \quad (11)$$

(Note that in inverse functions, the powers are also inverted so that the root is greater than the square. The relationship between energy and momentum can take the "relativistic" form, $(pc)^2 + m_o c^2 = (K + m_o c^2)^2$ if we identify K as total energy rather than kinetic.) We have now identified vertical and horizontal vector products. The latter will be made explicit in the following.

5. Classical Mechanics

The Compton collision is viewed as a combined electromagnetic-mechanical event, so we must investigate the latter property. The above demonstrates that there must be an energy equivalence between field quanta and mass, mediated by the ratio of their velocities. An earlier paper [6] shows there was a glaring mathematical error in the calculation of total mechanical energy, which, in fundamental units, results in the **same equation and exactly the same value as Eq. (9)** for the total electron's energy and velocity v_i , so that $K - C = T$, **where T is negative**. The vector product is opposite to the above.

With an increase in velocity, there is an increase in kinetic energy and a decrease in potential (less negative, conservative). The potential is the extension (a spring) of the conservative mag-

netic field. With a decrease in velocity, the reverse process ensues to equilibrium at zero and beyond. By this process, we have identified mass, its attendant magnetic field and an energy transfer mechanism in the vertical and horizontal opposing vectors. Energy transfer is required to achieve and maintain equilibrium between kinetic and potential energies, electric and magnetic fields. It is now reasonable to state that electricity, magnetism and mass, comprise a single entity (thesis, antithesis, synthesis) and we have only scratched the surface at this point. Despite possible appearance to the contrary, there is always a balance of forces. There is no gain without loss, as in Newton's third law.

6. Displacement - Inertia

Both mass and charge are invariant. There is no charge in the interior of an electrically-charged sphere. It has no electrical centre. It is a hole. Mass behaves as though all of its mass is concentrated at its centre. If one were looking for a "black hole", mass is the worse place to start. Electric charge has always had a hole, but it is not black. Mass is discrete and electricity has no boundary. One is the precise antithesis of the other. **Every aspect of one is duplicated in the other in the reverse sense.** Both mass and charge are inert (in the current sense). It is the fields that represent dynamic properties. One is the inertia of the other and their displacement is related to the potential energy of the system. Yet according to Eq. (9), each "entity" has a positive negative base $(c+v)(c-v)$. It will be found that total energy is,

$$K^2 - C^2 = T^2 \tag{12}$$

7. Mechanical-Electrical Orbits [4]

A classical one-dimensional elastic collision between an electron and a mass-equivalent photon would result in a Newtonian velocity v_n of

$$2\delta c/\delta + m = v_n = c \tag{13}$$

A similar configuration in a Compton collision gives, $cv_m = v_t^2$, where v_m is the velocity in the experimentally determined momentum. If the mass ratio is modified and/or a two-dimensional collision is introduced,

$$2 \delta cv_m \cos \theta / (\delta + m) = v_t^2 \tag{14}$$

where $\cos \theta$ is the recoil angle of the electron.

But if we remove v_m , we have the formula for v_n , so

$$v_m v_n = v_t^2 \tag{15}$$

Obviously the velocities are in opposite directions.

Multiplying each velocity by unit time for radii, gives a greater and lesser circle (see Fig. 1). The product is an ellipse, with the minor axis representing the latter. It is a displacement of foci. According to Miles Mathis, each focus **must** be occupied in order for it to exist. Since there is no apparent distortion evident in the mass-magnetic interaction, it must be a displacement between (for the purpose of comparison) the invariant electric charge-electric field and invariant mass-magnetic field; an absence and a presence. There is a profound aspect to this; both effects are apparent and real, not merely frame-dependent.

Equivalence is also evident in dual orbits which are manifest in Dirac's treatment of the energy levels of hydrogen, (Appendix) whose splitting when perturbed, exactly match,

$$v_m/v_n = 1 - v_k^2/4c^2 \tag{16}$$

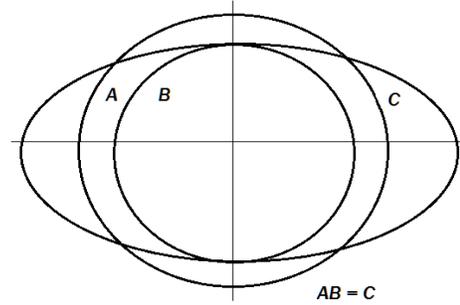


Fig. 1.

8. Mass, Electromagnetism and the Speed of Light [7]

It is difficult to provide the same type of analysis to the nucleus. Since few fundamental principles exist, the following must be indicative. However, the preceding formulae specifically contain proof that classical dynamic laws are evident, particularly since the velocities are comparatively small.

The above mass and magnetic effects relate to the experimental configuration of mass spectrometry with the appearance of the induced field of classical electromagnetic theory. The magnitude of this field increasing with incremental speeds is plotted as a function of v_t below. This is equal to energy levels at various intervals resulting from a uniform acceleration. Interaction of an electron with a nucleus is assumed. **Note:** The formulas are Initial field = 1 = c.

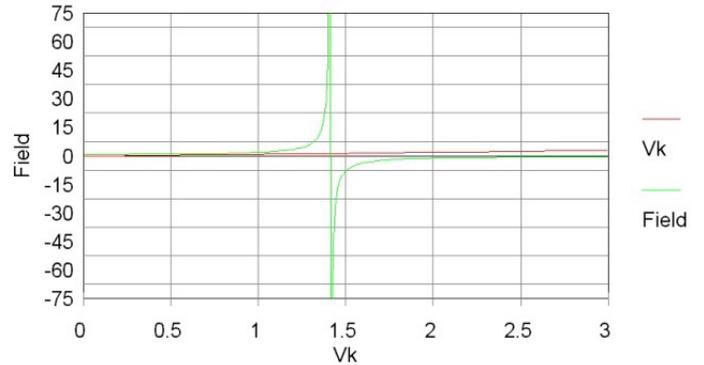


Fig. 2. Field Magnitude Function of V_k

As v_m approaches c , the inertial field supposedly becomes infinitely large, but it is where the primary magnetic field approaches the magnitude of the primary electric field, allowing Coulomb barrier penetration at c . (read v_t for v_k) There is a collapse at the classical electron radius, where

$$v_m = c, v_t = 2^{1/2}c, v_n = 2c, \text{ and } c^2 = 2c^2 - 4c^4/4c^2 \tag{17}$$

Beyond the barrier, there is a total inversion, as depicted in Fig. 2. The electric field becomes positive due to the increase in the induced fields, and the "magnetic" poles are reversed. The kinetic energy is eliminated and the magnetic, inverting to negative potential, **equals the mass of the proton.** The proton and the electron are either aspects of the same particle, or at least, one can be transformed into the other. A collision with a nuclear particle is indicated since there is a "reduced" mass emission of radiation as per Eq. (6). Mesons are considered the bond between

nucleons when in fact they are part of a nucleon-nucleon "reduced mass". The sum of the muon and pion multiplied by twice the anomalous neutron magnetic moment equals the accepted mass of the proton. This energy cannot escape the nucleus because of the Coulomb barrier (unless excited).

Since electrons cross the Coulomb barrier, it is probable that the neutron is a proton-electron pair. The conversion between protons-neutrons and the reverse is clouded, but the emissions, however effected, result in the formation of positrons and electrons. These can be no other than braking photons as the nucleus has sufficient stopping potential for the conversion to particles. I suggest the conversion is incomplete (they are not mass *per se*), since collision results in their reverting to gamma radiation.

9. Superluminal Speeds and Superconductivity

The question arises as to what limits may be imposed on the three speeds? This was explored by plotting the squared velocities as a function of v_t .

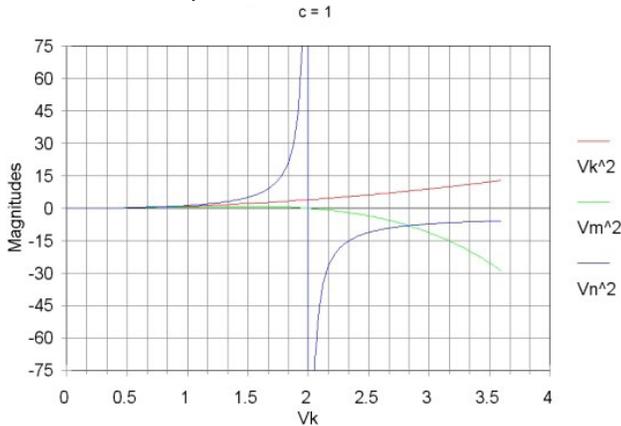


Fig. 3. Squared Velocities

As v_t approaches $2c$, v_n approaches infinity and v_m approaches zero. At precisely $2c$, there is an abrupt cessation of all linear motion and then a reversal of speeds beyond that point. (The existence of the cross vector v_t suggests particle spin.) This is analogous to behavior at the repulsive core of the atomic nucleus. Note that v_m does not exceed c and no limitation is imposed on v_n . Velocities beyond those indicated do not appear to be significant although the absolute values are all equal at $8^{1/2}c$.

Of significance is the existence of the velocities, c , $2c$ and an approach to infinity, in direct correspondence with the results of the Pappas-Obolensky experiments. [8] From the diagram, it is obvious that infinite means **dimensionless**. There is no infinitely large or small, precluding Cantor's infinite number of infinities.

As a general statement, we find in superluminal speeds, extremes of kinetic energy and with the cessation of speed, we can assume the ultimate expression of potential energy - superconductivity. In their proximity we find a conjunction of opposites cast in the finest traditions of metaphysical speculation.

10. Conclusion

I believe the synthesis of the two main theories of physics has been accomplished. A determination of anti-gravity is now ridiculously simple, but requires a whole new level of understanding for formulation, development and use. An extreme level of complication is indicated.

I hope I have justified my earlier remarks regarding mathematical physics. To this point, it is evident that the mathematical expression of all our laws can be inscribed on the head of a pin. As Dirac said of his formulas,

"Nature certainly does not have its ideas described in such a clumsy and ugly way. There is probably some very neat solution which is still to be discovered"

It is difficult from the perspective of 100 years in the future to fully understand the prevailing philosophies that lead to relativity theory. This paper rests, to a large extent, on the findings of physicists in the early part of the last century. Relativists can take comfort in the fact that its early formulas survive. This is more than a partial vindication. On the dissident side, the erroneous causes and interpretations of the same formulas justify their stand. What is not justified is the uncritical acceptance of theories that contain obvious logical errors, regardless of their efficacy.

Appendix: Analysis of Dirac's Relativistic Energy Levels - Hydrogen Atom

The fine line splitting observed in electron orbits are attributed to spin-orbit interactions, but analysis suggests a different explanation. Dirac's equation (CGS System) is:

$$E = -ue^4 / 2h^2n^2 [1 + a^2/n (1/(j + 1/2) - 3/4n)] \quad (a)$$

where $[u]$ = reduced mass, and $[n]$ and $[j + 1/2] = 1$ (1st Bohr orbit). $[a]$ = fine structure constant. Using the Bohr equivalence, equation (1) reduces to

$$E = -um_e^2v^4r^2 / 2m_e^2v^2r^2 [1 + a^2 (1 - 3/4)]$$

$$E = -uv^2/2 (1 + v^2/4c^2) \quad (b)$$

where $[m_e]$ = mass of the electron, $[v]$ = velocity in the first Bohr orbit. Removing $u/2$ from both sides and re-arranging,

$$v^2 = v^2 - v^4/4c^2 \quad (c)$$

Obviously, **there must be a difference in the velocities**. Replacing the left with the standard linear velocity $[v_m]$ and on the right with the angular (total) velocity $[v_t]$, we have

$$v_m^2 = v_t^2 - v_t^4/4c^2$$

or

$$v_m/v_t = 1 - v_t^2/4c^2 \quad (d)$$

References

- [1] L. Hogben, **Mathematics for the Million** (W.W. Norton, 1993) p. 9.
- [2] B. Russell, **Mysticism and Logic, and Other Essays**, ch 4, (1917).
- [3] O. Lodge, *Nature*, v106 n2677 (1921) 795-800.
- [4] Walter Babin, "The Synthesis of Quantum Electrodynamics, Special Relativity and Classical Mechanics," *General Science Journal* (Jul 2002), <http://wbabin.net/babin/wd6.htm>.
- [5] Walter Babin, "Determinism vs Probabilism in Physics," *General Science Journal*. <http://wbabin.net/babin/dvp.htm>.
- [6] Walter Babin, "An Analysis of the Theoretical Foundations of 20th Century Physics," *General Science Journal* (Apr 2009), <http://wbabin.net/babin/analysis.pdf>.
- [7] Walter Babin, "Superluminal Speeds and Superconductivity," (Feb 2003), <http://wbabin.net/babin/super.htm>.
- [8] P. Pappas & A. Obolensky, *Elect&WW*, v94 n1634 (1988) 1162-1165.