The Vector Magnetic Potential and A Schrodinger Wave Equation Solution for Electrogravitational Mechanics

by

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The vector magnetic potential (**A**) can exist apart and isolated in space from the magnetic field which gives rise to its existence. As a direct result of this peculiar characteristic, the vector magnetic potential has been postulated by myself to be the fundamental action mechanism for the gravitational force. Below are several quotes from established experts concerning the unique character of the magnetic vector potential, hereafter designated as the **A** vector.

Shadowitz (1988a) states, "(1) **A** provides tremendous advantages when variations with time are considered; (2) there is an intimate relation between ϕ and A which will be brought out when relativity is considered; (3) a strong case can be made for the argument that the potential fields, rather than the electric field and the magnetic field, are the fundamental physical quantities; and (4) sometimes, as in the transformer or the betatron, a knowledge of **A** gives a more direct and physical insight than does a knowledge of **B**. The knowledge of **B** is really only needed when one must know the force. In quantum mechanics, it turns out, ϕ and **A** must be used and **E** and **B** cannot be substituted for them." -Unquote

In the above quote, the field potential ϕ, is in the units of volts.

Imry and Webb (April 1989) states, "When the theories of relativity and quantum mechanics were introduced, the potentials, not the electric and magnetic fields, appeared in the equations of quantum mechanics and the equations of relativity simplified into a compact mathematical form if the fields were expressed in terms of potentials. The experiments suggested by Aharonov and Bohm revealed the physical significance of potentials: a charged particle that passes close to but in no manner encounters a magnetic or electric field will nonetheless change its dynamics in a subtle but measurable way. The consequence of the Aharonov-Bohm effect is that the potentials, not the fields, act directly on charges." -Unquote.

The Aharonov-Bohm effect has been repeated successfully many times by different people and even with very small conducting wires at low temperatures as reported in related text of the above quote. A salient point is that the **A** vector is in the direction of the particle motion and is thus 90 degrees to the **B** field. The **A** vector has the units of weber/meter, or (volt*sec)/meter.

To elaborate on the Aharonov-Bohm experiment, Shadowitz (1988b) is quoted as, "The Aharonov-Bohm experiments are significant because there is a region where **B** vanishes but **A** is finite. The Aharonov-Bohm experiment (see Chap. 14, Sec. 14-2, Example 4) utilizes the interference fringes produced by two coherent electron beams (i.e., both beams are produced by one source); the two beams pass around the outside of a solenoid whose length is very long compared to its radius. One beam passes on one side and one on the other, both beams coming from a beam splitter which separates them from each other in the original electron beam. The beams pass only through a region where **B** = 0. A fringe system is produced in a plane where the beams are brought together again. It is found that a shift in the fringes occurs, when the current passes through the solenoid; though the force on any one electron is unaffected by the absence or presence of **A**. Further, the magnitude of the shift agrees with the prediction of quantum mechanics. This effect has no classical analog and is intrinsically quantum mechanical. The conclusion is nevertheless inescapable: **A** possesses physical significance." -Unquote.

It is important to note that even though **A** does not exert force on the electron directly, a phase shift in the electrons wave function does cause a change in its momentum. Ergo, the **A** vector can cause the electron to have a change in momentum which is self-induced through a change in the associated electron wavefunction. This is fundamental to my theory of electrogravitational mechanics.

Mathcad's required parameter statements are presented below.

$\mu_o := 4\cdot\pi\cdot 1\cdot 10^{-07}\cdot H\cdot m^{-1}$ Permeability of free space.

$m_e := 9.109389700\cdot 10^{-31}\cdot kg$ Electron rest mass.

$q_o := 1.602177330\cdot 10^{-19}\cdot C$ Electron charge.

$l_q := 2.817940920\cdot 10^{-15}\cdot m$ Classic electron radius.

$h := 6.626075500\cdot 10^{-34}\cdot J\cdot s$ Plank constant.

$\alpha := 7.297353080\cdot 10^{-03}$ Fine structure constant.

$V_{LM} := (\sqrt{\alpha})\cdot m\cdot s^{-1}$ Quantum electrogravitational velocity.

$V_{LM} = 8.54245461211\times 10^{-2}\frac{m}{s}$

$\lambda_{LM} := \frac{h}{m_e\cdot V_{LM}}$ Quantum electrogravitational wavelength.

$\lambda_{LM} = 8.51499541615\times 10^{-3}\,m$

$W_{LM} := m_e\cdot V_{LM}^{2}$ Quantum electrogravitational energy.

$W_{LM} = 6.64744329842\times 10^{-33}\,J$

$f_{LM} := \frac{W_{LM}}{h}$ Quantum electrogravitational frequency

$f_{LM} = 1.00322480455\times 10^{1}\,Hz$

$t_{LM} := 1\cdot f_{LM}^{-1}$

$m'_e := \frac{(\mu_o\cdot q_o\cdot q_o)}{4\cdot\pi\cdot l_q}$ Charge and permeability derived mass.

$m'_e = 9.10938969141\times 10^{-31}\,kg$

Note that charge divided by time t = current and wavelength divided by time is velocity.

$A := \frac{(\mu_o\cdot q_o\cdot\lambda_{LM})}{4\cdot\pi\cdot l_q\cdot t_{LM}}$ Quantum vector magnetic potential

Where: $A = 4.85692479390\times 10^{-13}\,weber\cdot m^{-1}$

The quantum electrogravitational potential is derived by integrating the vector magnetic potential **A** with respect to velocity in eq. 1, below.

$$\phi_{LM} := \int_0^{V_{LM}} \frac{(\mu_o\cdot q_o\cdot V_{LM})}{4\cdot\pi\cdot l_q}\,dV_{LM} \qquad \phi_{LM} = 2.07450298031\times 10^{-14}\,V \qquad 1)$$

Note that: $\phi_{LM}\,t_{LM} = 2.06783461783\times 10^{-15}\,Wb$ which is equal to the standard quantum fluxoid, Φo

Where the standard quantum fluxoid is:

$$\Phi_o := 2.067834610\cdot 10^{-15}\cdot Wb \qquad 2)$$

Momentum is associated with the product of **A** and q_o where **A** is a vector and q_o is a scalar.

Note: **A** imparts momentum to the charge, qo.

$$p_{LM} := \frac{q_o \cdot (\mu_o \cdot q_o \cdot \lambda_{LM})}{4 \cdot \pi \cdot l_q \cdot t_{LM}} \qquad p_{LM} = 7.78165479829 \times 10^{-32} \frac{kg\,m}{s} \qquad 3)$$

A new field of force inline along **A** is obtained by taking the derivative with respect to time of the **A** field acting on the charge q_o above.

Note: 1st derivative of momentum, with respect to time = negative force.

$$F_{LM} := \frac{d}{dt_{LM}} \frac{q_o \cdot (\mu_o \cdot q_o \cdot \lambda_{LM})}{4 \cdot \pi \cdot l_q \cdot t_{LM}} \qquad F_{LM} = -7.80674911409 \times 10^{-31}\, N \qquad 4)$$

It must be emphasized that the **A** vector instantly affects the charge by acting on it to change its momentum. A change of momentum must be accompanied by a change in the particles wavefunction which also affects the quantum wavelength of the charge particle.

Negative energy, expressed as W_{LM} below, is obtained by integrating Force F_{LM} , with respect to wavelength λ_{LM}, below.

$$W_{LM} := \int_0^{\lambda_{LM}} F_{LM}\, d\lambda_{LM} \qquad W_{LM} = -6.64744329216 \times 10^{-33}\, J \qquad 5)$$

Momentum equals q_o times **A** where charge q_o is a scalar and the vector magnetic potential **A** is a vector. Since energy is momentum times velocity, then a cross-product of q_o times λ_{LM} and the derivative with respect to time of the **A** vector yields energy as a vector. Note that the charge terms have been split between vectors as have the velocity terms. That is, mass is in the whole expression but split between the vectors, as is the case also for the two velocity terms, one of which is distance over time. The resultant energy vector $\mathbf{W'_{LM}}$ is shown in eq. 6 below.

$$W'_{LM} := \begin{pmatrix} \lambda_{LM} \cdot q_o \\ 0 \\ 0 \end{pmatrix} \times \begin{bmatrix} 0 \\ \frac{d}{dt_{LM}} \frac{(\mu_o \cdot q_o \cdot \lambda_{LM})}{4 \cdot \pi \cdot l_q \cdot t_{LM}} \\ 0 \end{bmatrix} \qquad W'_{LM} = \begin{pmatrix} 0.00000000000 \times 10^{0} \\ 0.00000000000 \times 10^{0} \\ -6.64744329216 \times 10^{-33} \end{pmatrix} J \qquad 6)$$

<u>The faster the **A** field is changing with respect to time, the greater magnitude is the negative energy vector.</u> Also, please note that the first derivative with respect to time of the **A** vector is equal to a negative volt/meter which has the units of the electric **E** vector.

$$E_V := \frac{d}{dt_{LM}} \frac{(\mu_o \cdot q_o \cdot \lambda_{LM})}{4 \cdot \pi \cdot l_q \cdot t_{LM}} \qquad E_V = -4.87258742707 \times 10^{-12} \frac{V}{m} \qquad 7)$$

Note that **B** is the result of the derivative of **A** with respect to changing distance λ_{LM}.

$$B_I := \frac{d}{d\lambda_{LM}} \frac{(\mu_o \cdot q_o \cdot \lambda_{LM})}{4 \cdot \pi \cdot l_q \cdot t_{LM}} \qquad B_I = 5.70396642221 \times 10^{-11}\, tesla \qquad 8)$$

The result of a changing **A** field with respect to distance in eq. 8 above results in the magnetic flux density **B**. The product of $\mathbf{E_V}$ and $\mathbf{B_I}$ over μ_o is the poynting power.

$$S_{LM} := \left(\frac{1}{2\cdot\mu_o}\right)\cdot\begin{pmatrix} E_V \\ 0 \\ 0 \end{pmatrix} \times \begin{pmatrix} 0 \\ B_I \\ 0 \end{pmatrix} \qquad S_{LM} = \begin{pmatrix} 0.00000000000\times 10^{0} \\ 0.00000000000\times 10^{0} \\ -1.10585132041\times 10^{-16} \end{pmatrix} \frac{W}{m^2} \qquad 9)$$

The result in eq. 9 is the familiar poynting power vector expressed as the power per square meter related to the least quantum electrogravitational action due to eq. 7 and 8 above.

Thus it is immediately apparent that the **A** vector changing in time and distance generates the poynting power vector and thus the **A** vector is more fundamental than **E** or **B**. Further, the power is very small compared to ordinary communications levels and is not easily detectable, even at close range.

The vector magnetic potential **A** cannot be shielded against as was demonstrated on a quantum scale by the famous Aharonhov-Bohm experiment involving electron diffraction patterns changing in a modified two-slit experiment in spite of the **A** field originating **B** field being absent. This was by reason of niobium shielding in a special torus shape that confined the **B** field completely and thus isolated it from having any magnetic influence on the passing electrons. The **A** vector did cause the electron wavefunctions to be changed which effectively changed their momentum.

I propose that a torus wound coil (toroid) with an open air core be used to establish an **A** field axially which could be pointed at moving charges or ionized gas to see what type of effect the **A** vector may have on the moving charged particles. Ordinary current transformers may be suitable for this experiment. Perhaps an ordinary television screen could show some type of directional diffraction due to the action of the **A** vector. Shielding of various types could be employed to verify that the action is from the A vector and not caused by ordinary magnetic effects.

A summation of the material presented concerning the **A** vector is as follows: The S.I. units of the **A** vector are (volt*sec)/meter. The derivative with respect to time of the **A** vector is volt/meter, or **E**. Note that changing time is inversely proportional to changing frequency, with increasing frequency resulting in increasing **E**. If the **E** field increases, it will eventually become ionizing to the air and may produce a pink or purplish glow surrounding the field frequency changing device. If we allow a charge to be acted on by the **E** field, the units become (coulomb)*(volts/meter) which is energy per meter which is force in newtons. Thus, the **A** vector changing with time acts directly on charge to accelerate that charge by inducing a change in the wavefunction which is equivalant to force if the particle has mass.

Rotation is associated with the **A** vector since joules/meter is equivalent to kg*(velocity)^2 /meter which is the inertial force expression for a mass rotating about a point in space. Finally, my electrogravitational expression is newtons times the permeability of free space times newtons. Thus, the **A** vector changing with time becomes the fundamental force mechanism for electrogravitational propulsion as well as electrogravitational action. If we think about a tornado, the **A** and **E** vector is vertical with the rotation around that vector. Nature is thus a demonstrator of gravitational mechanics.

The Electrogravitational Wavefunction Solution

The formula for the rate of change of phase along a neutral particle path is given in the book, "The New Physics" on page 463 and is presented below.(Taylor, 1989a.)

$$\Delta\theta := \frac{h\cdot V_{LM}}{2\cdot\pi m_e} \qquad \Delta\theta = 9.88939924392\times 10^{-6}\,\frac{m^3}{s^2} \qquad 10)$$

Obviously, this is incorrect as stated and may be a misprint. The result should be expressed in radians and that is used as an exponent to the natural number e to create the wavefunction. The suggested correct formula is shown below in particular for the electrogravitational case.

$$\Delta\theta_n := \frac{h}{m_e \cdot V_{LM} \cdot \lambda_{LM}} \qquad \Delta\theta_n = 1.00000000000 \times 10^0$$ The answer is in radians. 11)

The above expression for the change in phase that is equal to $\Delta\theta_n$ is for a neutrally charged particle. An additional formula must be added to the above if we are dealing with a particle having charge. Thus is quoted from p. 469, eq. 17.16, (Taylor, 1989b) the below formula for the change of phase involving a charged particle such as the electron.

$$\Delta\theta_q := \frac{(2 \cdot \pi \cdot q_o \cdot \Phi_o)}{h} \qquad \Delta\theta_q = 3.14159263873 \times 10^0$$ which = π. 12)

This angle must be added to the neutral particle angle to arrive at the total angle in radians.

$$\Delta\theta_{nq} := \Delta\theta_n + \Delta\theta_q \qquad \Delta\theta_{nq} = 4.14159263873 \times 10^0$$ The answer is in radians. 13)

The answer in degrees for $\Delta\theta_{nq}$ is: $\Delta\theta_{nq} = 2.37295778662 \times 10^2 \text{ deg}$

The wavefunction ψ for the uncharged particle is derived as the natural number e raised to the power of $i\Delta\theta_n$ so as to arrive at a complex result, which is the nature of a quantum particle wavefunction.

$$\psi_{LMn} := e^{i \cdot \Delta\theta_n} \qquad \psi_{LMn} = 5.40302305868 \times 10^{-1} + 8.41470984808i \times 10^{-1}$$ 14)

Note: $\arg(\psi_{LMn}) = 5.72957795131 \times 10^1 \text{ deg}$ which is one radian.

The wavefunction ψ for the combined charged and neutral particle is derived as the natural number e raised to the power of $i\Delta\theta_{nq}$ so as to arrive at a complex result, which is also the nature of a quantum particle wavefunction.

$$\psi_{LMnq} := e^{i \cdot \Delta\theta_{nq}} \qquad \psi_{LMnq} = -5.40302318371 \times 10^{-1} - 8.41470976780i \times 10^{-1}$$ 15)

where, $\arg(\psi_{LMnq}) = -1.22704221338 \times 10^2 \text{ deg}$

It is of interest that adding the neutral wavefunction to the neutral plus charge wavefunction is an annihilation of both which suggests that the electrogravitational action may be the result of a charged particle to neutral plus charge particle action which could result in a zero energy result.
(Atkins, 1991a) states that "The time dependent Schrodinger equation is used to calculate the time evolution of a wavefunction. In many cases it is possible to separate the time dependence of a wavefunction from its spatial variation and to write the total wavefunction, Ψ, as a product of the spatial wavefunction, ψ, and a complex oscillating function of the form:

$$e^{\frac{-2 \cdot \pi i \cdot Et}{h}}$$ 16)

where E is the energy of the state." Therefore, the time dependent electrogravitational wavefunction is stated in the above format immediately below this sentence as:

$$\Psi_{LM} := \psi_{LMnq} \cdot e^{\frac{-(2\cdot\pi\cdot i\cdot W_{LM}\cdot t_{LM})}{h}} \qquad \Psi_{LM} = -5.40302323354\times 10^{-1} - 8.41470973580i\times 10^{-1} \qquad 17)$$

The time-dependent Schrodinger Equation is given by an example formula, (Atkins, 1991b), in his book's example in Box S.2 and is used as a guide for stating the electrogravitational Schrodinger equation below.

$$H\Psi = \left(i\cdot\frac{h}{2\cdot\pi}\right)\cdot\left(\frac{d}{dt_{LM}}\Psi_{LM}\right)$$ H is the Hamiltonian. 18)

or,

$$H\Psi := \left(i\cdot\frac{h}{2\cdot\pi}\right)\cdot\frac{d}{dt_{LM}}\left[\psi_{LMnq}\cdot e^{\frac{-(2\cdot\pi\cdot i\cdot W_{LM}\cdot t_{LM})}{h}}\right] \qquad 19)$$

$$H\Psi = 3.59162905512\times 10^{-33} + 5.59363057887i\times 10^{-33}\,J \qquad 20)$$

$$f_{real} := \frac{Re(H\Psi)}{h} \qquad 21)$$

$f_{real} = 5.42044692234\times 10^{0}\,Hz$ = Acoustic frequency?

$$f_{imag} := \frac{Im(H\Psi)}{h}$$

$f_{imag} = 8.44184552209\times 10^{0}\,Hz$ = Electric field frequency? 22)

Note: The acoustic frequency may be associated to physical motion while the electric frequency may be associated with the electric field frequency. This is on the complex Argand diagram.

$arg(H\Psi) = 9.99999979219\times 10^{-1}$ = angle in radians

$|H\Psi| = 6.64744329216\times 10^{-33}\,J$ = absolute value in joules which agrees with the postulated value of electrogravitational energy.

Note that:

$W_{LM} = -6.64744329216\times 10^{-33}\,J$

If we take the square root of the sum of the squares of hf_{real} and hf_{imag}, we arrive at the apparent energy which is equal to $hf_{LM} = W_{LM}$.

$$hf_a := \sqrt{(h\cdot f_{real})^2 + (h\cdot f_{imag})^2} \qquad hf_a = 6.64744329216\times 10^{-33}\,J \qquad 23)$$

Then a quantum frequency equal to f_a at the angle of one radian is equivalent to what constitutes the energy in the quantum electrogravitational energy loss. I have previously postulated that it is energy loss that is responsible for gravitational action. To be more precise, it can be equivalent to the slight frequency difference caused by spreading between energy states of a superposition of wavefunctions.

The following is quoted from (Atkins 1991c), "A wavepacket is a superposition of wavefunctions that is usually strongly peaked in one region of space and virtually zero elsewhere. (Fig. W.6). The peak of the wavepacket denotes the most likely location of the particle; it occurs where the contributing wavefunctions are in phase and interfere constructively. Elsewhere, the wavefunctions interfere destructively, and the net amplitude of the wavepacket is small or zero.

A wavepacket moves because all the component functions change at different rates, and at different times the point of maximum constructive interference is in different locations. The motion of the wave packet corresponds very closely to the motion predicted for a classical particle in the same potential. An important difference from classical physics is that the wavepacket spreads with time, but this tendency is very small for massive, slow particles. -Unquote.

Please note that in the above quote, the reference to (Fig. W.6) is in the book by Atkins and is not reproduced here. It portrays a single cycle of amplitude above a zero line which is where the frequency components add constructively and this amplitude moves through space as a function of time and frequency difference.

I propose that the frequency difference is very small as to the frequency separation caused by spreading, approximately 10 cycles out of 1^20 cycles per second. This causes particle motion which results in the gravitational action. The action is instantaneous through non-local energy space while the reaction is in observable local space. The carrier of the non-local instantaneous action is the wavefunction similar to the de Broglie pilot wave and the reaction is the net observable local space result. The Schrodinger wave equation does not describe an ordinary electromagnetic wave but a probability wave, and the probability wave determines all of the action and reaction of the total electrogravitational interaction.

In conclusion, I feel that including the wavefunction section below the vector magnetic presentation is necessary. If we expect to derive and utilize a new and useful force/energy field, we must consider the quantum aspect of what makes up current flow and basic particle motion. This requires a contemporary math approach and as a result, cannot be avoided.

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