GRAVITY MAGNETISM AND LIGHT
Polarized and Oscillating Charge
Inside Atomic Nuclei
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GRAVITY MAGNETISM AND LIGHT

Polarized charge inside atomic nuclei and inside electrons are shown to account for the magnetism of current carrying wires and the magnetic and gravitational fields of the Earth. This subnuclear charge polarization mechanism to explain gravity and magnetism is extended to the Moon, Sun and other stars and galactic centers. The electric dipoles produced in each proton are perpendicular to the tangential force associated with the spin and orbital velocity of the celestial body of which it is a part.

That is the dipoles are radially and longitudinally oriented. The length of the dipoles involved in any force between two dipoles are proportional to the distance between the two dipoles involved. A unique average dipole can be associated with each proton but the net force on the dipole results from the superposition of all pairwise forces. The dipole length cannot exceed the distance between immediately surrounding nuclei.

For example, the force between a dipole in a proton on the Earth's surface and all the $N \approx 10^{51}$ protons/neutrons in the Earth, or at least half of those that are partly similarly oriented, concentrated at a point near the center, R meters away, can be represented as the force between N dipoles, qeRs, and one dipole, qeRs, such that this dipole -dipole force $9\times10^{9} Nq^{2}e^{2}R^{2}s^{2}/R^{4}$ equals the Newtonian force, GMm/R². So, $s^{2} = .37\times10^{-42}, and, s = .6\times10^{-21}, and, Rs = 3.82\times10^{-15} meters$. We assume, $q \approx .918\times10^{3}$ based on the proton electron mass ratio.

Oscillations of charge inside electrons and atomic nuclei are shown to account for the propagation delay of electromagnetic radiation; that is, the time before a light signal or radio signal becomes detectable at a radio antenna or a light detector, eg, the eye, a charge coupled device, a photodiode etc.. Light speed measurements over large distances, which would seem to indicate otherwise, are shown to be calibrations.

That is, delay times of about 66 milliseconds in the case of the GPS system are shown to be calibrations to the distances known from Newtonian position calculations and Doppler measurements of the orbiting satellites. Similarly radar or lidar reflections after 2.5 seconds from the moon or radar reflections after 283 to 449 seconds from Venus. In the case of the moon, the radio communication delay from the moon should be 1.25 seconds if there were no electronic and needed redundancy delay. The redundancy delay is equal to or greater than the light speed delay here and in transmissions between Earth and more distant space craft. In the case of both the Moon and Venus, each radar pulse transmission occurs and then the transmitter is turned off and then the receiver is turned on at the expected time of reception. Or if a different receiver receives a train of returns, they are associated with transmissions at times predicted from Newtonian calibrations.

In the case of Bradley's stellar aberration measurement, what is measured is not light speed but the delay of reception of secondary scattering from objective lenses at various telescope lengths to the eyepiece relative to the orbital movement of the Earth during the same time. Similarly, Doppler shift is reception delay relative to the rate of change in emitter receiver distance. Light speed is not explicitly measured. Roemer's measurement is shown to be due to changes in the relative orientation of Jupiter's moons and the Earth.

INTRODUCTION:

We first show that the magnetic attraction between parallel wires a few centimeters apart is due to numerous small transverse electrostatic dipoles in the longitudinally moving electrons and the lattice nuclei of the parallel current carrying wires. And that the transverse dipole fields of one wire inhibit the dipoles produced in the other wire so that as the wires are moved further apart the magnitudes of the dipoles increase. In this way the inverse fourth power dipole force reduces to the observed force between the wires which varies inversely as the distance between them.

We then show that 10^{-56} kg. orbiting negatively charged particles around positively charged cores are excited into ellipses to produce a displacement of centers of opposite charge inside the Angstrom diameter electron and atomic nuclei. That is, sustained fields in the wires, that drive the current of free electrons, can account for these electrostatic dipoles. The ellipses and dipoles so formed are transverse to the longitudinal free electron movement. .

The fact that the 10^{-56} kg orbiting particles must be moving faster than the speed of light is explained by considering similar larger forces that produce the ejection of electrons from radioactive nuclei at different high velocities. The apparently greater mass of the slightly faster electrons, at speeds nearer and nearer to the speed of light is shown to be due to the elasticity of these orbital systems which becomes non linear as the elasticity limit is approached. That is, the responsiveness of a fast moving electron to an applied magnetic and electrostatic field through which it moves, is less than expected at greater velocities. The electrostatic dipoles inside the electron do not increase in proportion to the electron velocity or to the field producing the velocity, as they did at lower velocities.

Thus mass does not increase with velocity. Thus orbital systems inside electrons and inside atomic nuclei involving superluminal velocities of the orbiting charged particles are possible. Ironically, such superluminal orbital systems explain why superluminal velocities are possible and why mass does not limitlessly increase with velocity.

The implications of this simple mechanism are many. From a simple, miniscule mechanism, it is possible to explain the magnetic fields and gravitational fields of the planets and Sun and stars and the Galactic centers, involving distances of 10^{20} meters and more.

The mechanism of charge polarization inside electrons and atomic nuclei also explains the delay in electromagnetic radiation in terms of oscillations of charge inside atomic nuclei before oscillations of charge inside molecules or inside radio antennas are detectable. Measurements of light delay at greater distances, for example the GPS system are not so much measurements as calibrations consistent with distances as determined by

basic Newtonian mechanics.

Also the dipole mechanism explains without recourse to General or Specific Relativity, various experiments and observations, such as the bending of light supposedly by the gravitational field of the Earth, the apparent increase of decay time of faster moving muons, the Michelson Morely experiment etc...

The paper is divided into the following sections: 1)IS MAGNETISM ULTIMATELY ELECTROSTATIC? 2)IS GRAVITY ULTIMATELY ELECTROSTATIC?
3)ZOLLNER, BLACKETT,AND WESSON
4)RELATIVITY AND CHARGE POLARIZATION INSIDE ATOMIC NUCLEI
5)DIAMAGNETISM AND FERROMAGNETISM
6)LIGHT SPEED & OSCILLATING CHARGE INSIDE ELECTRONS AND ATOMIC NUCLEI
7)LIGHT EMISSION AND RECEPTION
8)RADIO RECEPTION
9)LIGHT SPEED MEASUREMENTS

IS MAGNETISM ULTIMATELY ELECTROSTATIC?

Years of evidence for charge polarization inside electrons and atomic nuclei, from high energy collision data, permit the hypothesis that electrostatic dipoles inside atomic nuclei can account for the magnetism of current carrying wires.

For example: “Moreover nuclear charge polarization occurs[in protons] during the fission process.” ref 1. Another example is the detection of a repulsion between a current carrying wire and a charged foil opposite to the statically induced attraction when the current was in a specific direction. ref 11.

As parallel current carrying wires are drawn further apart, the force between them, whether attraction or repulsion, decreases as the reciprocal of the distance. If we consider parallel infinitesimal segments of wire, and assume the force between them decreases in proportion to the reciprocal of the distance squared , then for wires of various finite lengths the force between them should be inversely proportional to the distance between them- the observed force. Ampere was the first to demonstrate this.

But you say, the force between electrostatic dipoles decreases as an inverse fourth power of distance, how can this cause an inverse square force for infinitesimal or Angstrom long segments? The answer is that the electrostatic dipoles increase in proportion to the distance between them. That is, attractively oriented collinear electrostatic dipoles transverse to a pair of attractive parallel current carrying segments interfere with each other less as they are drawn further apart. Thus the inverse fourth power electrostatic dipole force reduces to an inverse square force for infinitesimal

segments of parallel wires – which, after integration, reduces further to the observed force between parallel current carrying wires, of finite lengths, inversely proportional to the distance between them.

We can represent this mathematically as follows:

$$F = -9(10^9)(rnAev/c)(rnAev*/c)dsds*/r^4$$
$$= -10^{-7} ii*dsds*/r^2$$

The currents per unit length are, i, and $i*$ equal to the number of electrons, n, per unit volume, times A the cross section area of the wire, times v or $v*$, the drift velocities of the electrons in the wires in the direction of currents. The drift velocity is $v = eEt/m$ along the length of the wire, as E acts for the times between thermal collisions every $t = 2(10^{-14})$ seconds for copper and c is $\sqrt{3}$ times the speed of light, and e and m are the charge and mass of the electron. The collinear electrostatic dipoles per unit length associated with the parallel currents are $(rnAev/c) and (rnAev*/c)$. The negative sign indicates the parallel currents are in the same direction and so, like the collinear dipoles, are attractively oriented.

But you say, the electrostatic dipole model of magnetism seems to contradict the evident transparency of metals to magnetic fields though not to electrostatic fields! Not at all! The reason essentially is because the electrostatic dipoles, are very numerous and very small.

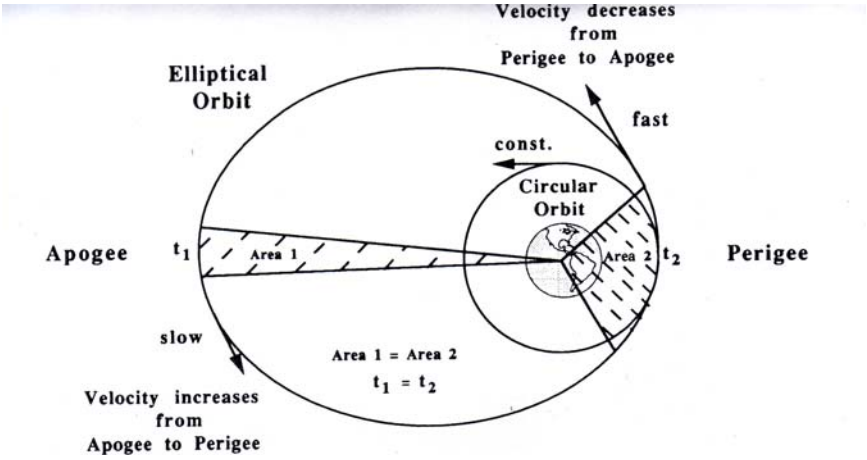
Consider a specific example: two parallel current carrying wires, 2.58mm diameter, one on either side of, and, 1 mm of insulation from, an equally long, 2mm thick, 10mm wide metal strip not carrying current. The proposed maximal co-linear electrostatic dipole lengths 'inside' nuclei, are .1 Angstrom and are oriented in the same direction. The dipoles in each wire when the currents are in the same direction, produce a small displacement of charge in the non current carrying strip between the wires that produces a displacement of electrons and positive lattice nuclei in this strip, in effect dipoles oriented in the same way as the dipoles in the wires. (note the dipole to point charge forces producing this displacement varies inversely as the distance cubed, much weaker than the inverse distance force between our dipoles)

Thus the pulling of the wires toward each other , due to the inversely- proportional- to-distance, force, is slightly increased. If the currents in the wires are in opposite directions, they produce nearly equal forces in opposite directions on the metal strip between them. and so little net displacement of charge in the metal strip. The only noticeable force is the inverse distance force between dipoles. Thus there is no electrostatic shielding effect in either case- as we readily observe with magnets placed on opposite sides of a sheet of aluminum etc..

In ferromagnetic materials etc, the magnetic field of electron spin and the magnetic field of an orbiting charge are in combination attributable to an electrostatic dipole inside

the electron in two mutually perpendicular directions transverse to, and perpendicular to, its motion. More on ferromagnetism and diamagnetism vis a vis electrostatic dipoles below.

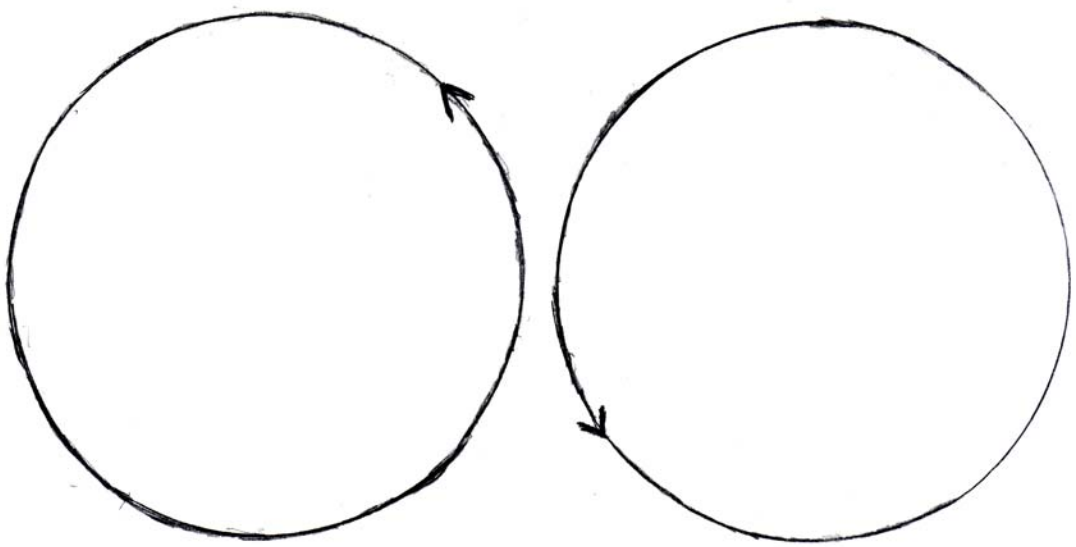
How does the polarization inside atomic nuclei (and inside electrons) come about? We could have an orbiting charged particle within the nuclei and free electrons of radius $R=10^{-15}$ meters approximately, that is, of very small mass, m*, and such that when added to the central mass and charge, the total charge and mass of the electron and of the nucleus are as observed. When the sustained field, E, acts on the free electrons, it also acts on the orbiting charge inside the free electrons and inside the lattice nuclei. The result is an increase in the interior orbital charge velocity analogous to the engine burn of a rocket moved from a circular to an elliptical orbit.



Also we require that free electrons have an orbiting charged particle of charge, say $-2e$, and larger mass core of charge, $+e$, and that the lattice nuclei have orbiting charged particles of charge, $-e$ and a larger mass core of $+2e$, inside the atomic nuclei. That is, the field causing an elliptization of the negative orbital charge and so a polarization of negative charge, in a specific direction will produce the same polarization direction inside the nucleus and inside the free electron.

Also an atomic nucleus and an inner orbital electron repel each other if their orbiting negative charges are close enough. Thus the electron orbit in hydrogen cannot become smaller than the half Angstrom ground orbit radius, with the negative orbiting charge around the electron being repelled by the negative orbiting charge around the nucleus.

And so the mystery of why the orbiting electron does not fall into the nucleus is partially explained. The other aspect of the mystery, why the electron velocity does not slow to a stop, as its energy is radiated away, is explained by the dynamic cooperation of adjacent atoms. That is, the timing of adjacent orbital electrons is, half of the time, to oppose their orbital motion and half of the time to reinforce their orbital motion.



The orbital electrons, at the arrow points in the above diagram, are reinforcing their orbital motions but just prior to this they were opposing each other's orbital motions.

Of course such a model assumes particles moving at supposedly impossible speeds inside electrons and inside atomic nuclei. The answer to this is not "Tachyons". Rather it is that the apparent mass increase of Beta electrons to infinity as the speed of light is approached, is due to a decreasing rate of increase of the electrostatic dipoles inside the speeding electrons. In the early 1900s, Kaufmann showed the trajectories of the slightly faster high speed electrons ejected by radium nuclei moved more slowly than expected. The electron trajectories showed a decreasing rate of increase of the response of faster electrons to a magnetic field and to an electrostatic field through which they moved

From (1)the roughly 10^{-15} meter radius,R, of the nucleus and of the electron and (2) The equal sustained fields, E, producing equal currents in parallel wires r meters apart producing dipoles proportional to the distance apart and to the current, $rneAv/c$ -and so to, E:

We can infer the mass, $m^* = 10^{-56}$ kg, of the orbiting charge and the eccentricity, ε, of the orbit needed to produce these dipole lengths, $rv/c = \varepsilon/(1-\varepsilon)$ times 10^{-15} meters where ε <.99999 so $rv/c < 10^{-10}$ meters. The argument is as follows:

The centripetal acceleration of our proposed hypothetical system inside the electron and inside the nucleus is

$m^* v_0^2 / R = 9 \times (10^9) \times 2e^2 / R^2$ implies

$$v_0 = [9\times(10^9)\times 2e^2/Rm^*]^{1/2} = [(9)\times(2)\times(2.56)]^{1/2}\times(10^{(9-38+15)/2}) = (6.62)\times(10^{-7})/m^{*1/2}$$

Is there another relation which would help in determining, m*? In the time between collisions, 10^{-14} seconds, the sustained electric field,E, in the wire that produces the drift velocity of the electrons also produces a transverse ellipse of eccentricity, ε, of the orbital charge inside the atomic nuclei and inside the free electrons. The increase in orbital velocity required for an ellipse of eccentricity ε, is

$$eEt/m^* = v_1 - v_0$$

$$= (1+\varepsilon)^{1/2}v_0 - v_0 = (1+\varepsilon/2)v_0 - v_0 = v_0\varepsilon/2 = (\varepsilon/2)\times(6.62)\times(10^{-7})/m^{*1/2}$$

This follows from the general equation for an orbiting charged mass around an oppositely charged mass,

$$(m\rho^2)(v_0{}^2/k\rho) = 1+\varepsilon\cos\alpha$$

where $k = 9\times(10^9)e^{2\cdot}$ and ρ is the distance from a stationary central charged particle to a moving charged mass, m, etc..

And what also follows is that the distance between the center of charge of the small orbiting mass,m*, and the position of the core mass of opposite charge of twice the magnitude can be written in terms of the eccentricity as, $R\varepsilon/(1-\varepsilon)$, where we assume, R=$10^{-15}$ meters.

Thus we can determine the hypothetical orbiting mass, m*, from the electric field E associated with a specific current carrying wire parallel to another such wire at a specific distance and experiencing an attractive force proportional to the currents,

$$F = -9\times(10^9)\times(rnAev/c)(rnAev^*/c)dsds^*/r^4$$

$$= -10^{-7}ii^*dsds^*/r^2$$

For example, suppose our parallel wires are r=2cm apart, of copper with a 2mm diameter carrying a current of one Amp so A=(3.14) × (1^2) × (10^{-3})^2 and, following the standard free electron model of current,

$$1 = nAev = (8.47)\times(3.14)\times(1.6)\times(10^{28-6-19})(v) = 4.255\times(10^4)(v)$$

so $v = (2.35)\times10^{-5}$ meters per second,

$$v = eEt/m = (2)\times(1.6)\times(10^{-19})\times(E)\times(10^{-14})/(9)\times(10^{-31})$$

if $t = 2\times(10^{-14})$ seconds, then the resistivity of copper is as observed, $\rho = m_e/ne^2t$

Thus $E = 9\times(2.35)\times(10^{-31=5})/[(3.2)\times(10^{33})] = 6.6\times(10^{-3})V/meter$

(If E and so v increases, the time between collisions, t, becomes smaller and E, must increase more to maintain a specific, v, value unless the wire burns or breaks.) The

electrostatic dipole moment is
$rv/c = (2.35/\sqrt{3})(10^{-15})meters = R\varepsilon/(1-\varepsilon) = (10^{-15})\varepsilon/(1-\varepsilon)$
implying that $\varepsilon/(1\text{-}\varepsilon) \approx 2.35$; so by trial and error .9/.1 = 9 and .8/.2 = 4 and .7/.3 =2.33 so ε = .7 approximately when $E=6.6\times(10^3)$ V/meter.(If rv/c is much smaller, for example, 10^{-18} meters then ε/(1-ε) is .001 about so ε= .001/.999 = .001001 . Therefore $eEt/m^{\circ} = (\varepsilon/2)v_0$ is much smaller and so E is about .007 times the previous value of E, namely, $46.2\times(10^{-6})\ V/meter$.

Note a larger value of separation, r, would imply a larger dipole for the same, v, and E, due to a lack of interference from the transverse dipole field of the other wire. If the dipole moment (length), rv/c was 10^{-10} meters say, then ε = .99999 with $\varepsilon/(1\text{-}\varepsilon) = 10^5$ = .99999/.00001

This could also happen with drift velocity, v= 1 meter/sec and $r=10^{-2}$ meters, so rv/c = 10^{-10} meters would mean, $E = 10^2 V/meter$ and the current would be 100 megaAmps and the millimeter radius wire would break. But if the electron were moving in low pressure gas, the density of electrons and current and time between collisions would be less. For example suppose $E = 10^4\ V/meter$ and we have a proton whose initial radius is 10^{-15} but is subject to this field for 10^{-7} seconds before a collision.

Thus the dipole could be fairly large with a small or medium E field and an average drift velocity small enough so as not to break the wire. The value of, ε, might be slightly larger say .999 instead of .7. This suggests a maximum value of E of about $1 V/meter$ for this velocity, v, in this wire and that our estimate of, m*, based on our example is reasonable although it could be one or two order of magnitudes greater or less.

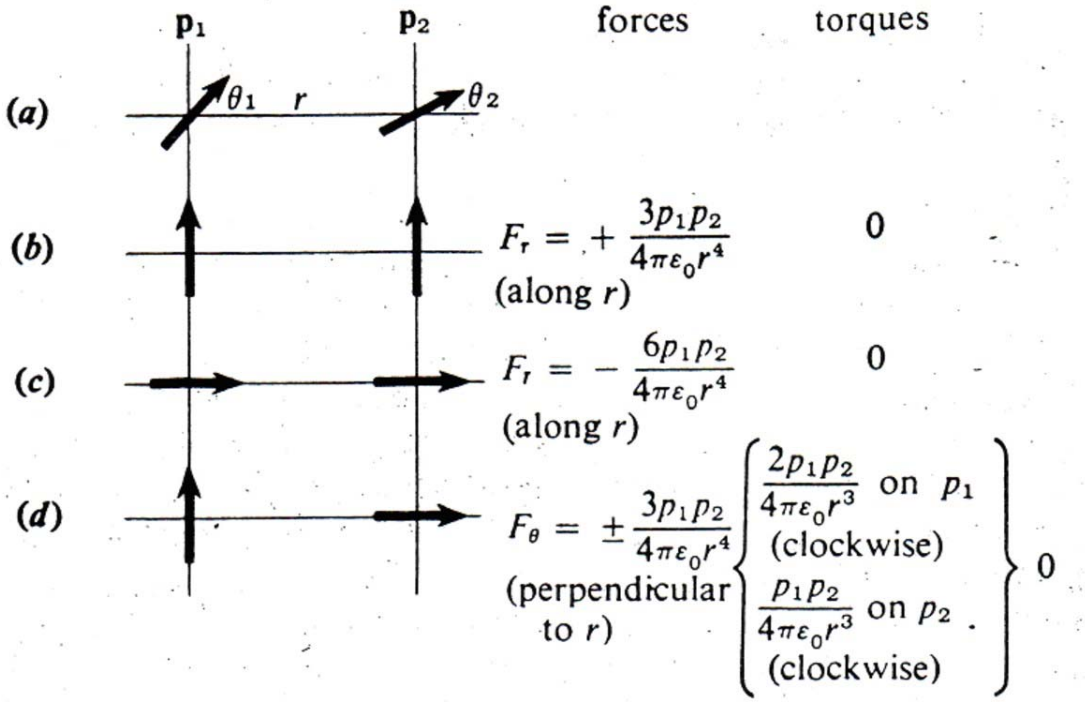
Since, from above, $v_0 = (6.62)\times(10^{-7})/\sqrt{m^*}$, we can solve for m*:
$eEt/m^* = (\varepsilon/2)\times(6.62)\times(10^{-7})/\sqrt{m^*}$
so $eEt = (\varepsilon/2)\times(6.62)\times(10^{-7})\sqrt{m^*}$,
so $\sqrt{m^*} = (1.6)\times(6.62)\times(2)\times10^{-19-3-14}/[(.7/2)\times(6.62)\times10^{-7}]$

$= 9.11\times(10^{-29})$, so $m^* = 10^{-56}$ kg approximately. So $v_0 = (6.62)\times(10^{-7})/\sqrt{m^*} = 10^{21}$ meters/second, and the frequency, $f_0 = 10^{21-(-15)} = 10^{36}$ approximately.

Note that there is a second transverse dipole perpendicular to both the first transverse dipole and to the longitudinal current, but the repulsion between two similarly oriented such dipoles that are parallel to each other, is half as great as the dipole attraction of collinear dipoles and so there is a net attraction. See W.J. Duffin's exceptionally lucid textbook, Electricity and Magnetism, ref2

The following diagram from his book shows the forces and torques between dipoles. One must imagine wavy arrows perpendicular to the dipole arrows to be collinear or parallel current carrying wire segments,ds, to see the forces between current carrying

segments forming dipoles per unit length: (kr/c) × (nAev) where nAev is the current per unit segment ds:



Since r in such tests is typically a few centimeters and v is typically 10^{-5} to 10^{-3} meters/second, the dipole length, rv/c, is about 10^{-15} to 10^{-13} meters, roughly the diameter of an atomic nucleus to within the 1 to .1 Angstrom diameter of the inner shell of electrons.

But as the distance between parallel wires increases, the transverse dipole forces from each upon the other decrease and so the dipole per unit length, rv/c can increase-at least until other such forces and local forces prevent further expansion of the dipoles beyond about .1 Angstrom. In these cases the dipoles are krv/c where k is less than one.

The transverse dipole field produced by a combination of such dipoles in one wire or a filament in the same wire, makes the transverse elliptical dipoles, formed in a second, parallel wire or filament, revert to a wider circular, less elliptical, smaller dipole, shape,

Just as the greater transverse elliptical extension of the transverse dipoles, associated with a greater voltage difference and current, implies an increase of thermal collisions and an increase of thermal resistance, the greater longitudinal as well as elliptical extension implies an even lesser time between electron ion collisions.

The result is a reduced current for the given voltage difference. The ammeter measured "magnetic" transverse electrostatic effect of the current, before an increase in the independently measured ambient magnetic field, is diminished by the smaller transverse electrostatic dipoles as well as the greater thermal resistance effect of a shorter time between electron - ion collisions. Thus the reduction in ammeter measured current when an ambient magnetic field is introduced can be attributed to both of these effects.

The current and electron velocity, v, we measure is the net result of the longitudinal field, E, the electron's mass, m, and the combined effect of these transverse dipoles and forces in reducing the times between collisions, t, as well as the transverse dipole field that is a measure of the current.

Thus if we consider three parallel current carrying wires, the different dipoles associated with any of the three pairwise interactions are added together by the principle of electrostatic superposition to give three unique dipoles at each of these locations and at any other location a unique force.

Thus we can account for the so called magnetic force between parallel(or otherwise oriented) current carrying wires and the Pinch Effect of streams of electrons in a plasma as the electrostatic force between electrostatic dipoles inside the lattice nuclei of the wires or the electrons in the plasma. At least until rv/c is no larger than the average distance between surrounding particles, eg less than one or one tenth Angstrom inside a wire but larger in a plasma as indicated by the average distance between electrons and ions at atmospheric pressure or lower pressures.

Considering the force which produces elliptization of the orbital charge inside nuclei, assuming the different values of R observed, we find a relation between R and the so called speed of light. We take into account the central force projected on the X axis which acts half of the time in the same direction, half the time in the opposite direction as the exterior force (assumed to be acting along the X axis); thus:

$F = qE \pm [(9) \times (10^9) \times (2q^2)]/R^2$ $F = qE \pm [(9)\times(10^9)\times(2q^2)]/R^2$

$(F)(x/R) = qE \pm ([(9)\times(2)\times(2.56)]/2.486^3)\times(10^{(9-38+30+15)})x \approx qE \pm c^2 x,$

$q \approx (1.6)\times(10^{-19}), R = (2.486)\times 10^{-15}$

That is, the speed of light squared is the elasticity of charge polarization inside atomic nuclei or inside electrons- if the radius of orbiting charge inside the proton or the electron is exactly R=2.486 femtometers! That is, the speed of light squared is a function of the electron radius and charge and the electrostatic force constant, $(9)\times(10^9)$. Note that the general equation for an elastic system is –kx = mx"(t) which has the general solution:

$x=A\cos(2\pi ft)$ where $(2\pi f)^2 = k/m$. Here, m, is $m^* \approx 10^{-56}$ kg and $k=c^2$

So $v_0 = (6.62) \times (10^{-7})/\sqrt{m^*} = 10^{21}$ meters/second, and the frequency,

$f_0 = 10^{21-(-15)} = 10^{36}$ approximately. So we see that the speed of light squared is also the product of the mass of the orbital particle inside atomic nuclei and inside electrons times the square of this orbital frequency.

This orbital radius is in the neighborhood of both the electron radius estimated from Xray scattering, 2.8fm, and the radius of the copper nucleus, 4.7fm estimated from nucleus-neutron scattering and the estimation formula , $R = 1.1\times 10^{-15} \times \sqrt[3]{A}$ where A is the atomic mass number. Some high energy electron electron scattering experiments show Coulomb repulsion at separations of $.2\times (10^{-15})$ meters. If the electron's rest mass, $9.11\times (10^{-30})$kg, is completely convertible into potential energy, $((9) \times (10^9) \times e^2)/R$, then we obtain the classical electron radius,

$R = ((9)\times(10^9)\times e^2)/mc^2 = \quad (2.824) \times 10^{-15}$ meters.

Considering all of these nearly equal possible values for the orbital radius of an actual orbiting mass inside the electron or inside the nucleus of a conductor, we will use, the value, $R=2.48\times (10^{-15})$., that makes the elasticity of the orbit equal to the square root of the ratio of, the electric force between unit charges, to, the magnetic force between unit currents, the so called, speed of light..

The variation in the experimental values is evidence for an orbital system electron and nucleus in preference to a billiard ball or infinitesimal point charge electron etc.. It is also evidence of a relation between oscillating charge inside the nucleus and the so called speed of light.

We consider later in discussing radio transmission, the interaction between a pair of parallel oscillating current carrying wires where the current in one wire is much weaker; e.g., milliamps to picoamps and the values of, r, may be meters to kilometers to hundreds of kilometers and more. Thus the transverse dipole expansion in the weaker current wire is inhibited initially by the transverse dipole field from the other wire and the effect of the surrounding orbital electrons in the weaker current wire is effective in reducing the dipole expansion from what it would be otherwise, in the receiver wire.

The average or root mean square oscillating dipoles inside atomic nuclei in these parallel oscillating currents could be rv/c per unit length but due to the local effects of the surrounding orbital electrons for large values of v, and r, rv/c may be larger than .1 Angstrom and not permitted. We may have krv/c = .1 Angstrom where $k \le 1$ For example, $r = 10^{18}$ meters and $v=10^{-6}$ meters/second, when the oscillation becomes detectable in the receiver, makes krv/c about k times 10^{18-6-8} , so k must be 10^{-15} or less so that $krv/c = 10^{-11}$. That is, the radiation is received, not after $r/c = 10^{10}$ seconds but after $kr/c = 10^{-15+18-8}$ or 10^{-5} seconds. This received radiation consists of oscillations of rms amplitude, krv/c, equal to about .1 Angstrom, the upper limit. If the distance from the source, r, is increased, then, krv/c will become .1 Angstrom sooner and detectable sooner than $kr/c = 10^{-5}$ seconds.

Consider a much closer and much weaker radiation source, $r= 10^1$ that produces a detectable oscillation in the receiver of root mean squared velocity, v meters/second, such

that rv/c is at most .1 Angstrom. That is, v, can be as large as 10^{-4} meters per second after 10^{1-8} or 10^{-7} seconds.

Thus, the increasing amplitude of oscillating dipoles, $A(t)\cos 2\pi ft$, $A(t) = \mathrm{QD(t)}$ inside the lattice nuclei of receiving antenna wires and of molecules of semiconductors and of cells of the eye precede the detectable oscillation of free electrons in the receiving antenna or the excitation of bound electrons from molecules of the eye or of a photodiode or CCD array of pixels or other photoemissive surface.

The delay before radiation is detectable at a distance r, from the source for large enough r- when the intensity at the receiver is sufficiently weak-after r/c seconds- can be kr/c seconds, where k is smaller than 1. Below we show that the supposed evidence for light speed of 186,283 miles per second at distances beyond 200 miles is not as unambiguous as commonly believed.

For example radar reflections from the moon and planets from a continually sending and receiving transceiver could be radar returns from emissions just before reception having been emitted much later than the supposed emissions. The GPS satellites at distances of 12000 miles produce weak signals at the receivers. The strength of the signals can be calibrated to produce delays calculated from the known distances of satellites from fixed GPS receivers and the assumed speed of light. Then the matching of repeated millisecond long codes with a replica code in the receiver so that differences in distance of up to only 180 miles can be detected, can be used to determine the delay to the remote satellites.

Why does such charge polarization with its magnetic effects not occur in dielectric strips subject to an electric field? Because the loosely bound electrons around atomic nuclei in these dielectrics, redistribute themselves, to cancel the effects of the outside electric field on the central nuclei. The dielectric as a whole becomes polarized opposite to the applied field.

But if the applied field is constantly changing, then the nuclei of dielectrics have a chance to respond to the applied field before the surrounding electrons can completely cancel the changing applied field. The result of each change in force will be a small amount of charge polarization transverse to the force or force change.

This in fact happens all the time as the Earth spins. As the Earth spins on its axis (.465m./s. and orbits the Sun, (29.9m./s.) at a distance on the order of 10^{11} meters and with the Sun orbits the Galactic center 10^{20} meters away at (220m./s.) etc, the motion of the Earth's atoms implies constantly changing forces.

These mechanical forces were initially ultimately electrical on the Earth's major dielectric atoms, eg, silica, and oxygen, and so produced a small amount of charge polarization in these atomic nuclei each time the tangential velocity changes direction. (That mechanical,contact forces are ultimately electrical, is seen from the example of two colliding billiard balls and the electrical nature of the constituent atoms.)

As the Earth turns, the centripetal force due to the initially created radial collinear dipoles that attract each other is at any point , perpendicular to a tangent line which itelf is at a slight angle to a subsequent tangent line and thus has a non zero component projection on this subsequent tangent line. And this tangential dipole force produces radial oriented dipoles along a subsequent radial line from the Earth's center to this subsequent tangent line. And in this way the radial and longitudinal dipoles are sustained.

Another possible mechanism to account for the radially and longitudinally oriented dipoles: The initial force that caused the rotation and after, sustained by inertia, was tangential along a west to east line of latitude and thus perpendicular to a radial line to the Earth's center and to a north south or longitudinal line. The radial and longitudinal dipoles initially produced, cause collinear attraction along radial and longitudinal lines etc and in combination, produce forces on protons initially without dipoles, that cause dipoles transverse to the radial dipoles and transverse to the longitudinal dipoles. That is new radial, longitudinal and latitudinal or tangential dipoles are continually produced.

Thus it is possible that an uncancelled electric field, E_{rot}, exists inside the average dielectric atom of average duration, τ, and due to this time limitation and not just to surrounding electrical forces, produces an elliptical extension of orbital charge inside the protons of eccentricity, ε. The increase in orbital velocity from $v_0 = [(9\times(10^9)\times 2e^2)/Rm^*]^{1/2} = 10^{21}$ is $eE_{rot}\tau/m^* = eE_{rot}\tau/10^{-56} = (\varepsilon/2)v_0$. and the dipole produced is, $R\varepsilon/(1-\varepsilon)$ where $\varepsilon = 2v_0E_{rot}\tau/m^*$ where $v_0 = [(9\times(10^9)\times 2e^2)/Rm^*]^{1/2}$ and $m^*=10^{-56}$.

For example, if the produced dipole length is $s=10^{-18}$, then $R\varepsilon/(1-\varepsilon) = 10^{-18}$, so with. $R = 10^{-15}, \varepsilon \approx 10^{-3}$. is the eccentricity.

The electrical force and duration, $eE_{rot}\tau$, producing dipoles is proportional to the force or torque that produced the spin angular momentum of the Earth: $eE_{rot} = KM_E v_{rot}^2/r_E$ where $M_E = [5.98\times(10^{24}]$ and $v_{rot}^2/r_E = [465]^2/[(6.37)\times(10^6)]$. So $E_{rot}\tau = 2.03\times(10^4)$K volts/meter times τ. The duration may be inversely proportional to the 24 hour period as a measure of how rapidly the tangent lines change direction.

The net result is the existence of co-linear similarly and so attractively oriented electrostatic dipoles along the Earth's radii and along lines of longitude with parallel longitudinal dipoles repelling.

Thus a magnetized steel compass needle is pulled downward and made to line up with lines of longitude. The Earth's magnetic field and that of other planets is thus accounted for. The Earth's magnetic field is just the Earth's Gravitational field measured by magnetic measuring instruments. The slight difference in the pattern of relative strengths of Gravitational and Magnetic fields over the Earth's surface is attributable to the

susceptibility of such instruments to the unequal distribution of iron, cobalt and nickel beneath the Earth's surface(but above the unmagnetizable molten core etc..).

IS GRAVITY ULTIMATELY ELECTROSTATIC?

Thus the Gravitational force of the Earth on terrestrial objects is attributable to charge polarization inside their atomic nuclei transverse to the direction of the Earth's spin, ie along an Earth's radius and along a line of longitude. Similarly for the Sun on planets and Galactic center to the Sun. Etc..

The inverse square Gravitational force is equivalent to an inverse fourth power electrostatic dipole-dipole force if the dipoles in any pairwise interaction are proportional also to the distance between the dipoles. Thus adjacent objects along a radius toward the Earth's center, attract. Objects on adjacent longitudes repel because of the repelling parallel dipoles while objects on the same longitude or north south line tend to attract. But the total force on any object is the sum total of all such pairwise forces. The influence of more distant dipoles on any given dipole is obviously less than the nearer dipoles and the expansion of the dipole lengths, rs at increasing distance, r, is subject to the restriction that, rs, is less than the distance between atoms or, in a plasma, between ions and electrons. The poles of each dipole are -qe and +(q-1)e

Thus $9\times(10^9)$ times, $qers$, times, $N_E qers$, divided by r^4 is the force between a radially oriented dipole on the surface of the Earth and all of the N_E dipoles of the earth, some of which attract and some of which repel the surface proton dipole, can be represented by a net average dipole that produces the same force as the Newtonian force directed toward the Earth's center. Of course, the nearer dipoles along the same radial line have a greater influence than the more distant dipoles at greater angles to the surface dipole under consideration etc..

That is, we can represent all of the pairwise forces as the force between a concentration of dipoles near the center of the Earth and the test object where the concentration of dipoles are radially oriented toward the test object and sufficient to give a force equal to the Newtonian force on the test object. Every pairwise dipole force has a component along such a radial line. Adding these forces gives a net radial dipole force while perpendicular dipole forces from parallel dipoles on opposite sides of the test object cancel and add to zero.

If we consider two pairs of objects such as the two small(2gram) gold beads .3 meters horizontally from two 8kg lead balls in Boys' version of the Cavendish torsion experiment, the attraction between the small beads and the large balls is in part, the projection of the radially oriented,centrally force toward the Earth's center, on the small balls and the radial oriented dipoles inside them

If the horizontal arm holding the moveable gold beads was placed along an east west

line, the collinear dipoles along an altitude line would be attracted downward while the north south oriented electrostatic dipoles inside the atomic nuclei of the balls would be in an attractive collinear, north-south alignment and the slight twist of the suspension wire shows the observed roughly 10^{-7} Newton, force.

If the arm was placed along a north -south line the orientation of the electrostatic dipoles in adjacent balls of each pair would be in a parallel repelling alignment and there would be no collinear attractive dipoles. An intermediate placement of the arm would show the effect of collinear attractive force components and parallel repelling forces. The sum of these effects are generally attractive because repelling, parallel, dipole forces are half as strong as collinear dipoles forces for the same size dipoles. (However the effect of all of the other dipoles inside the Earth will reduce these local effects. One way of considering the total force is that there is a horizontal component of the downward radial force on each of these smaller moveable balls that produces an apparent attraction to the larger balls)

This phenomena, not a fifth force, explains the Gravitational repulsion observed by Eotvos in the 1890s and analysed later by Fishbach in 1986. Eotvos's measured the pull of a weight when the weight and the spring holding it were moving eastward in a boat on the Black Sea and were both heavier than when his boat was moving westward. But most of the effect was due to the spin of the Earth and the tangential velocity, centrifugal force, offsetting the radial Gravitational force as the boat followed the curvature of the Earth, That is, the downward movement of the weight toward the Earth's center appeared less for this reason. In a plane, after takeoff, usually westward into the wind blowing from west to east, opposite to the Earth's spin, the subsequent difference in eastward and westward speeds of 400mph produces a noticeable difference in radially oriented electrostatic dipoles making eastward moving objects heavier. But the greater tailwind on eastward moving planes hides this effect..

The unexpectedly small Gravitational effect of the largest mass on the Earth, the Himalaya, which was carefully investigated by J.H.Pratt and G.B.Airy with a plumb line on the Indian side in 1855(Phil Trans v145) is attributable to the electrostatic dipole representation of Gravity. They reported that the plumb line is not deflected as much as expected assuming the same average density of the mountain as of the Earth. And we see that this could be be due to the plumb line being placed north or south of the mountain.

That is the east west line from the plumb to the mountain contains no collinear dipoles in the plumb or the mountain, only parallel repelling dipoles oriented in the up down direction. (Of course there is small horizontal component of the downward force along an Earth radial that might attract the plumb line to the mountain)

From these considerations we can write the radially oriented centrally directed Newtonian force on an atom or group of atoms on the Earth's surface as the force on the radially oriented total dipole of the atom or group of atoms produced by part of a ring of radially oriented dipoles around the Earth's center representing the net effect of the total number of dipoles in the Earth.

There are 6.02 times 10^{26} atoms in a volume of any atom whose mass in kg is the total of the protons and neutrons in the atom; e.g., 28kg of silicon contains 6.02 times 10^{26} atoms. The Earth has (5.98 times 10^{24}) kg which if all silicon has $5.98\times(10^{24})/28$ times 6.02 times 10^{26} such atoms each of which has 28 dipoles allowing one dipole per proton or neutron $\approx 36\times(10^{26+24})$ and so 3.6 times 10^{51} dipoles.

Hence whatever the average atom, the force between these dipoles concentrated at a point, $R_E = [6.37\times10^6]$ meters from the surface, and a single dipole at the Earth's surface is

$$[9\times10^9\times3.6\times10^{51}][6.37\times10^6]^2[1.602\times10^{-19}\times(1.836/2)\times10^3\times3s]^2/[6.37\times10^6]^4$$

$$=[(9\times3.6\times9\times1.6\times1.6\times.918\times.918)/(6.37\times6.37)]\times10^{9+51-38+6-12}\times s^2$$

We let, q, the number of electron–positron charges on the poles of the dipole qes, inside the proton be equal to $(1.836/2)\times10^3$ *since the number of electrons plus positrons in the proton with a net charge of +e that would have the observed proton mass would be 1836 electrons or positrons or both. The form such charged masses would take inside the proton could be orbital charged masses around other orbital charged masses as in our hypothesis above of* 10^{-56}*kg charged masses orbiting proton or other nuclear cores or electron cores. This hypothesis explained the charge polarization produced in current carrying wires that gave the observed force between the wires.*

Setting this dipole-dipole force to the Newtonian force and solving for, s, we have.

$$GM_E m_H/[(6.37)\times(10^6)]^2=[(6.67\times5.98\times1.67)/(6.37)^2]\times10^{-11+24-27-12}=1.6\times10^{-26}\ Newtons$$
$$=[(175.18)/(40.58)]\times10^{9+51-38+6-12}\times s^2$$

so $s^2=.37\times10^{-42}, and, s=.6\times10^{-21}, and, Rs=3.82\times10^{-15}\ meters$

The length, Rs, is well within the upper limit imposed by the surrounding orbital electron shells of the atoms. We have thus explained a possible mechanism of the gravitational fields of planets in our solar system..

The fact that this mechanism explains Gravity as an electrical dipole force a explains the precession of the planetary orbits particularly Mercury as the torque between one net dipole of the Sun and one net dipole of the planet at right angels to each other.

It also explains how the Earth pulls negative ions produced by sunlight or cosmic rays of positive ions from the solar wind or beyond the solar system to the Earth's surface. (e.g a net negative charge and a potential difference of 100 Volts per meter with an increase of altitude above the Earth's surface but less so as we go up to about 400,000 volts at the top of the stratosphere, 50km up,)

The negative charges at the Earth's surface pull positive charges down and lose negative charges with a current of 10 micromicroamps in regions of fair weather due to this average potential difference. (This current is similar to the solar wind of positive particles moving from the Sun past the planets to the spherical boundary of the solar system) On the Earth, this process is interrupted by thunderstorms and lightning, bringing, nine times out of ten, negative charges to the Earth and making the region near the Earth again more negative. A similar process of current reversal of the solar wind is suggested in the Thornhill-Talbot book (ref 12) where the vast distribution of a large total flow of negative charge toward the Sun is not manifest until it nears the Sun where such plasma, non atmospheric, lightening effects and flares become evident. The analogy between the Earth and Sun is clear but the analogy between Earth's ionosphere and the edge of the solar system is less so.)

That the potential difference between the Earth's surface and the top of the stratosphere is due to electrical charge on the Earth's surface is shown by the following experiments: A copper plate with a wire attached to the Earth was suspended a few inches above and parallel to the Earth. Its charge was measured by an electrometer to be negative. Then another plate, parallel to the first but larger and above the first was also connected to the ground. It also showed negative charge but the smaller plate beneath it showed none and the current measured from the lower smaller plate showed the previous amount of negative charge on it.

Similarly we can show the Gravitational attraction of the planets to the Sun may be represented in terms of electrostatic dipoles.

(Note the planet masses from Mercury to Pluto are multiples of 10^{24}kg. namely, .22, 4.87, 5.97, .64, 1899.7, 568.8, 86.9, 103.0, and .013 times 10^{24}kg vs the Sun's (2) $\times$ (10^{30}) kg. Note the distance between the Sun and Mercury through Pluto is .58 , 1.0728, 1.49, 2.235, 7.748, 14.155, 28.608, 44.849 and 58.855 times 10^{11} meters). The distance between the Sun and the Galactic center is 10^4 parsecs = $3\times$ (10^{20}) meters.

The Sun is .92H+.08He; a kg of H contains 6.02 times 10^{26} molecules each of which contains one proton and 4kg of He contains 6.02 times 10^{26} molecules. So 1kg of He contains (6.02/4)(10^{26}) molecules each of which contains 2 neutrons and 2 protons. Thus an average Sun kg contains .92 times 6.02 times 10^{26} protons-neutrons plus .08 times 4 'protons-neutrons' times ¼ of 6.02 times 10^{26}. We multiply this sum times the mass of the Sun in kilograms to obtain the total number of 'protons-neutrons' in the Sun: 6.02 times 10^{26} times (.92+.08) times $2\times$ (10^{30}) kg in the Sun. *We could also divide by the mass of the proton(roughly the same as the neutron), 1.67 times 10^{-27} to get the approximate number of protons plus neutrons.*

Hence, whatever the atoms, the Sun contains 6.02 times 10^{26} times M or 1.2 times 10^{57} protons-neutrons and each of these contains a unit dipole, $q\,es_{Sun}$, oriented along a line from the Sun to the Earth perpendicular to the tangents of the orbital motion of the Earth and to the tangents of the spin direction of the Sun.

Similarly there are $6.02\times$ (10^{26}) times $5.98\times$ (10^{24})kg = $41.3\times$ (10^{50}) = $4.1\times$ (10^{51}) protons-neutrons each containing a unit dipole, $q\,es_{Earth}$, in the Earth. The attraction

between the net dipoles in the Sun and Earth, R meters apart, with $q = .918 \times 10^3$,
$[(9) \times (2.56) \times (.918)^2 \times (10^{9-38+6}) \times [6.02 \times (10^{26})]^2 [Mm / R^4] Rs_{Earth} \times sRs_{Sun}] = GMm / R^2$
$= 7.04 \times (10^{9-38+6+52+2}) \times [Mm / R^2] s_{Earth} s_{Sun}$. Cancelling Mm / R^2 on both sides leaves,
$G = 6.67 \times 10^{-11} = [7.03 \times (10^{9-38+6+52+2}) \times 9] s_{Earth} s_{Sun} = 63.27 \times 10^{28} s_{Earth} s_{Sun}$

So $s_{Earth} s_{Sun} = .105 \times 10^{-42} \approx 10^{-43}$.

Thus if $\mathrm{R}\, s_{Earth} = 10^{-15}$ meters is the maximal allowable dipole length pointing to the Sun, then, with $R = 10^{11}$, $s_{Earth} = 10^{-26}$ and $Rs_{Sun} = 10^{11-17}$ or 10^{-6} meters as the length of dipoles in the Sun. A more rigorous calculation might yield a dipole length of 10^{-7} meters and a greater value for, q. The density of atoms or protons on the surface of the Sun, a tenth of gram per cubic centimeter, implies an average separation distance of about 10^{-7} meters.(The extreme temperatures of the Sun and the forces producing the 220 km/sec orbital velocity of the Sun as well as its 2km/sec spin velocity could produce such separations of charge inside the proton.)

Similarly for the attraction of the Sun to the Galactic center. The unit dipole on the Sun of 10^{-20} meters vis a vis the Earth is not as small as required as the unit dipole on the Sun vis a vis the Galactic center which would have to be 10^{-24} to give a .0001 meter dipole as the maximal allowable with the dipole charge difference of 1000 to 1 and even this might be too large.

Another possibility is that the particles in the Sun and the Galactic center being at very high temperatures may be smaller than the positrons and electrons that may make up the proton and neutron at lower temperatures. Recall our proof of superluminal orbiting masses of 10^{-56}kg inside the proton and inside the electron. Each one of these smaller particles that high energy collisions show to exist for fractions of a second, when the collision temperatures are very high, may have dipoles within them. The greater tangential forces associated with the greater orbital and spin speeds may rip loose more oppositely charged particles inside the protons. Thus the lengths of the net Galactic Center dipole and that of the Sun can be as small as required to give the observed "gravitational" force.

In summary, the Gravitational force as a dipole force explains the heretofore unexplained combination of electrical and thermal forces in and around the planets and the stars. Also variations in the Gravitational force on Earth; the torque caused precession in the planets; the Newtonian Gravitational forces between planets and the Sun and between the Sun and the Galactic center can be represented as due to dipoles transverse to the spin and orbital movements of the planets and the Sun.

The heretofore unexplained mechanism of Gravity, that Newton claimed was desirable but unnecessary to demonstrate the validity of his force equation, is partially established. But the implications of the electrostatic dipole model for understanding the Sun and solar wind and other stars and the Galactic center and untapped nuclear energy sources require further testing and research. .

ZOLLNER, BLACKETT,AND WESSON

Here is some of the historical background to the electrostatic dipole theory of Gravity:

"Gravitation is an electromagnetic phenomenon, there is no primary motion inherent in planets and satellites. Electric attraction, repulsion, and electromagnetic circumduction govern their movements. Each atom is made up of positive and negative electricity and though neutral as a whole may form an electric dipole when subject to an electric force.

Thus in the theory presented here, this attraction is not due to "inherent Gravitational" properties of mass but instead to the well known electrical properties of attraction. Two dipoles arrange themselves so that the attraction is stronger than their mutual repulsion."

We are to conclude that a pair of electrical particles of opposite signs, ie two Weberian molecular pairs attract each other. This attraction is Gravity; it is proportional to the total number of molecular pairs" said prescient German physicist, Fredrich Zollner in 1882. ref 3.

P.M.S. Blackett in 1947 writes that: "It has been known for a long time, particularly from the work of Schuster, Sutherland and H.A. Wilson, though lately little regarded, that the magnetic moment P and the angular momentum U of the Earth and Sun [and then recently the star 78 Virginis] are nearly proportional, and that the constant of proportionality is nearly the square root of the Gravitational constant, G, divided by the speed of light ,c."(ref4)

Blackett first noticed this while considering the influence of the magnetic field of stars on cosmic ray activity. The importance of cosmic rays and magnetic field disturbances on communications and radar surveillance during World War Two stimulated interest in these matters. But prior to this time and even now the regard of geologists and astronomers for this relationship was and is surprisingly indifferent and it does not appear even in their texts or recent general physics texts that I have seen. Blackett suggested a laboratory test using a bronze sphere of 1 meter diameter rotating at 100 r.p.s. which should give a field of about 10^{-8}Gauss, which modern devices like the SQUID for measuring weak magnetic fields could reveal and perhaps already has.

Thomas Gold in a later issue (April 2, 1949) of Nature represents the opinions of Runcorn and Hoyle that the difficulty in entertaining the hypothesis was that there was "no physical quantity which might be related, by way of a new law, to the magnetism of large rotating bodies." [But now there is: radially and longitudinally oriented electrostatic dipoles in their atomic nuclei is the unknown missing quantity.]

The greater the mass, ie the greater the number of protons, neutrons and electrons, all of which contain electrostatic dipoles and the greater the tangential velocity, the greater the length of each dipole. The counter clockwise orbit produces a tangential force on an orbiting -2e charge in electrons and on a –e orbiting charge in protons that produces an expansion of the dipoles in the same radial direction with the negative charge pointing to the center.(if clockwise with positive charge pointing to the center]

Blackett references Hale, Theissen, and Babcock measurements of the Zeeman

splitting indicative of a magnetic field acting on the spectra of light from different parts of the sun. Later such measurements give values due to the 450km/sec emissions of positive ions and electrons from sunspots etc and other such flows as well as the field due to the 2km/sec rotation of the sun so there is some confusion. That is the local fields associated with sunspots spread out over the suns surface that reverse every 11 years may also influence the measurement Babcock made later of the reversal at the poles which otherwise would imply under Blackett's theory, an unobserved rotation reversal.

Because of the problems with Zeeman splitting measurements of the magnetic fields of stars and the sun, the main support for Blackett's theory is the evidence of electrostatic dipoles inside current carrying wires and inside their free electrons and atomic nuclei as the cause of their magnetic fields and the implication of such dipoles in spinning orbiting masses.

Also there are ambiguities with space probe measurements of planetary magnetic fields that NASA hopes to resolve with the Russian and Austrian proposal to use a hot air balloon a few km above the surface of Mars. A possible explanation of the lack of correspondence between space probe measured planetary magnetic fields and planetary angular momenta is that the probes are magnetometers being influenced by the space probe velocity relative to the planet velocity.

A related phenomenon might be the following (from the New Scientist (p485): "In one [of Henry Wallace's-US patent 3 626 605] kinemassic machines a pair of wheels of brass alloy, like gyroscopes are rotated at a speed of 20,000/60 r.p.s. [and then at the same time] rotated about another axis [at some unspecified speed]... [the wheels appear to be propelled upward or become lighter]" I am told but I do not have the references that other evidence of Gravitational anomalies of spinning objects has been obtained by DePalma, Kidd, Strachan, and Laithewaite. The Hyzer angle of frisbees and sinker pitches in baseball also may be related phenomena.

Thus any accelerated object, eg a bullet, a rocket, a plane, a car, a frisbee, a skidding or spinning billiard ball etc has electrostatic dipoles produced in its atomic nuclei transverse to and proportional to the accelerating force which even if mechanical is still ultimately electrostatic; The tendency of linearly propelled atomic nuclei to then rotate may add to the aerodynamic efficiency of spinning projectiles. The resulting dipole field may or may not be self sustaining against thermal disturbances as in the dipole chain model of ferroelectrics (ref 6 Feynman vol2, p5-5, 11-10).

In the above mentioned ferroelectric model the dipoles are assumed to be composed of poles, concentrations of charge, that are fairly constant over time unlike our model of charge polarization inside atomic nuclei which changes rapidly with the position of the orbiting charged particle(s) inside the nuclei but which averaged over the orbital time period represents a displacement of centers of negative and positive charge in a specific direction. In both models the dipole-dipole interaction is the same but the interaction of one dipole with a single pole of the other is different in the two models.

In our model the action of one dipole on the single pole of another is to produce a transverse elliptical motion of the single pole, rather than as in the ferroelectric model to produce a motion of the pole only in the direction of the dipole field and thereby to sustain a dipole field.

P.S. Wesson in 1981 (ref5) derives a relation similar to the one of Wilson that Blackett describes, namely that the angular momentum of planets stars and galaxies divided by the square of their masses is approximately constant and equal to 10^{-17} meters per sec per kilogram. This suggests a common centrifugal or tangential acceleration from zero, a common force, associated perhaps, in analogy to other forces, with an agent, with a Prime Mover.

Returning to the Blackett and Wilson conjecture, the reason for the relation between Gravity, magnetism and angular momentum may be due to the component of the ever present force that is manifest in the linear and angular velocity components of the motion of the astronomical body. The more atomic nuclei there are in the body and the greater its velocity components, the greater the Gravitational and Magnetic fields of the body. Hence a spinning motion given to a ball by a momentary force may produce initially additional charge polarization in its atomic nuclei in radial oriented directions but without repetition of this force perhaps through the self sustaining interaction of radial and longitudinal dipole fields the added charge polarization in the atomic nuclei quickly becomes zero due to thermal collisions.

In the case of the planets, measurements of their magnetic fields is complicated by the fact that different parts and layers of the Sun and gaseous planets rotate at different velocities and for the planets near the Sun, the Sun's magnetic field has an influence on the measurements. The fact that the gaseous planet Jupiter has a magnetic field ten times stronger many miles above its equator suggesting a field at the surface, 20,000 times that of the Earth even though it is only several hundred times larger in mass and spinning only 30 times faster and the fact that the direction of the field is opposite to its surface rotation is perhaps understandable in terms of different directions of rotation in different regions and the added magnetic fields of electric currents.

Also the similarity of Uranus to Jupiter except that is about one twentieth of the mass of Jupiter and the similar ratio of their magnetic fields to the ratio of their masses can be so understood.

RELATIVITY AND CHARGE POLARIZATION INSIDE ATOMIC NUCLEI

We will show that the various phenomena used to support the premises of relativity can be explained by charge polarization inside atomic nuclei. Before considering the esoteric experiments, consider the commonplace observation of improvement in the reception of radio frequencies at night from reception during the day. This is attributed to greater radio activity ie interference during the day but it could also be attributed in part to a decrease in the distance between colliding free electrons and lattice ions, nuclei and their surrounding electron shells in the receiver antennas when the antenna is on the sunny side of the Earth.

That is, as we hypothesized above, the side of the Earth nearest the Sun is more

attracted to the Sun but also because of the added Sun tracking dipole in the atomic nuclei, in the same direction as the dipole associated with the planet's spin, both having their positive pole toward the Sun, the atoms of the Earth nearest the Sun are more attracted to each other than to atoms on the dark side of the Earth. On the dark side, the Sun tracking and Earth center tracking dipoles are in opposite directions.

When a star is observed against the background of stars at say midnight its position seems to be about 3/3600 degrees ahead of its position when its position is determined at the time of year it is visible during an eclipse near the Sun at noon; that is the greater residual nuclear dipole seems to make possible a difference in the delay of reception; a longer delay as the Earth turns more before light from the particular star becomes visible. And this effect is greater, the less the angle between the radial orientation of the dipoles.

That is the proposed theory explains the bending of light, by Gravity without requiring a distortion in the three dimensional Cartesian coordinate system, according to Einstein's ingenious formula, representing physical space far beyond ordinary observations.

What about Gravitational lensing; quasars viewed on different sides of a large distant star or galaxy. The red shift of the quasars is about the same with an error that translates into thousands of meters per second. Can we simply say, to please the General Relativity departments and the Black Hole sub departments, that this is evidence of a single quasar whose light is bent by a large mass as it passes by the large mass on the way to Earth?

A better case could be made if there was clear evidence, but there isn't, that stars or quasars as near each other as those in claimed instances of Gravitational lensing but without a closer stellar object blocking their view from the Earth had more dissimilar red shifts. The difficulty, if not impossibility of making a conclusive case of this sort reduces the claim to idle speculation.

A similar explanation applies to the red shift in radar reflections from Venus and Mercury when they are on the opposite side of the Sun; that is the Gravitational effect of the Sun is not to change the time scale of light wave disturbances in the aether near the Sun so as to increase the time between successive peaks and valleys of a sine oscillation but to influence the radar receiving antennas on the Earth so that they do not respond as quickly to changes in oscillating forces on the free electrons in their antennas resulting in a lower frequency for the received oscillation of charge in the radar antenna.

Similarly for other red shift experiments like Brault's on the Gravitational red shift of solar lines (Bull Amer Phys Soc. 8,28 1963). The red shift of gamma rays as a function of their height, 22.5 meters above the Earth's surface and the Gravitational field of the Earth may have a similar explanation. That is the shift should be greater the greater the distance between the source and the receiver at least during the day; if the experiment is performed at night, the results should be a lesser delay.

But the cause of the delay is not the Gravitational field of the Earth but the effect of the Sun's Gravitational field or net dipole field on the Earth's atoms and their dipoles. Recent variations in the Gravitational constant when electrostatic means are used to create stability in balance measurements also may be explained more clearly in terms of these effects than in terms of General Relativity.

The precession of the planetary orbits as a function of the Sun's mass and proximity can be explained in terms of the torque interaction between the Sun's net dipole and the the planet's net dipole instead of the curvature of space or spacetime in the vicinity of the Sun. In both cases the size of the effect is a function of the Sun's mass or net dipole and the the proximity of the Sun.

Lets consider how the electrostatic dipole theory can be used to explain the phenomena that Special Relativity in 1905 was designed to explain. Namely, the Michelson Morely Experiment and Kaufmann's mass increase experiment and later, the faster decay time of faster moving muons, the apparent mass increase of accelerated protons as in the Cockroft Walton and modern accelerator experiments, relativistic corrections to high velocity Doppler shifts and the 1971 Hafele Keating experiment.showing clocks running slower in fast moving planes.

Regarding the Michelson Morely experiment, we show below that by attributing light's delay to effects inside the atomic nuclei of the receiver, we avoid the need for an aether wave. That is, light moving past a slanted half transparent mirror in the same direction as the Earth's velocity to a mirror and being reflected back interferes with the light being reflected at right angles by the half transparent mirror and then reflected again by a mirror the same distance away but in a direction at right angles to the first light ray.

Light's delay in both cases due to effects inside the atomic nuclei of the mirror, is the same because the total distance is always the same. Thus, the different times of wave motion in the two cases if one adds or subtracts the velocity of light to the Earth's velocity is not a consideration.

We also have shown how charge polarization inside a Beta electron causes a decrease in the rate of increasing magnetic responsiveness of the fast moving Beta electron which is wrongly interpreted as an increase in inertial mass.

We have suggested how the same principle is at work in the case of the the Cockroft Walton experiment, and the faster moving muons. And so when unstable particles like pions, muons, kaons etc are made to move at .98 times the speed of light, the muons(209 times the mass of the electron) for example decay five times slower than they do when they are at rest. The force which produces the increase in speed can act on the orbiting charged particle or particles within the larger muon increasing charge polarization transverse to the velocity disrupting the particular balance of forces in the muon at rest or lesser velocities associated with a more rapid decay time. Also the increased pull of the Earth's Gravitational (electrostatic dipole) field on the muon with an increased average electrostatic dipole can help increase the decay time of the muon..

Similarly in the Haefele Keating experiment, the forces that propel the eastward and westward moving planes produce an increase in the negative elliptization of atomic dipoles along an Earth radial toward the center of the Earth. Specifically of the nuclear dipole in Cesium atoms when eastward and a negative elliptization away from the center of the Earth when moving westward. Thus a slower speed, indicated by the heavier Cesium molecule in the 400mph plane moving eastward. So when the plane returns to the point of takeoff, the Cesium clock on the plane is 275 nanoseconds slower the Cesium clock that remained on the Earth. When the plane moves westward, the Cesium clock gains 59 seconds on the Cesium clock that remained on the Earth. Thus the Lorentz

formula is applicable but to mass rather than time and we have shown that Lorentz is describing charge polarization inside atomic nuclei not mass, time or space.

The same effect could be measured in terms of the less than expected increased speed of a plane per unit fuel used as the plane moves with the spin of the Earth eastward. When the plane takes off into the west- to-east-blowing, prevailing westerly wind, it is moving also against the 465meter per second spin of the Earth but it is somewhat lighter because of the reduced electrostatic dipole and the reduced attraction to the Earth associated with the net force pushng it westward. Then as it reverses direction and becomes slightly heavier but with tailwinds from the prevailing westerlies it moves at the sum of the speed of the plane and the speed of the wind, $v_{pl} + v_{wind}$. As it moves around the world from west to east the world is spinning in the opposite direction at about 800 mph at 40 degree latitude etc so subtracting this speed from the distance from $v_{pl} + v_{wind}$ we have the formula for the duration of the trip from which we can compute the plane speed v_{pl} , and the speed per gallon of gas. This should be the same for the plane moving in the opposite direction so long as the Pitot tube type measurements of wind speed, v_{wind} ,in both directions are accurate.

Why should the dipole explanation of these phenomena be preferred to the relativistic explanation? 1)Because the relativistic explanation requires adding additional premises to the basic premises of classical physics regarding space and time while the dipole explanation requires no such addition of basic premises. 2)The dipole explanation explains not just these phenomena but other interactions of Gravity and electrical phenomena and astronomical evidence of superluminal velocities, which relativity does not.

DIAMAGNETISM AND FERROMAGNETISM

It is helpful first to explain magnetic moments of electrons and atoms in terms of electrostatic dipoles. The forces producing the velocities of electrons in orbit also produce radial charge polarization in the electrons; the proximity of the nucleus r meters away, inhibits the magnitude of the dipole in the orbiting electron. This is analagous to the inhibition of transverse dipoles as in the nuclei and free electrons of parallel current carrying wires. That is, there is a transverse force between nucleus and electron that inhibits the tendency of the orbiting negative charge inside the electron to become more elliptical. The dipole length increases as , r, increases. So the dipole in the orbiting electron of mass, m, in the ground orbit of hydrogen is erv/c *where* $mvr = \hbar$ *. This dipole then is equal to the Bohr magneton,* $\mu_B = e\hbar/2mc$ *which is the unit in which the magnetic interaction of atoms with applied magnetic forces is usually expressed.*

An example of the interaction of atoms and an applied magnetic force is the force on a gas of neutral atoms from a heated oven that pass through a magnetic field as in the Stern-Gerlach experiment that showed the quantum effect of a magnetic field. The

spectral lines were discrete instead of a continuous band. We will look at their experiment in terms of electrostatic dipoles instead of electron spin. Then we will show how these dipoles in other atoms produce ferro-,para- and dia-magnetis

Stern and Gerlach produced a gas, composed of silver atoms, thermodynamically forced from a high temperature region to a lower temperature region, and a small fraction of these through collimating slits and then through a magnetic field. “Thermodynamically forced” means stronger and more frequent pushes from hotter atoms than colder atoms.

The spectra produced by the gas in the field has two distinct lines of light at nearly the same wavelength, while, with the field turned off, there is only one line.

These lines correspond to the average frequencies of radiation emitted as an excited electron falls back to the normal orbit (or moves from the normal orbit(s) to the excited orbit) which is really two slightly different “normal” orbits when the magnetic field is applied.

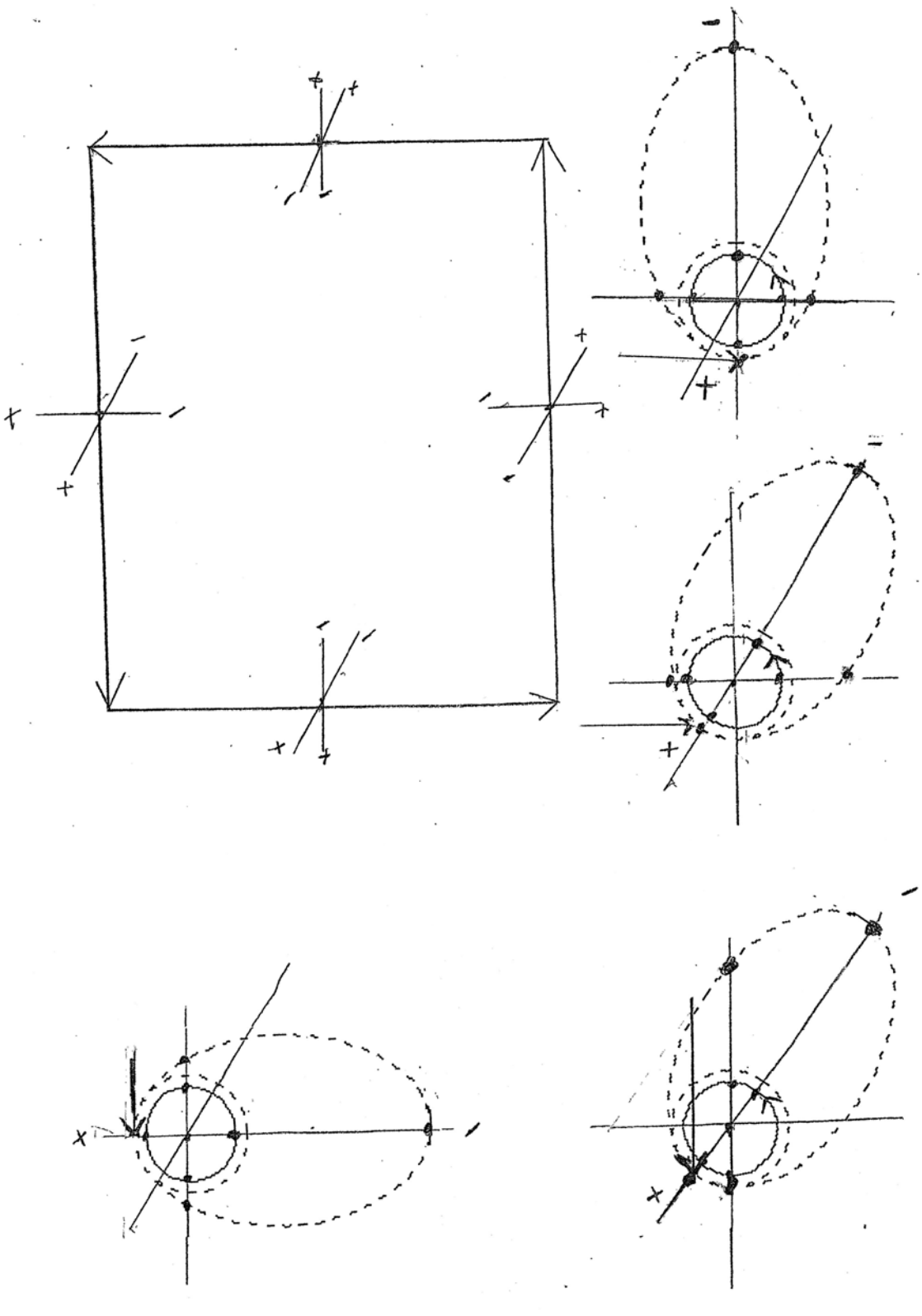
Roughly half of the atoms have one normal orbit and the other half a slightly different normal orbit as described below. When orbital electrons are in a normal state or other metastable state, the effective oscillations of electrons in neighboring atoms are according to the least energy principle, completely out of phase and their radiation cancels.

During a transition however, radiation is not cancelled by opposite oscillations of surrounding orbits; and so it is transmitted. Note the average frequency is not measurably different from the difference frequency as discussed in the next section on Light.

The total magnetic moment of the silver atom is, after the canceling of oppositely oriented dipoles from the other orbiting electrons in the same atom, only the effect of the average electrostatic dipole field of a single unpaired orbital electron in the outermost orbit.

This can be visualized as the projection of an electrostatic dipole in an electron at a point of the electron’s orbit onto a line from this point to a point on an axial line perpendicular to the electron’s orbital plane through the nucleus. The projection from all of these spokes onto the axis gives the total electrostatic dipole field of the atom with one orbiting electron.

The electrostatic dipoles produced by the orbital electron at successive instants of time at different points in the orbit, is, because of the small size of the orbit and the great speed of the electron, equivalent to the simultaneous electrostatic dipoles at points all along a current carrying coil of diameter on the order of centimeters or larger, instead of Angstroms, as shown in the following diagram.



(The way the dipoles are produced is shown in the accompanying diagrams of orbital charge inside the atomic nuclei and free electrons.)

If the direction of the orbital electron is counter clockwise in say a horizontal plane, and the direction of orbiting charge inside the electron is counter clockwise, the negative pole is always pointing inward. This leads to an average electric dipole projected on a line perpendicular to the orbital plane at the nucleus , with the negative pole pointing upward- *if there is a positive charge or pole on or near the axis above the orbital plane*. The reverse is true if there is a negative charge or pole on the axis above the orbital plane. If the electron is moving clockwise and the orbital charge inside the electron is moving counterclockwise, the positive pole is always pointing inward. And a similar effect is obtained. Note that the same effects occur below the orbital plane if there is a positive charge or pole on the axis or near the axis below the orbital plane.

(Note,this force is distinct from the force between two adjacent solenoids. The above diagram of the square coil could also represent one of many current carrying coils connected to form an electromagnet with an air core. The attraction between two such solenoids with currents going in the same direction can be understood in terms of the attraction between similarly oriented dipoles in adjacent segments of the two coils facing each other and the coils behind these. This despite the fact the similarly oriented dipoles on facing sides of two coils are opposite in orientation to those diametrically opposite in each coil.)

The spectra of the silver atoms in the Stern-Gerlach Experiment indicated that half of the outer orbital electron orbits were counter-clockwise with counter-clockwise orbiting charge inside the electron and half were counter clockwise with clockwise orbiting charge inside the electron.

To better see this, consider a circular atomic orbit in the horizontal plane where say two diametrically opposed electrons are moving in a counterclockwise direction as we look down on their orbit as if it were the face of a clock. The implicit tangential force on the right side of the clock that causes the motion of an electron there, say from 3 o'clock to 2 o'clock, also creates an elliptical extension to the left, of the counterclockwise orbiting negative particle inside this electron, creating a negative pole of the dipole inside the electron pointing inward, toward the atomic nucleus.

The electron on the left side moving from 9 o'clock to 8 o'clock apparently produces a dipole with the negative pole pointing away from the nucleus as if the orbiting negative charge inside the electron had been made to move clockwise relative to the orbital electron. Thus the force between the two orbital electrons due to their dipoles is one of attraction. Thus also the net dipole component force pointing upward or downward from these two electrons is zero on a specific dipole of either polarization. From these considerations, atoms, with an even number of electrons, should have no response to an applied magnetic field. Note that the magnetic field is equivalent of an electrostatic dipole. The exceptions are strongly diamagnetic diatomic molecules of Bismuth and Antimony with an odd number of electrons in the outer orbit of the atoms. Apparently in the molecular configuration of the two atoms similar to that of a single atom with a pair of electrons in the outer orbit.

But the changing magnetic field of a magnetized ferromagnet as it is brought near diamagnetic material, is to induce movements of electrons in atomic orbits in the

diamagnetic material, so that the average electrostatic dipoles produced, are oppositely oriented to, and so repel, the equivalent electrostatic dipole of the ferromagnet. (The mechanism is similar to the momentary, oppositely directed, current induced in a wire when a parallel current carrying wire is brought near it, the so-called 'Lenz effect''. The exact mechanism in terms of electrostatic dipoles inside atomic nuclei and free electrons is described in the next section on Light.)

Other atoms where the electrons in the outer orbit are paired and the electrons in the adjacent inner orbit are paired may interpenetrate each other and influence the orientations of the electrostatic dipoles in these electrons.

Iron has two electrons in an outer 4s orbit; that is, the "4" is the value of n and the square of n times the innermost radius orbit gives the radius of the orbit. The "s" indicates that the orbit is circular. The next more inner or 3d orbit has $n^2 = 9$ and "d" indicates that the orbit is the most elliptical orbit of orbits with quantum number, 3. Thus, there is the likelihood that the 6 electrons in the 3d orbit interact with the 2 in the 4s orbit because of greater proximity at times.

One possibility is that the paired electrons in the outermost circular 4s orbit cause one electron of the six in the elliptical 3d orbit to flip over and , the reaction force causes one of the 4s electrons to flip over. Thus the net dipole of each of these and its previously paired dipole will be in the same direction and not zero. That is, the two dipoles are both oriented with the negative pole facing the nuclear core and the projection of these dipoles on lines toward a point on the axis of the orbital plane are both oriented with the negative pole pointing upward. And the projection of these dipoles on the axis is a dipole with the negative pole pointing upward. This net dipole is non zero and twice the magnitude of the net dipole formed by a single orbital electron.

This makes iron in a vapor state, 4 times more paramagnetic than silver. That is more responsive momentarily to the same applied magnetic field. But in a solid state, something else happens. These similarly oriented paramagnetic atoms coalesce to form a domain with similarly oriented dipoles. And when a strong external magnetic field is applied to this solid, these domains will be lined up with their magnetic moments parallel to this field. That is, the net electrostatic dipole of the ferromagnetic solid will line up with the net electrostatic dipole of the applied field.

This explanation of ferromagnetism is clearer than the standard wave mechanics explanation http://en.wikipedia.org/wiki/Exchange_interaction.

The potential energy of the 4s electron due to the nucleus and other electrons and that of a 3d electron which being sometimes at equal distances from the nucleus are sometimes equal. Note the average energy of each electron can be approximated from spectral data making certain simplifying perturbation assumptions and it is equivalent to the average energy calculated for a specific orbit making similar simplifying assumptions. But the actual cause of magnetism can be explained more clearly in classical terms. The electrons in the same or overlapping orbits repel each other less if the electrostatic dipoles in the electrons are oriented so as to attract each other even if this means a slight decrease in the attraction of the electron to the nucleus or nuclear core. The least energy principle applied to the atomic systems apparently requires this dynamic adjustment in the electron orbits in iron.

The magnetic dipoles of protons and other nuclei and the magnetic dipole of the applied constant magnetic field are net electrostatic dipoles. The orientation of the net electrostatic dipoles in the protons of water for example, are, in the absence of applied fields, according to the standard theory, randomly oriented but we have shown[2] that there is a residual amount (10^{-18} e) of charge polarization determined by, and lining up with, the longitudinal and tranverse dipoles of all atomic nuclei in the spinning of the Earth etc.. The effect of the applied magnetic (net electrostatic dipole) field is to produce a small re-orientation of these nuclear dipoles to line up somewhat with the strong applied field. This nuclear effect plus the atomic and molecular diamagnetic effects and paramagnetic effects add up to an observed diamagnetic effect in the case of water in a non uniform field eg in the levitation of frogs etc.

But the variation of the nuclear dipoles in Hydrogen atoms in water and other atoms, first aligned with those of a strong uniform magnetic field., and then subject to a changing electric and associated magnetic field at right angles to the uniform field at microwave frequencies is used in Nuclear Magnetic Resonance to identify the atoms. That is, the aligned dipoles are easier to rotate at some frequencies more than others depending on the field strength and the specific atom. There is an analogy here to the rotation spectra of diatomic molecules etc..

That Gravity is ultimately magnetic and so electrostatic is related to the views proposed by V.A. Bailey and also those of Thornhill and Scott. Bailey claimed that the Sun had a large net electric charge at the same time that authorities at Harvard vehemently denied it. The net charge was finally measured by NASA space probes as Bailey had contended. Thornhill and Scott claim that the power of the Sun and stars are provided wholly or in part by plasma currents or the solar wind comprised of positive Helium and Hydrogen ions moving away from the Sun and a smaller number of electrons moving toward the Sun but a net flow of positive charge toward the edge of the solar system implying for unexplained reasons a more negative potential in this region.

Other explanations of the solar wind are that electrons and positive ions are present in equal numbers and are pushed out of the Sun by heat and pressure factors at up to 450km/second but are not close enough to recombine. And that they continue by inertia past the Earth unless captured by oppositely charged particles or are deflected by other sources of magnetic and electric fields such as the spinning orbiting Earth etc, to the edge of the solar system etc.. It is helpful to consider the magnetic fields of the plasma streams as due to charge polarization inside the ions and electrons transverse to the direction of the streams. It is also helpful to recognize the electrical interaction between electrically neutral spinning orbital bodies in terms of electrical dipoles and plasmas.

The magnetic field of moving charges in the Sun is added to the magnetic field associated with the 24.7 day rotation of the Sun. The magnetic field due to electrostatic dipoles associated with the Sun's rotation and with the moving charges of plasma streams influence radiation emitted by Sunspots on the Sun's photosphere. Specifically the line of an observed frequency is split into many closely spaced lines showing that the field there is thousands of times stronger than that of the Earth. Also that the first spot in the direction of the Sun's spinning has the opposite polarity of that in a nearby spot that comes next into view. That is, the excitation from one orbit to another of the electrons emitting light is inhibited or stimulated by the surrounding magnetic field so called, depending on its orientation.

From the mass and number of atoms or ions in the Sun, we can estimate the Gravitational field of the Sun and so the equivalent magnetic or electrostatic dipole field of the Sun not due to the magnetic (gravitational) effect of solar currents. That is the electrostatic dipole field of the Sun is the Gravitational field of the Sun and the magnetic field of the Sun independent of the magnetic or electrostatic dipole field associated with the plasma stream of positive ions and electrons of the solar wind.

LIGHT, PRECEDED BY WEAK NUCLEAR CHARGE OSCILLATIONS

LIGHT SPEED & OSCILLATING CHARGE INSIDE ELECTRONS AND ATOMIC NUCLEI

Since Maxwell's 1864 paper, the theory of Light has involved ever stranger, more non intuitive assumptions: Maxwell hypothesized a vacuous space filled with invisible wheels and ball bearings, like vortices in a gas, but utterly massless- and with the density of iron! Later, massless, even probabilistic particles(photons) transferring discontinuous changes in energy, time dilation, space contraction and curvature, one dimensional objects('strings)' vibrating in 10 dimensions, etc..The mystic, religious appeal of these concepts, appealing to the right side of our brain, is undeniable. But, annoying to the left side of the brain, is the continual addition of properties of light carrying particles and of the space or spacetime continuum between source and receiver. It is reminiscent of the ever increasing number of Ptolemaic epicycles that were added to explain planetary motions. The Ptolemaic theory which was intended to reduce and simplify the chaos of raw data, became as extensive as the raw data itself- until the comfortable, but incorrect assumption of a central Earth was replaced with the correct premise of a central Sun.

A similar correction to the theory of Light and electromagnetic radiation is long overdue.

The reason, initially, for the non intuitive assumptions about light was the greater difficulty in conceiving of cumulative instantaneous forces acting over unbelievably large

distances, and of masses, volumes and sequences of velocities and accelerations involved in these great forces, occurring over time scales and space scales that, then, were inconceivably small and beyond the scope of the technology of the period.

That light or radio radiation may be the result of cumulative instantaneous forces at a distance (not waves or photons) is indicated by the following experiment: A shuttered photocell was exposed to intermittent 15 nanosecond long light pulses, 2000 per second, from a source thirty feet (30nanoseconds) in front of the light source. When the photocell was blocked by the (polarizer crystal and modulated Pockells crystal) shutter at the expected time of arrival of the light pulses, plus or minus 5 nanoseconds, the signal on the photocell was nearly maximal and when the photocell was blocked during the time of emission of the light pulses, the signal on the photocell was zero. (Oscillations of charge in the light source not in the direction of polarization of the polarizer can produce effectively no oscillations in the photocell receiver in front of the polarizer/ modulator. When a high voltage is applied to the modulator crystal, oscillations of charge produced by the light source and allowed by the polarizer, on the modulator crystal can produce oscillations in a photocell receiver on the side of the modulator but not on a photocell receiver in front of the modulator crystal. The prevention of oscillations of charge in the photocell receiver is attributable to out of phase interference of differently delayed forces from secondary oscillations in the crystals.) This experiment was reported in the online 1997-1998 Optical Testing Digest, Dr, T.W. Ng editor. For further details of the experiment contact the author at vze01rki@verizon.net.

Recent discoveries have led to such measurements of smaller and smaller time and space scales. Particularly measurements of charge polarization inside electrons and atomic nuclei from high energy proton-proton collisions. And at the other extreme measurements of unexpectedly greater astronomical distances and energies of the more distant galaxies and stars.

If charge polarization can occur inside electrons, then the mass of electrons, apparently increasing to infinity as their velocity increased to the speed of light, might be attributed to changes in charge polarization inside the electron, causing a decrease in the rate of increase of magnetic and electric responsiveness of the electron.

(The reason, I think, this was not considered originally is that it was easier to explain the response of the electron, by ‘one’ thing, the mass, instead of ‘two’ things, the magnetic property and the electric property of the moving electron. The success of the space contraction and time dilation formula that Lorentz proposed and Einstein developed into the theory of Relativity, to explain the Michelson Morely experiment, also could explain this mass increase. The idea of mass increase and the conversion of energy into mass and mass into energy helped later to describe radioactivity and the technology of fission bombs and fission power plants. But now, knowing the magnetic property is an electrostatic property, specifically an electrostatic property, acknowledging the causes of such apparent mass energy conversion, can improve the theory eg, by reducing the number of axioms. This in turn could lead to improvement in the technology including nuclear waste disposal etc.)

An implication of charge polarization inside electrons and atomic nuclei is that the so called speed of light or rather the delay in the response of a radiation receiver to radiation from a radiation emitter could be due to prior unobservable changes in charge polarization inside the electrons and atomic nuclei of the receiver resulting from rapidly changing instantaneous electrostatic forces from the emitter. (Note, the attraction between parallel dc currents r meters apart can be represented as the force between collinear electrostatic dipoles krev/c per unit length but less than .1 Angstrom where c is $\sqrt{3}$ times the speed of light, and that orbital systems inside atomic nuclei can account for these dipoles.

(We require that free electrons have an orbiting charged particle of charge -2e and larger mass core of charge, +e, and that the lattice nuclei have orbiting charged particles of charge –e and a large mass core of charge +2e. Or something similar so that parallel current carrying wires will attract due to the similarly oriented dipoles inside the electrons and inside the atomic nuclei. That is, the sustained electric fields causing the current, produce an excitation of the negative orbital charge inside the electrons and inside the nuclei that form transverse elliptical orbits and so transverse dipoles in the same direction. Also an atomic nucleus and an inner orbital electron repel each other if the orbiting negative charges become too close to each other when the electron comes closer than the ground orbit radius of the electron to the atomic nucleus. Thus our hypothesis explains the magnetic force between current carrying wires as an electrostatic dipole force and the ground orbits or energy levels of atoms.)

The average or root mean square electron velocity in a receiving antenna caused by the increasing ac field and denoted, v, is preceded by increasing transverse dipoles inside the atomic nuclei due to the same field. The changing transverse dipoles produces longitudinal dipoles and changing longitudinal dipoles produces changing transverse dipoles etc. As an alternating voltage is induced in this way inside the receiver antenna, the cumulative effect of the instantaneous forces producing increasing dipoles is to produce an observable oscillation of charge in a distant receiver after kr/c seconds if the light or microwave or am/fm/tv source forces per unit charge, $E_s(t)$, are repeated often enough and are not too weak relative to the source receiver distance, r, and to the ambient noise in the receiver. After this delay, the average length of the oscillating dipole "inside" the nucleus is almost as large as the inner electron radius and cannot increase further: rv/c cannot exceed this limit of approximately .1 Angstrom (If it does at r* less than r, say r* = kr, k<1, then the delay is kr/c).

The formula for the increase of the field in the receiver could be written then as the transient solution of a "resonant forced harmonic oscillator with damping":

$$(1-\exp -ct/kr)\times[(2\pi krf/c)^2\times(\cos 2\pi ft)\times QD/4\pi\varepsilon_0 r^3]=E_R(t)$$

as derived below. Notice that the term in brackets is, when the r's are cancelled, formally the same as predicted by Maxwell's well known equations, involving alternating magnetic and electric fields proceeding wavelike through the ether, arriving at

a receiver, r/c seconds after emission, but we allow that there is some value, kr, less than the source to receiver distance r, and time, kr/c < r/c seconds later that the field at the receiver rises above noise to its maximal value, especially for larger values of, r.

How do we arrive at this formulation? An electrostatic dipole field, an inverse cube field, varying over time is produced by oscillating dipoles; for example, an oscillation of $nA_0D_0 = 8.47 \times (3.14) \times (4) \times 10^{28-6}$ free electrons in a copper vertical emitting radio antenna, $D_0 = 1$ meters in height of 4 millimeter diameter or excited bound atomic and molecular electrons, a few Angstroms in height and 1mm in diameter on and around for example, a vertical heated tungsten filament of a light bulb in an Argon atmosphere. ($n = 8.47 \times (10^{28})$ per cubic meter is the density of free electrons in copper.). Note that these oscillations occur only when the bound electrons of an atom or molecule are thermally excited to wider orbits and fall back to less wide orbits and to their ordinary bound orbit. Radiation from adjacent, out of phase, ground and wider metastable orbits of the same radius, cancel each other such that energy lost in part of the orbit is regained during the rest of the orbit. The frequency emitted during a transition between two such orbits is uncancelled and is the average frequency of the two orbits (which is, within measurement error, equal to the difference frequency)

In a radio antenna receiver, the source field acts for short times between thermal collisions on free electrons but again and again at a specific frequency in the same direction. These forces, we claim, also act on negatively charged particles of much lesser mass inside atomic nuclei. The repetition of force leads to a cumulative increase in oscillation amplitude inside the nuclei and then on the orbital electrons of the receiver of light. We show below that the initial longitudinal force from the emitter produces transverse charge polarization and that these changes in transverse charge polarization produce longitudinal charge polarization first inside the nuclei and then among the free electrons inside the antenna. And that the induced longitudinal charge polarization produces a field stronger than the field from the emitter and in the opposite direction.

LIGHT EMISSION AND RECEPTION

Not all radiation energies are possible but only integral multiples of Planck's constant, h which Bohr showed was the energy expended by an electron of charge e, in a single orbit around a central core of opposite charge in a circular path with a radius, $r_0 = ((1/2)\times 10^{-10}\, meters$. Roughly h = 10^{-18} Joules times 10^{-16} seconds. That is, $[m_e v_0^2/2]\times(1/f_0), where, m_e v_0^2 = 9(10^9)\times e^2/r_0 \approx 10^{-18}, and, v_0 = 10^{(10-38+10+30)/2} \approx 10^6$, $and, 1/f_0 = 2\pi r_0/v_0 \approx 10^{-16}$

Thus when we multiply h times the frequency of the ground orbit of Hydrogen the frequency cancels the associated 'period' factor of h and leaves the 'instantaneous kinetic energy' factor, 10^{-18} Joules. Other orbital frequencies of an outer electron of other atoms or of excited orbits of the Hydrogen atoms, times the number of atoms involved, produce multiples of this energy. Radiation from hydrogen gas heated for example by oscillating charge on the metal walls of a tube containing the gas and observed through a window in the wall is produced by transitions between orbits, namely metastable orbits including the ground orbit and orbits of greater diameters. Xray radiation involving transitions between inner electrons in smaller orbits, we can use the same Planck constant and a frequency, f, such that fh=f*h* where, f, is defined as f*h*/h and where h* is the kinetic energy expended in 1/f* seconds of these smaller radius orbits and f* is the frequency of these smaller orbits. Since only the energy,fh, of the radiation is measured, this is ok. However we must realize that the actually occurring frequency is not, f, but rather f*. We can extend the convention to the emission of gamma radiation due to orbiting charged masses inside nuclei moving at superluminal velocities as described and justified above. Also to continuous Xray radiation from electrons propelled by an applied potential difference to a target. As the electrons push past the outer electrons of atoms in the target, they are attracted to the positive charge of the nucleus until repelled by the orbital negative charge inside the nucleus. They then move more slowly in another direction away from the nucleus. The succession of projectile electrons produces an increase then decrease of velocity again and again in a sine pattern of various frequencies.(Other radiation is produced by the infrared excitations of outer electron transitions that absorb most of the energy of the propelled electron).Also to the band of frequencies associated with radiation from incandescent solids, liquids and gases under high pressure as the average frequency of excitation of smaller to larger orbits and back again and other charge oscillations associated with the vibration and rotation of molecules.

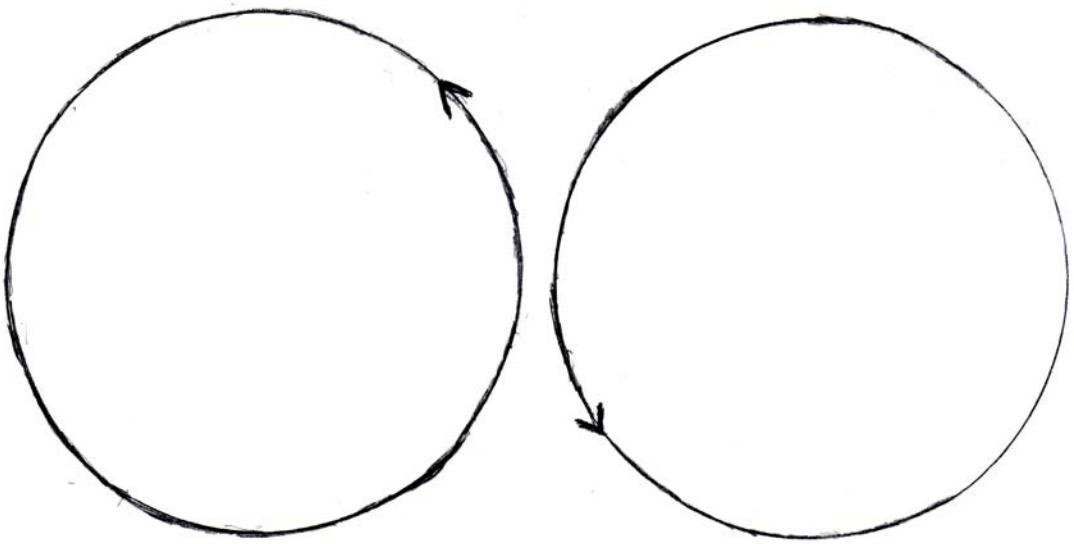
The point is that all radiation energy, then, is a multiple of the product of some charged mass, usually electron mass (but it could involve charged masses inside the electron etc) times its squared velocity which can be represented by convention as Planck's constant times some frequency times the number of atoms involved.

The orbital excitations are produced by thermal collisions. At each collision, we propose, a tangential force acts on an orbiting electron to produce additional transverse

expansion of the elliptically moving negative charge inside the electron of charge, -2e, around a larger core mass of charge, +e, and radial charge polarization inside the orbiting electron. Since the attractive force and repelling force between the electron and nucleus are equal at the ground orbit radius, this charge polarization must increase the repulsion between the electron and the negative charge inside the nucleus beyond this equilibrium and so add to the velocity increase of the electron away from the nucleus.

This explains the discrete, quantized, frequencies and energies observed. Why it leads to elliptical orbits and circular orbits of radii, $n^2 r_0$, and velocities v_0/n and frequencies f_0/n^3 is explained in part by the additional kick of the thermal collision causing an increase in orbital velocity. And in part by the relative stability of these orbits in analogy to standing waves as identified by de Broglie and Schroedinger. But the underlying causes have to do with charge polarization inside the excited electrons, .related to the charge polarization inside the ground orbit electron that prevents a smaller than minimal radius ground orbit for the atom. Also, the attraction between the increased charge polarization in the orbiting electron with the negative pole inside the electron facing the the nucleus produces for a small interval of time a greater attraction and neutralization of the effect of the added velocity until the added velocity is increased again and the result is a larger radius orbit.

Another aspect is: the least energy arrangement of adjacent orbitals so as to cancel one another's radiation which means that the energy lost in part of an orbit to an adjacent orbit, is wholly or partially regained in the rest of the orbit. Consider, a charged particle moving counterclockwise in the left circle at the point of the arrow, opposes a similarly charged particle moving counterclockwise in the right circle at the point of the arrow, etc...



. The net result, as Bohr showed, was that the average frequency and energy radiated during the transition between a ground orbit of radius,r, and a radius 4r or 9r is:

(h) $\times 10^{16}$ $\times$ (½) $\times$ (1+1/8) or

(h) $\times 10^{16}$ $\times$ (½) $\times$ (1+1/27).

The lack of a measurable difference between 1)average frequencies, during a light emitting or absorbing transition, and 2) difference frequencies means there is no need for the quantum premise of discontinuous absorption and emission of energies associated with difference frequencies.

As the receiving oscillator is constantly changing its orientation, the sequence of forces from the source is constantly changing direction in the sense that the component oscillating forces from the source in the direction of a receiver molecule orientation is constantly changing but their effect on the receiver can be described in terms of the combined effect of component oscillations in the plane of the receiver molecule at successive instants of time.

In the case of forces produced on orbiting electrons in the atoms and molecules of a photoreceptor such as the silicon material in a CCD array, the orbital electrons react to a tangential force that produces at first charge polarization inside the electron and an excitation of the orbital electron into a wider orbit. Before and during this time, the nucleus of the same atom experiences charge polarization from the same outside force which is transverse to the direction of force which is the same as the tangential direction of the force on the orbiting electron.

The effect of these forces inside the nucleus of the orbiting electron are equivalent to the forces in the longitudinal radio antenna. That is, changing transverse polarization creates changing longitudinal polarization and an amplification of the source 'longitudinal' forces but the directions of transverse and longitudinal are constantly changing. The result is an increase over kr/c seconds in the tangential forces acting on the orbiting electron, and so an increase in the orbit until the electron in the photosensitive silicon is ejected into a region of the silicon where it is held by a capacitor plate for a preset time, and the energy per second of the received radiation is calculated by a digital circuit.

We can infer the final root mean square v(t) of oscillating charge from measurements of the average or rms voltage and current in a receiver antenna given a distance r, from a radio(am or fm) or a microwave transmitter of a specified power. In the case of photoreceptors, we can infer, v(t), from the number of emitted electrons after successive picoseconds etc. assuming 1.26eV per electron emitted in a CCD array as indicated by the electron's ability to overcome a positive potential on the emitting surface etc.. That is, if one electron is emitted after a nanosecond which is 10^5 times the 10^{-14} seconds between thermal collisions when the average field due to the source and resonantly

increasing induced forces, is say producing rms average values of v, that are say .4 meter per second, during each orbital period which is also about 10^{-14} seconds for visible light, then (.4) $\times 10^5$ times $10^{-1} = 4 \times 10^4$ is added to the 10^5 meter/second velocity to produce, roughly, the square root of 2 or 1.4 times 10^5 which is the escape velocity that registers as one electron on the CCD capacitor. Note, $mv_0^2/2$ = 4.5 times $10^{-31+12} = 4.5 \times 10^{-19}$Joules = 4.5eV if v_0, denoting the escape velocity of the orbital electron, is 10^6 meters per second, Thus a smaller escape velocity on the order of 10^5 is implied. Also then a slightly smaller average root mean square v(t) of induced oscillating charge is required.

If it takes a micro or millisecond before an electron is emitted, then smaller values of v are produced each 10^{-14} second. Call these values, x, where 10^8 or 10^{11} times 10^{-14} seconds implies 10^8 or 10^{11} times x equals 10^4 so x=10^{-4} or 10^{-7}. That is, these are the velocities, v, each 10^{-14} second that, added to the atomic orbital velocity, produce the observed rate of ejection.

So the energy of a photoelectron is due to the continual oscillation of the forces at just the right frequency from the light source. Maxwell's wave theory implies that the energy from the oscillating charge in the light source a few meters away on the pixel size receiver would not produce the observed ejection over a second, much less the nanoseconds observed. So Maxwell's wave theory is disproved in this context. And Einstein's hypothesis of a photon is not required. The specific forces of the oscillating charge just described, allowing another nanosecond for the delay implied by the Maxwell like formula derived below, account for the observed delay and frequency dependence of the photoelectric effect.

Thus the rate of ejection of electrons from a CCD pixel is a measure of the delay before a light or modulated light source is detectable due to the weakness of the source as well as to the distance from the source. The forces in both cases are acting again and again for very short times. The electron velocities in the direction of the field in a radio antenna are much smaller eg 10^{-5} meters per second typically than the free electron thermal velocity, or atomic electron orbital velocities 10^6 or 10^5 meters per second.

Note the orbital velocities whose differences between pairs of excited orbits etc., because these differences are nearly equal to the averages of the same pairs, produce visible light.

Suppose for example, v=10^{-4} meters/second is added every 10^{-14} second period to the above orbital velocity of $10^{5.5}$ so that after 10^{10} such additions, the added orbital velocity is 10^6 meters per second, then ejection at the square root of, 2, times the orbital velocity will occur after only about a millisecond. Note thermal collisions of the orbits will have a net zero effect over time but the repeated resonantly increasing velocity will have a net cumulative effect.

RADIO RECEPTION

Initially in the radio receiver antenna there is a sequence over time, t, in picoseconds or less, of Coulomb forces,
$eE(t) = (e)[(1/4\pi\varepsilon_0)$ times $neA_0D_0 \cos 2\pi ft / r^3 = F_0 \cos \omega t,$
perpendicular to a line from the source, on free electrons of charge, e; (similarly for orbital electrons and on the orbital charge inside the lattice nuclei of the receiver antenna.)

These forces constitute a single oscillating force analogous to that of a forced mechanical oscillator, eg the pushing of a child on a swing, with characteristic parameters, the mass, m, the elasticity or stiffness, h, and the frictional resistance, j. There is the possibility of resonance if the forcing frequency, $\omega = 2\pi ft,$ is timed to the natural frequency, $\omega_0,$ of the oscillator eg the child is pushed forward always at the time of the swing's highest backward ascent.

The mechanical force equation is $F_0 \cos(\omega t) - hx - jx' = mx''.$

$-hx$ denotes a restoral force proportional to the displacement and $-jx'$ denotes a resistive eg frictional, force proportional to the velocity. Dividing by the mass, m, and rearranging terms.

. $(F_0/m) \times \cos(\omega t) = x'' + \gamma x' + \omega^2 x$

where $\gamma = j/m$ and $h/m = \omega_0^2$ is the natural frequency squared of the mechanical oscillator being forced. We can think of x as the displacement at time t, of oscillating electrons in a radio antenna from their average position and q(t) =neAx(t) as the magnitude of charge displaced, and dq(t)/dt is the current at time t, etc..

We will show, following this analogy, that the field at the receiving antenna acting on, q, is

$E(t,r) = (1 - \exp - ct/kr) \times [-(krf/c)^2] \times [(1/4\pi\varepsilon_0) \times nAD \cos(2\pi ft)]/[(r^3)]$
where $\omega = 2\pi f, and, \omega_0 = 2\pi f_0$

In words the oscillation of charge in the receiving antenna rises to two thirds of its steady state maximum after kr/c seconds where the steady state maximum is an oscillation at the same frequency as the source field. The maximum is proportional to the source field divided by the distance from the source and multiplied by the square of the frequency divided by the speed of light squared.

This transient increase and constant of proportionality is produced by the interplay of changing transverse and longitudinal dipoles inside the lattice nuclei of the receiving antenna in response to repeated forces from the oscillating source field. The effect is to produce an increase in the amplitude of the oscillation of charge until it is detectable as an oscillation of the free electrons in the receiving antenna.

That this is exactly equal to Maxwell's formula for the radiation received at a later time except for the exponential term in the numerator is support for the validity of the assumptions.

This implies that a stronger source sometimes can be received or detected sooner than a weaker source. In Maxwell's formulation the received radiation from a strong or weak source will arrive at the same time. We make the disclaimer that at small distances, r, the average transverse dipole effect of a stronger source could inhibit more strongly the transient increase of the received radiation than a weaker source. The net effect would be that the radiation from a stronger source becomes detectable no sooner than that from a weaker source. But at larger distances, r, this effect may be negligible given nearer sources of other such transverse dipoles. That is the expansion of transverse dipoles in the receiver is not made easier by having the distance to the original source made larger.

Lets now show how this result is obtained where we take into account charge polarization inside atomic nuclei as well as the motion of free electrons caused by the applied forcing oscillator. We have a displacement of charge, nex, in the antenna containing neAD electrons where neAx'(t) = I(t) is the current and the restoral force on an electron, e, is $-ne^2x(t)/\varepsilon_0$ from this displacement as derived below. The above mechanical solution suggests $x(t) = KF_0\cos(\omega t)$, where K is to be determined.

We have a second force, $-jx'$ due to the resistive effect of more thermal collisions when the electron velocity, x', increases due to more collisions and reduced time between collisions and that this is due in part to greater transverse dipoles, (r/c) times $x'(t)$, so the resistive force is –(j) × (r/c) × $(-K\omega F_0\sin(\omega t))$.

We have a third force proportional to x'' that is due to longitudinal dipoles that produce a field in the opposite direction to the applied field. These longitudinal dipoles $(r/c)^2$ times x'' yield, $-(K)\times(r/c)^2\times\omega^2F_0\cos(\omega t)$

Let's examine more closely first, the restoral force and then the forces due to transverse and longitudinal dipoles:

$mx'' = -(ne^2/\varepsilon_0)\times x$ describes the force of an electron displaced a distance, x, in a closed volume of electrons and positive particles from its equilibrium position where the net force on it is zero. This formula is derived from considering the force per unit charge produced by a region of unspecified net charge inside a sphere of radius, r, on the surface

of the sphere which Gauss showed was the same for any shaped surface, eg a cube enclosing the sphere.

Considering the force component vector at each point of the surface normal ie perpendicular, to the surface due to all of the net charge enclosed and integrating over the sphere, we get the net charge inside. So a displacement of charge by a distance x perpendicular to one face of the cube, times the density gives a net charge and this is the integral over the surface, so that you multiply the surface area of the sphere, $4\pi r^2$ times $nex/4\pi\varepsilon_0 r^2$ times, e, the charge of a displaced electron, which is the force per unit charge at each point on the sphere normal to the surface so that all that is left is, ε_0, in the denominator and ne^2x in the numerator.

Now let's examine the transverse dipoles. As in the case of a constant voltage in a dc current carrying wire, there is here in the case of an oscillating current, a transverse distortion of the orbits of negatively charged particles around a more positive core inside the lattice nuclei of the radio antenna or of the atomic antennas of the photoreceptors which produces transverse dipoles, perpendicular to the movement of the electrons and negatively charged particles inside the lattice nuclei. We showed that these dipoles per unit length were kr/c times the electron velocity in the direction of current and voltage, so in this ac case, $krx'(t)/c = p_{tran}$ is the transverse dipole.

The rate of change of these dipoles is a transverse oscillation of charge, a transverse oscillating "current" which produces a current of oscillating longitudinal dipoles per unit length $(kr/c)^2 \times x''(t) = p_{\lg}$

At successive times, t, transverse chains of these dipoles produce a transverse field at any point along the chain in the direction of the dipole and on either side of the dipole where the distance between dipoles is "a" where for example $1/a^3 = n = 8.47 \times (10^{28})$ for copper. (Note the field of each dipole, p, of length, s, p=es, along the axis of the dipole is $2p/4\pi\varepsilon_0 a^3$.(R.Feynman, **Lectures on Physics** vol 2, p6-3) ref 6. Adding up the forces from each dipole:

$$E_{tran} = [(p_{tran}/(4\pi\varepsilon_0) \times (2/a^3)] \times (2 + 2/8 + 2/27 + ...) = (p_{tran}/\varepsilon_0) \times (.383)/a^3)$$

"If the next identical lines of dipoles were only the distance "a" away - the number .383 would be changed to 1/3. In other words, if the next lines were at the distance "a" they would contribute only -.050 to our sum.[that is all the other atoms in the wire can be ignored in determining the longitudinal force at any point in a single chain]" Feynman Lectures, vol 2, p11-10 , ref 6.

E_{tran} is the field produced by each chain of dipoles on every point eg on every free electron inside the conductor in addition to the field from the emitting antenna.

Now this field would be immediately cancelled by a redistribution of free electrons if it

was not constantly changing. This oscillating current of varying transverse dipoles inside the atomic nuclei or rather the associated changing field creates dipoles transverse to itself, i.e., longitudinally. Just as in the case of direct currents the dipoles per unit length are proportional to the current or the average electron velocity, namely krv/c. In this case a transverse current of changing transverse polarizations of charge inside the atomic nuclei.

One question here is that the original longitudinal current was the movement of free electrons and still this provided a measure of the charge polarization of much smaller mass inside the atomic nuclei transverse to it. Does the derivative of this "current" also provide a measure of the rate of change of charge polarization inside the nuclei? We assume that it does. In both cases the "current" is produced by an implicit electric field in combination with the elasticity of charge, c, inside the nucleus, that produces the charge polarization.

The longitudinal dipoles in combination produce a field described by the same cosine function as the field from the emitter but with a negative cosine so the field is opposite to the field from the emitter.

$$E_{long} = (p_{long} / \varepsilon_0) \times (.33 / a^3) = (n / 3\varepsilon_0) \times (kr / c)^2 (x''(t))$$

Thus the forced oscillator equation to be solved could be written, with $(1/4\pi\varepsilon_0) \times neAD\cos(2\pi ft)/r^3$ set equal to E(t,r), acting on a point in the receiver antenna along with forces 1)proportional to the second derivative of this force times $(kr/c)^2$ meaning it is a cosine function in the opposite direction of E(t,r), and 2) a force also proportional to the current which is ninety degrees out of phase with E(t,r) meaning it is a "–sine" function of the same frequency, and 3) a force in the opposite direction of the displacement.

$$eE(t,r) - (ne^2 / \varepsilon_0) \times x(t) - (kr / c) \times (ne^2 / \varepsilon_0) \times x'(t) - (ne^2 / 3\varepsilon_0) \times (kr / c)^2 \times x''(t) = mx''(t)$$

But multiplying

$$eE(t,r) - (ne^2 / \varepsilon_0) \times x(t) - (kr / c) \times (ne^2 / \varepsilon_0) \times x'(t) - (ne^2 / 3\varepsilon_0) \times (kr / c)^2 \times x''(t) = mx''(t)$$

by D/e and writing x=q/neA and ED=V we obtain

$$V(t,r) = [(ne^2 / 3\varepsilon_0) \times (kr / c)^2 + \mathrm{m}]$$
$$\times q''(t) \times (D / ne^2 A) + [(kr / c) \times (ne^2 / \varepsilon_0)] \times q'(t) \times (D / ne^2 A)\,]$$
$$+ [(ne^2 / \varepsilon_0)] \times q(t) \times (D / ne^2 A)$$

or

$$V(t,r) = [(ne^2 / 3\varepsilon_0) \times (kr / c)^2\,]$$
$$\times q''(t) \times (D / ne^2 A) + [(kr / c) \times (ne^2 / \varepsilon_0)] \times q'(t) \times (D / ne^2 A)\,]$$

$$+[ne^2/\varepsilon_0]\times q(t)\times(D/ne^2A)$$

(Note $(ne^2/\varepsilon_0)\times(r/c)^2$ which for typical values, like $r=10^4$ is $10^{29-38+11-8}=10^{-6}$ or in a range typically of 10^{-10} to 10^{-4} and in any case so much larger than $m=9\times10^{-31}$, that we can drop the "m" term or electron mass in the first V(t,r) equation here. Simplifying, we obtain

$$[(kr/c)^2\times(1/3\varepsilon_0)\times(D/A)]\times q''(t)+[(kr/c)\times(1/\varepsilon_0)\times(D/A)]\times q'(t)$$
$$+[1/\varepsilon_0]\times(D/A)]\times q(t) = V(t,r)$$

This equation represents the voltage difference in a wire of cross section area, A, and length D at time, t, at a distance, r, from a powered emitting antenna. It is similar to the equation for an oscillatory amplifier circuit with the inductance, resistance, and capacitance parameters as indicated by the corresponding bracketed coefficients of q",q' and q.

$V=[L]q''+[R]q'+[1/C]q$. The familiar amplifier circuit solution (see Feyman Lectures vol 1, pg23-6 and 24-6 (ref 6) and as summarized in Feynman Note below) is obtained by assuming that the charge displacement, q, is proportional to the forcing oscillator with a phase lag and considering the corresponding complex numbers, $\hat{q}$, and, $\hat{V}$.

$\hat{q}=(1-e^{Rt/L})\times\hat{V}/(L((i\omega)^2+R(i\omega)+1/C)$ but here $\omega_0^2=1/LC=3c^2/k^2r^2$
and $\gamma=R/L=3c/kr$.

Also here the charge displacement, q, is determined after the transient delay time less by the source field than by the induced field which is the product of L and q'' or $(krf/c)^2$ time the source field at the distance, r, from the source.

Thus the charge displacement at time, t, and the oscillation of charge in the receiver is NOT given by the source oscillation divided by the sum of the inductive, resistive and capacitive coefficients that can be chosen at will.

Rather it is determined by the dominant force in the receiver, the inductive coefficient times the second derivative of the charge displacement where the inductive coefficient is $(krc/)^2$ and the charge displacement is assumed oscillating at the same frequency as the emitting antenna. This factor is derived from the assumption of induced longitudinal charge polarization and changing longitudinal charge polarization producing changing transverse charge polarization in turn producing increased longitudinal charge polarization etc.. The inductive force proportional to the second derivative is $(krf/c)^2$ times the source force and thus larger than the source force if the product of the separation distance and the frequency is larger than $3(10^8)$. For example a frequency of 30kHz and a separation distance, r, equal to 10km.. Thus for most radio and light signals the source force is less and the dominant field in the receiver is

$$E(t,r) = (1 - \exp - ct/kr) \times [-(krf/c)^2] \times [(1/4\pi\varepsilon_0) \times nAD\cos(2\pi ft)]/[(r^3)]$$

Note that the resonance characteristics and phase lag that followed from the standard amplifier circuit assumptions are not implied by our alternative assumptions. Of course by tuning the receiving antenna to the expected frequency by adding amplifying circuits, with inductors and capacitors and by lowering the resistance eg by cooling or increasing the crosssection ares etc, the signal could be made resonant with the receiver and detected more quickly than otherwise.

This is all quite analogous to Maxwell's model of a changing electric field creating a magnetic field and the changing magnetic field creating an electric field. But instead of changes happening through ethereal vortices or wheels and ball bearings or some mathematical equivalent, i.e., the curl and divergence of vector fields, ie of magnetic and electric fields, in the intervening space between source and receiver, it happens in movements of actual, charged particles inside atomic nuclei in the receiver and source.(If you haven't used the concepts of divergence and curl lately or ever, a good review can be found at the web site at reference 7.)

Note that for large r, rv/c, is near .1 Angstrom even when the average or root mean square velocity of charge in the receiver is very small and so the delay before this occurs and the electron oscillation amplitude is large enough to be detectable, may not be so great. That is, the delay may be much smaller than r/c. kr/c is the delay where k is much less than 1, before the oscillation of charge inside the nuclei increases and produces the oscillation of charge inside the antenna.

We have now definitions of Inductance, and Resistance, in terms of charge polarization inside atomic nuclei.

Are these definitions compatible with the standard definitions?

Since R=1.7 $\times 10^{-8}$D/A is the resistance of a copper wire of length D meters and cross section area, A square meters, as in this example, it follows from the equation,
$q''(t) \times [D/A] + (kr/c) \times (1/\varepsilon_0) \times q'(t) \times [D/A]] - (1/\varepsilon_0) \times q(t) \times [D/A]$
that $(kr/c) \times (1/3\varepsilon_0) = 1.7 \times 10^{-8}$ which it is for the right value of ,r.
In this context we have k=1. With $c = 3 \times 10^8$ and
$4\pi\varepsilon_0 = 1/(9 \times 10^9)$ so $\varepsilon_0 = 1/(12.56 \times 9 \times 10^9) = .88 \times 10^{-11}$
then $r = 3 \times 2.64 \times 1.7 \times 10^{8-11-8} = 10 \times 10^{-11}$ This implies that the distance between interacting filaments of current is a little more than the interatomic spacing. Such spacing is consistent with the fact that the dipole force formula is applicable only when the dipole length is much smaller than the distance between the dipole and another dipole or point charge on which the first dipole is exerting a force.

Since $L = (4\pi \times 10^{-7}) \times (l \times 8\pi)$ for a wire of length, l, this should equal our $((kr/c^2) \times (1/3\varepsilon_0) \times (D/A)]$ where D = l and A= πr^2 and we see that

$(1/c^2)\times(1/3\varepsilon_0) = (1/3)\times(1/9)\times 10^{-16}\times 4\pi\times 9\times 10^9/3 = (1/3)\times 4\pi\times(1/3)\times 10^{-7}$
and that $r^2/\pi r^2$ times this is (4/9) times 10^{-7} and times l, gives us the standard, experimentally determined value, $L = 4\pi\times(10^{-7})\times(l)/(8\pi)$ for a wire of length, l.

Thus electrostatic dipoles inside atomic nuclei used to explain the magnetic force between current carrying wires also explain the mechanism of resistivity and the mechanism of self inductance.

. Such an explanation of light transmission requires that the cumulative increase of the received radiation above a threshold of observation depends on constant exposure of the receiver to the source. That is, radiation we observe from stars cannot have originated years or centuries ago as implied by the extrapolation of terrestrial light speed measurements to such distances; indeed it could not have originated more than 12 hours or 12 times 3600 = 43,200 seconds earlier at most when a heavenly object rises and then falls below the horizon of any observer tracking its trajectory across the sky.

One of the side benefits of this explanation of light transmission is that the Lorentz Transformation, $1/\sqrt{(1-v^2/c^2}$, times mass, length or duration, where v is the relative velocity of source and observer, which Einstein used to explain infinite `mass increase because it so well explained the lack of ether drift in the Michelson Morely experiment is unnecessary. That is, if light is not the motion of something but rather the additive effect of repeated instantaneous forces at a distance, then there is no need for space contraction or time dilation etc..

Red Doppler shifts etc. of spectra from a source moving away from a receiver would be expected because of the ratio of the speed of the moving source to the rate of increase of the transient as successive oscillations of charge are produced in the receiver and have nothing to do with time slowing down. Slower muon decay in very fast moving muons can be ascribed to the interference of forces causing the high speed of the muons and the inner forces leading to the decay and not to time slowing down in the muon.

Also, as shown in detail later, there is no need to have the force of Gravity, say between the Sun and the Earth, depend on curved space, ie the rate of change of the force, proportional to the mass and inversely to the distance squared, to avoid the supposed light speed delay problems of Gravity. This was Laplace's concern around 1800, that the Earth orbiting at .5km/second, for example would be dragged backward when pulled in the direction the Sun was when the force was "emitted" and so spiral into the Sun unless the speed of Gravity was much larger than the speed of light. If the force of Gravity is instantaneous and continuous unlike the repeated oscillating relatively weak instantaneous forces causing increases in oscillations of light or microwave frequencies etc., from comparable distances over times that are still much less than the r/c seconds usually ascribed, there is no need to worry.

The bending of starlight by the Sun associated with the curved space effect is the same as predicted by the difference in the electrical influence of the Sun on radiation reception

on the Earth when the Sun is facing the Earth compared to its effect when the Sun is on the other side of the Earth. Other supposed validations of the curved space hypothesis, eg the precession of Mercury and other planets have explanations in terms of torques produced by the net electrostatic dipoles associated with the planets and the Sun. etc..

FEYNMAN NOTE. Here is an expanded version of Feynman's solution of the equation for a forced oscillator with damping:
$m(d^2x/dt^2) + c(dx/dt) + kx = F$

The solution to this equation is obtained by writing the unknown, x, as the real part, x_r, of a complex number, $\hat{x} = (x_r, x_i)$ and the known driving force F as the real part of a complex number $\hat{F} = (F_r, F_i) = F_0 \cos\omega t + iF_0 \sin\omega t = \hat{F}\ e^{-i\omega t}$. We thus are led to assume that $\hat{x} = (x_r, x_i) = x_0 \cos(\omega t + \theta) + ix_0 \sin(\omega t + \theta) = \hat{x}\ e^{i\omega t + \theta}$. In words we are led to assume that the unknown solution of the displacement of charge at time, t, due to the driving force and the resonance properties of the oscillator, is an oscillation at the same frequency as the driving oscillator with a possible delay of phase,

The advantage of this complex representation is that the derivative of an exponential function is the function itself. Thus, d/dt $[\hat{x}\ e^{i\omega t+\theta}] = e^{i\theta} d/dt\ [\hat{x}\ e^{i\omega t}] = i\omega\ \hat{x}\ e^{i\omega+\theta}$
Substituting the complex numbers in our forced oscillator equation above. $(F_0/m) \times \cos(\omega t) = x'' + \gamma x' + \omega_0^2 x$ and writing their derivatives as indicated we obtain.

$$[i\omega)^2 \hat{x} + \gamma(i\omega)\hat{x} + \omega_0^2 \hat{x}]e^{i\omega t+\theta} = (\hat{F}/m)e^{i\omega t}$$

Dividing both sides by $e^{i\omega t}$ and dividing the left side by the coefficient of $\hat{x}$ we see that $\hat{x} =$ $\hat{F}$ divided by $m \times ((-\omega^2 + \omega_0^2) + i\gamma\omega)$ times $e^{i\theta}$ is the solution.
$= F_0 \cos\omega t + iF_0 \sin\omega t$. Note
$(1/\rho)e^{-i\theta} = ((1/\rho)\cos(-\theta) + i(1/\rho)\sin(-\theta)) = (1/\rho)\cos(\theta) - i(1/\rho)\sin(\theta))$.
We can write $\hat{x}$ as $(1/\rho)e^{-i\theta} \times \hat{F}$ where $1/\rho^2 = [m((-\omega^2 + \omega_0^2) + i\gamma\omega)]$
$\times [m((-\omega^2 + \omega_0^2) - i\gamma\omega))]] =$
$((1/\rho)\cos(-\theta) + i(1/\rho)\sin(-\theta)) \times ((1/\rho)\cos(-\theta) - i(1/\rho)\sin(-\theta))$
$= ((1/\rho^2)(\sin^2\theta + \cos^2\theta))/ = [m^2((-\omega^2 + \omega_0^2)^2 + \gamma^2\omega^2)]$ so

Thus the real solution is $x_0 = F_0 \cos(\omega t + \theta)/m\sqrt{(\omega_0^2 - \omega^2)^2 + \gamma^2\omega^2}$
This representation too, shows us that
$[(1/\rho)\sin(-\theta]/[(1/\rho)\cos(-\theta)] = -m\gamma\omega/m(\omega_0^2 - \omega^2) = \tan\theta$
It is minus because tan(-θ)= - tan(θ). A negative value of θ results for all ω, and this corresponds to the displacement x lagging the force F. The moreso the greater the resistance over the inductance, $\gamma = R/L$, and the closer to resonance the forcing oscillator is to the receiving circuit..
(see ref 6) Feynman **Lectures on Physics**, v1, 23-4, 23.12.

LIGHT SPEED MEASUREMENTS

Many measurements of light delay between a radiation source and receiver are only of the initial rate of increase of the transient carrier oscillations of charge in the receiver, . Examples are the Earth moving relative to the radiation source, like Bradley's fixed star or a spacecraft radio transmitter. Thus the Doppler frequency shift from the spacecraft signal is f' = $(1 \pm u/c) f$, where u denotes the relative speed of Earth and spacecraft toward or away from each other and c, the speed of light, is really just the rate of increase of charge oscillations in the receiver. In Bradley's so called light speed measurement, the Earth's orbital speed, v , transverse to the impinging light is compared to the parameter, c, and an angle θ is measured where $\tan\theta = vt/ct$ and vt is the distance the earth moves in t seconds transverse to the impinging light. "ct" is the rate of increase of amplitude of oscillating charge in the eye times the time until the increase is detectable at the eye at the eyepiece end of a telescope. Thus, ct is the length of the telescope and the distance light moves from the objective to the eyepiece.

Everyone assumes that light speed is something that has been verified hundreds of times at all frequencies and terrestrial distances and that time delay can be used to accurately determine not just plane to ground or gun to target distances with radar but, with GPS devices, distances to within centimeters to satellites about 12000 miles away, and with microwave communications distances to space probes up to billions of miles away, and with Lidar and Radar reflections sent from the Earth to the moon and planets, distances to stars four hundred light years away as determined by parallax and further as determined by the relationship determined between apparent brightness and spectrum peak detected brightness for these distances applied to greater distances.

If one looks at the details, the experimental confirmation at greater distances is not as unambiguous as we are led to believe. That is, weak radar returns from emissions a minute earlier are not always distinguishable from returns of emissions twenty minutes earlier from a target say 600 seconds away according to the standard speed of light delay assumption. Thus returns arriving earlier than expected are not examined. If the radar returns are time stamped, they are so weak that the only indication that they are not noise is that they are chosen from among a sequence of similar returns to be the least noisy. And there is no independent confirmation of the data as there is in the GPS system discussed below. Also built in electronic delay and built in redundancy delay in radio measurements from distant satellites and space probes typically exceed the assumed speed of light delay. (the radar transceiver is continually switched back and forth from sending to receiving mode)

The Maxwell theory implies that a doubly strong source at the same distance, r , to a receiver would NOT be received with half the delay. And the theory of transient oscillations of charge inside atomic nuclei agrees that this might occur for small values of r . That is, magnetic resistance would be produced by the associated transverse field of the longitudinal source field. The greater the longitudinal field the greater the transverse

interfering field, at least for small values of, r, while for larger values of, r, magnetic resistance fields from other sources would cancel such an effect. But there is no evidence, that I have been able to find, to support this. For example in the Fizeau-Michelson type experiments where the distances are five to 25 miles, doubly strong source fields have not been compared with weaker source fields. Similarly for GPS satellites at distances near 12000 miles.

It almost seems that light speed delay measurements, by accident or , by design in the GPS case, have source powers-eg the 50 watt GPS transmitters instead of 8kW- and distances so that the intensity of radiation at the receiver is very small. This means that the delay from received satellite emissions can be calibrated to match the Newtonian calculation of satellite position based on the Doppler confirmed speed of the satellites etc, and the known latitude,longitude and altitude of a receiver on Earth. That is, a radio receiver with improved resonance tuning and amplifying circuits and digital techniques will receive weaker signals and receive them to some extent sooner than otherwise. Calibrating the receiver, increases or decreases the delay from the signal sent with given power from the satellite.

Thus engineers involved in the calibration know then exactly to what extent light speed delay can be modified for distances of 12,000 miles(64 milliseconds) etc. by calibration of the receiver and, to the extent possible, by calibration of the orbiting transmitter.

According to Maxwell's accepted theory and the theory proposed here, there are longitudinal forces produced by the source on the receiver that cause a oscillation of charge in the receiver and transverse forces that reduce this oscillation from what it would otherwise be. An increase in the longitudinal forces entails an increase in the inhibiting transverse forces so that the net result of weak and strong forces from the source are equivalent. This implies that that a more sensitive receiver can have little if any influence on reducing the delay between source and receiver. But at least for the theory proposed here, there is reason to believe that at greater distances, the inhibiting forces associated with the forces producing oscillation of charge constituting the radiated carrier, that these inhibiting forces are cancelled by other such forces in the vicinity of the receiver.

Before analysing historical measurements, that everyone, including NASA, considers as support for the speed of light delay extrapolation to astronomical distances, let me state the following:

Statistical methods for analysing a pseudo random sequence of microvolt changes against a background of random changes of the same magnitude are used by NASA in interpreting radar signals bounced off the moon and nearby planets and their moons. See for example Pettingill et al, at MIT: "A Radar Investigation of Venus" ref 9. "Individual runs consisted of transmitting a simple train of uniformly spaced pulses for a time approximately equal to the EXPECTED round-trip echo delay which varied 283 to 449 seconds over the course of the experiment [given the Earth and Venus orbits and the

assumed speed of light]

"Shortly before the first pulse of the train arrived back, the transmitter was shut down and the antenna connected to the receiver. This of course assumes the speed of light delay though the arriving pulse could have been produced by a later transmission. The receiving frequency was adjusted for the Doppler shift and integration in the computer was begun. Since the individual returning echo pulses were much weaker than the overall system noise, they could not be seen. In general five minutes of integration were required to render the echo visible [By adding supposed repetitions of the noise plus known pseudo random sequence of ones and zeroes, for a repeated train of pulses the noise with various starting points, the noise should cancel out in a large number of such additions"] (ref 9).

The supposed echo was the chosen sequences of pulses which when added together showed the larges number of sums that were non zero, ie above an arbitrary level and came closest in agreement with the pseudo random sequence. But there was no independent confirmation of the procedure as in the GPS system! Thus there are two reasons to question the value of this data for supporting the standard speed of light delay assumptions; 1)The received data is valid but it was transmitted earlier than assumed and 2)The received data is chosen so as to be least like noise.

The GPS device(ref 10) apparently measures the time, t*= .064 seconds about, it takes to receive a radio signal emitted by a fifty watt satellite transmitter from a distance of about 12,000 miles(19,310km). The satellite transmitter or rather the transmitters of each of three satellites send identifying codes and time signals every 300 seconds at slightly different frequencies. The time signals are given in 20millisecond long bits, inside of each such bit there are 20 strings of code each 1 millisecond long containing 1000 bits, each a microsecond long. The code bits are produced by a sequence of more than a 1000, .62nanosecond long sine waves constituting the carrier. The beginning and end of each microsecond or each 20 milliscond bit or sequence of bits is marked by a change in phase. That is, the .62ns sine wave, varying from zero to, +1 to zero to -1 to zero etc, as it goes down from 1 toward -1, it stops at zero, and goes up again. This is a 'marker' that indicates a change from a zero bit to a one bit or a one bit to a zero bit as agreed upon. In this way the values of the 20 millisecond bits as part of a data sequence or of the microsecond bits as part of a pseudo random code sequence are determined.

The large data bits give the time, and position and velocity at that time of the satellite when the first .62nanosecond bit of the carrier is emitted, every 300 seconds. The receiver records the time of reception from each of the three satellites,Ti=T, since the satellite clocks are precisely synchronized by atomic clocks, and 300 seconds later, T +300 + ti, where, ti, denotes the delay time from the ith satellite transmitter. The coordinates of the receiver can be calculated from the coordinates of the transmitters and these delays and implied distances, the speed of light times these delays. The different distances are viewed as the radii of three intersecting spheres. The radii equal the sum of squares of the xyz coordinates of points on each sphere. The xyz coordinates of points on a circle where two spheres intersect (the rim of a hole in one sphere) contain the xyz

coordinate of the GPS. The intersection of this circle with a third spherical surface is two points only one of which will be on the Earth, and this is the coordinate of the GPS device. An algorithm to calculate the point is the Snellius Trilateration algorithm. http://en.wikipedia.org/wiki/Trilateration. Corrections to the GPS device position so calculated are made using a known satellite transmitter distance to a fixed receiver in the same vicinity and the correspondence of this distance to a similarly measured time delay, every 300 seconds.

Thus the time delay from a satellite to the beginning of some 20millisecond long bit is given and the overlap of the received 1000 code bits, each a microsecond long, with a stored replica of the code bits gives the delay to the nearest microsecond about and distance to the nearest .18miles about.

A stored pseudorandom sequence of a thousand, zeros or ones, forming a .001 second long stored 'replica' is compared to a received version of the 1000 microsecond long code bits that is repeatedly being sent.

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If you had to start the stored replica, 3.3 nanoseconds later to get a perfect overlap or correlation then the delay would be 3.3 nano seconds more than implied by the time data number. The maximal added delay possible is 181/186,000 = .97 times .001 seconds.

Note this would mean that the further away GPS device would show the rise above noise, the matching of the stored replica code to the received version of the code, 3.3 nano seconds into the first bit of about .6 microsecond duration. Thus, so long as the rise time above noise is less than the difference in distances divided by the so called speed of light, the distances between GPS positions can be detected. (The matching up of the stored replica would be one bit earlier in the closer GPS).

The implication here is that the time before a more distant GPS receiver has a signal rising above noise can be confirmed by a number of matches between replica and received radiation is about 150/186000 so less than 1 millisecond. This is near the delay times observed in Fizeau-Michelson type measurements.

The bottom line then is that the GPS transmitter and a fixed GPS receiver are to some extent adjusted so that the delay of the transmitted signal to a receiver at a precise distance and time, precisely calculated from Newtonian mechanics and Doppler data etc, about r=12 thousand miles away, is what would be expected from the speed of light delay, r/c. Atmospheric conditions can partially absorb and so weaken the signal and so make the delay longer for a given calibration. It would be interesting to know how much less than the expected r/c delay can be obtained by adjusting the fixed receiver and under ideal atmospheric conditions. That is, to what extent at r=12000 miles, do the local transverse dipole forces ie magnetic fields, cancel some of the inhibiting effects of the transverse dipole forces, accompanying the longitudinal forces from a GPS transmitter, that produce the received longitudinal carrier oscillations in the GPS receiver?

In the Pioneer space craft that went to the edge of the solar system before their signals

became too weak to be observed on Earth, after passing Jupiter, Doppler shift measures of successive changes of position wrt time were more reliable than range measures of the time between sent and received signals.

Note that as the craft-Earth distance increased, the number of repeated bits in each signal increased to avoid errors and the time of this repetition exceeded the speed of light delay.

Specifically, communication with the 8kW transmitter on the Pioneer 10 space probe near Pluto at a distance of $4.34 \times (10^{12})$ meters or, dividing by 3×10^{8} m./s., 14,400 seconds or 4 hours away or something similar for the Voyager space probes. But it may also be, as allowed by the proposed mechanism, that the speed of light delay was less. I am told by NASA that the duration of repetition of ones and zeros in a series (comprising a code or an instruction or a set of instructions) sent to and from deep space probes always exceeded the speed of light delay (4 hours per bit or group of bits). Even if the duration or repetition of the carrier modulation for a one or a zero was less, even much less than the speed of light delay, the difference in positions of the space probe at successive times would have been accurately detected.

That is, the change in frequency received on the ground showed the relative speed of craft and the Earth antenna. Increasing conflict between successive Doppler measures and range measures after the probes passed Jupiter indicated something might be wrong with the speed of light delay assumptions.

John Anderson, a radio engineer at NASA, unwittingly has shown that the speed of light assumptions implicitly used by NASA for all of their work to track the Pioneer and Voyager deep space crafts were probably wrong. That is the spacecrafts seem to be slightly more attracted to the Sun than were the planets. A possible reason for this is incorrect assumptions about the speed of light delay and implied positions of the craft when signals were received supposedly many hours after they were sent from the craft and when the Earth was not aimed at the instantaneous position of the craft. Many other relativistic and light pressure explanations were exhaustively examined and discredited by Anderson and his team.

Now for the historical measurements: First, Roemer's so called measurement of the speed of light in 1676. Roemer's measurement of the speed of light required that light be a wave front or a group of moving particles. That is, Roemer's measurement required that reflected Sunlight, reflected from the surfaces of Jupiter's moons, traveled as a wave front or particle for about 40 minutes using Bradley's value (or 5 5 minutes using Roemer's value) until it reached the Earth.

By which time an observer on the Earth would have orbited and spun with the Earth a substantial distance, sometimes from under clouds, to a location with an unclouded view of the night sky. Roemer's measurement did not entail constant exposure of the light receiver to the light. But nothing of course could block the reception of light at the expected time of arrival.

Until Bradley's paper on stellar aberration in 1728, the most knowledgeable astronomers at the time, like Cassini, thought that the changes Roemer observed were due to changing points of view, the obvious, changes in relative positions of Jupiter's moons and the Earth and not to light speed. Then the order of magnitude similarity of Roemer's measurement of light speed and Bradley's measurement of light speed from a distant star but independent of its distance, suggested the light speed delay from the star was r/c where r was the unknown large distance to the star

Unlike Roemer's measurement, Fizeau's measurement of light speed in 1849, entailed constant exposure of the light receiver to the distant mirror when light from the distant mirror was supposedly traveling about five miles to successive gaps of a spinning cogwheel or toothed wheel. That is, a strong sodium vapor light source reflected off of a nearby, slanted, partially transparent mirror, the source mirror, and was focused by a lens to pass through a fixed region of successive gaps in a spinning toothed wheel to a distant mirror 8.67km away through the still dark enough Parisian night sky and then reflected back and focused through the same or another gap if not blocked by a tooth, going straight through the slanted glass to the observers eye.

The wheel with 720 teeth when revolving at 25 revolutions/s. gave maximum light intensity and at 37.5 rev/s the teeth apparently eclipsed the light and at 50 rev/s maximum light intensity again. If the wheel made one complete revolution in a second, the time between successive gaps at the locus of the focused light would be 1/720 of a second. So 1/25 times 1/720=1/18000 second is the time it takes for light to leave through one gap and reach the distant mirror and then to return just in time to pass through the next gap. This meant a speed of 17.34km./5.566$\times$ 10^{-5}s. = 3.10204$\times$ 10^{8} m./s.

But it is also true that the during the supposed travel time or rather one quarter of it, light from the source mirror is exposed to the distant mirror and then, for half of the travel time, a tooth is interposed between the source and distant mirrors and then for another quarter, the observer's eye behind the source is exposed to the distant mirror.

Now if during these times of exposure first the mirror and then the eye are responding to the oscillations of charge in the source and mirror respectively. During the time the cog tooth is blocking the eye, these forces from the source or lenses as secondary sources cannot act on the eye.

Thus it is possible that instantaneous forces at a distance initiated at these unobstructed times, and, delays taking place in the distant mirror, the lenses and the receiver's eyes, could account for the observed delay made measurable by the spinning toothed wheel. What would have happened if the light source had been twice as strong or the distance had been half as great?

In terms of the proposed mechanism, the transient rises to a maximum value of krv/c where v is a sine function of the visible light frequency when t=kr/c where r is the total distance of about ten miles and k is 1.

That is, oscillations of charge in the eye's molecules like those in the Silicon molecules of a CCD array increase in amplitude until the small but increasing velocities added to orbiting electrons, each 10^{-14} seconds produce after 100 microseconds, an effect similar to the ejection of an electron onto a virtual capacitor plate of a CCD array signaling the reception of light.

It is interesting to note that Bradley's 1723-28 light speed observations also could be explained as well as in terms of the light delay from the observed star but also in terms of the light delay from the refractive glass, the objective lens at the far end of his 12.5 foot or 25.5 foot telescope, where the star's light is then re-emitted to the eyepiece in front of the eye (forming a reverse image there) and then being reversed again by the refracting eyepiece into the eye- or even from the eye's own lens to the receptor molecules in the rods and cones.

That is, a bright northerly star, Gamma Draconis, the brightest star in the Dragon constellation, at a specific time, spun briefly into the narrow view of the telescope raised from a north south line of longitude to point directly overhead ie the zenith(51degrees lat. at London) and capable of being moved by a micrometer mechanism in seconds of a degree but not to exceed eight minutes of a degree of altitude up or down or to the side being east or west or north or south.

The Earth, orbits at 29km/s in its orbital plane directly below this somewhat polar star. In March, the motion was such that if you drew a line from this star to the object glass of the telescope and then down to the eyepiece at the time of day the star passed into and out of view in a east to west direction you would see that the star appeared more south than at other times of year.

That is, at this time, the star appeared 41 seconds of arc more southerly than in September as determined by moving the micrometer until the star was exactly at the center point of the cross-hairs of the eyepiece at the time of day when it crossed the line of longitude ie the Greenwich or zero meridian.

It was as if the Earth and eye were moving exactly opposite to the way they were moving in September and in a more directly north direction so that by the time the light reached the eye, the eye had moved more northerly and the image of the star appeared to come from a more southerly direction.

This meant that the time it took the light impinging on the objective glass to register on the eye 12.5 or 25.5 feet away was the time it took the Earth and so the observer's eye, to move in the Earth's orbital plane a small southerly distance from the base of a vertical perpendicular dropped from the objective glass edge at the instant the starlight impinged on the objective glass.(Of course all this time the spin of the Earth makes the star image to move in an east to west direction also but we are ignoring this and just looking at the orbital movement that appears to be northerly at this time of year.) The distance along the vertical perpendicular is, ct, where, c, is the unknown speed of light and the

horizontal(north-south) distance is ut where, u, is the orbital speed of the Earth. The time, t, is the same in both cases.

We know that at one day in March, this distance is 41 arc seconds more south than at the opposite time of year in September and thus 20.5 arc seconds more south than when 3 months earlier or later where, there is no such change. Consider then the right triangle formed by the vertical side of length ct, the hypotenuse being the 25.5 foot telescope and the horizontal side, ut. The quotient, ut/ct, is the tangent of 20.5 arc seconds =.0000099 and so c is 29 times this or 2.929292×10^8 meters/second. The implied delay is about 25.5 nanoseconds and other telescope lengths, ct, would have longer or shorter delays. Bradley's calculation here allows the possibility that light delay could be in the space between the star and the eye or, as one in Bradley's circle, T Melvill, in 1753 suggested, wholly inside the eye. (p483 of Bradley, Miscellaneous Works and Correspondence edited by Stephen Rigaud). As the telescope length, and vertical distance expressed as, ct, is made smaller or larger, so also is the horizontal distance that the Earth moves expressed as, ut. But only one value for, c, will work in all of these cases.

We can interpret these times, t, as the delays before the oscillations of charge in the receiver atomic nuclei increase to a maximum amplitude when the distance projected on the vertical is ct and the receiver is moving along a horizontal at velocity,u. Thus light from a telescope objective twice as far away as that from a smaller telescope objective would have r/c delays produced by the interaction between longitudinal and transverse dipoles induced in the eye as described above. It is possible that light from the star could have been delayed for t* such that ct* is the distance to the star about 148 light years where a single ly=5×10^{12} miles, determined, long after Bradley, by parallax, and other astronomical theory but it is not necessary and Roemer's observations do not require it to be so. That is, Roemer's observations of Jupiter's moons could be explained by changes in the vantage point from the Earth as the Earth and Jupiter and these moons moved relative to one another.

Thus c, need not be the speed of something but the rate of increase over time of a detectable level of light at various distances, c times various times. As the distance increases the delay time increases. The distance could be the delay time from the objective lens to the eyepiece glass in a telescope times this distance or the delay time for a slightly longer scope ie a longer distance between eyepiece and objective lens. But these delay times are all very small fractions of a second. If a greater time is implied the ratio of ct to the distance vt, the earth moved in its orbit in this greater time is still v/c.

But then we are left with the question as to how great is the actual delay of light from the star? The delay is not just due to distance but due to combined effect of distance and the strength of the oscillations of charge in the star. If we construct a light source at some arbitrary distance so that it has the same effect on a CCD array of pixels as the star. That is, the number of ejections per second in each pixel above the dark current tells us in microseconds or nanoseconds or picoseconds the delay of light from the strong distant star as well as from the weak, close, light source.

You might object that the stronger more distant source might have a stronger transverse dipole inhibiting effect. But as we have said before, such 'magnetic resistance' at great distance would be cancelled by other magnetic fields in closer proximity around the receiver.

In Maxwell's formula by itself, there is only the assumption of an r/c delay and a mechanism of ethereal wheels and ball bearings in the intervening r meters of separation applies to all values of r. But this assumption has only been unequivocally validated for r= 181 miles at most by the GPS system. Thus the light from the star experiences a transient delay in the receiver eye or CCD molecule of kr_{star} /c seconds which is the same as the r_{lens} /c seconds for the star's light reflected by the objective lens of Bradley's telescope. In both cases the delay is a few nanoseconds and k must be a very small fraction of, r_{star} .

So our $(Ar^{-1})(1\text{-}exp\text{-}kct/r)$ model implies that, if the average rms velocity produced is say $v=(4) \times 10^{-3}$ meters/second and a CCD array emits a 1.6eV electron after repeated additions of this velocity every 10^{-14} second period of the electron orbital, after every 100nanoseconds (10^{7} repeated additions leading to an additional 4×10^{4} meters per second to the orbiting electron which sum $(1+.414) \times 10^{5}$ is the square root of 2 times the 10^{5} meters per second velocity of the orbital electrons leading to ejection) then rv/c for r = 148 ly or 148 times $(5) \times 10^{12}$ miles times 1.6 to yield $1184 \times (10^{12})$km = 10^{18} meters, is $10^{18\text{-}3\text{-}8}$ is 10^{7} which we know is 10^{18} times too large for rv/c to be .1 Angstrom. Thus we have to multiply 10^{-18} times rv/c to make the dipole .1 Angstrom which implies the delay for the light from the star to the Earth is 10^{-8} seconds about: The same as the delay for the light from the objective lens at the top of a 12.5 foot or 25.5 foot telescope to reach the ocular lens and eye.

We can consider secondary scattering from the objective lens as a much closer and weaker radiation source, r=10 meters that produces a detectable oscillation in the receiver of root mean squared, v meters/second, such that rv/c is at most .1 Angstrom. That is, v, can be as large as 10^{-4} meters per second after a delay of $10^{1\text{-}8}$ or 10^{-7} seconds. Note that the strength of the field at the receiver is QD/r times f^2/c^2 where QD is the total maximal dipole in the source antenna or the secondary source antenna. QD for the star is enormous but so is the distance,r. QD for the objective lens as secondary scattering source is very small but so is the distance, r. If both of these net fields are very strong, the oscillating dipoles produced in the receiver may reach a detectable magnitude before the kr/c or r/c delay because the fraction from the exponential though much less than 2/3, produces a large value when multiplied by the strong net field.

From these considerations, the light from the star has a delay to our naked eye of about ten nanoseconds. Similar computations can be made for other planets etc, Light from the moon and Sun arrive with even less delay, In all these cases the delay is nearly zero.

If we choose Cassini's explanation of Roemer's observation then, Roemer's observations are not due to light delay but due to changes in the view from Earth of Jupiter's moons at different times. Thus light from the Sun or from the reflection of

Sunlight on Jupiter and its moon's could be observed in small fractions of a second after it is emitted without being inconsistent with Roemer's observations. Similarly for observations of Binary Stars whose explanations in terms of the speed of light could equally well be explained in terms of changes in the view from the Earth at the chosen times.

The Earth's orbital speed, 29km/sec, was known then from the known 365 day period and Cassini's 1672 observation of Mars' position from two widely separated points on Earth(Paris and French Guyana) at the same time which gave the Earth Sun distance or orbital radius as $1.4\times (10^8)$km. ($1.46\times (10^8)$ is the more accurate present estimate). Since 39370inches =1km, 29km/sec is $1.141730\times(10^6)$ inches per second.

Thus in the case of the Bradley and Fizeau measurements, the delays in the perception of light are nanoseconds or milliseconds and not 40 or 55 minutes in the case of Roemer's measurement and the receiving eye was exposed to the refracted image at the time of secondary emission from the glass lens.

In any case, Maxwell's theory of light transmission and delay in 1861 based on Kirchoff's theory of transmission in an aerial coaxial cable(1857), both a few years after Fizeau's measurement in 1849, showed that Fizeau's light speed measurement agreed roughly, not only with the Bradley, Roemer values but also with the ratio of the magnetic constant, $\mu_0=4\pi\times (10^{-7})$ to the electric force constant, $1/4\pi\,\varepsilon_0 = 9\times 10^9$. That is, the force between parallel wires a meter apart carrying currents of 1 amp or 1 coul/s is 10^{-7} Newtons and the force between two charged spheres a meter apart each carrying one Coulomb of charge is 9×10^9 Newtons. And that light speed was a fundamental constant relating magnetism to electricity, $c^2 = 1/(\mu_0\varepsilon_0)$, Kirchoff's value was $c=3.1\times 10^8$ m/s.

This led many to conclude that the differences in the other measurements were due to experimental errors and that more care in making these measurements- Albert Michelson spent his entire life doing this- would yield exactly the ratio of the electric force to the magnetic force. But as we have shown, the true significance of the speed of light squared is that it is a measure of elasticity of charge polarization inside electrons and atomic nuclei. The actual speed or delay of light in any particular case is a result o the transient increase, a function of this constant, of oscillating charge inside the atomic nuclei of the molecules in the receiving antenna or photosensitive material.

We have shown that discrete frequencies of radiation emitted by excited atoms of light sources are the average of the initial and final stable or meta-stable orbital frequencies (no radiation is emitted by the stable or meta-stable orbits because their oscillating fields after their least energy arrangement of themselves cancel each other out.)

We have also shown that the stable and meta-stable orbits or energy levels of atoms are the result of a balance of the attractive nucleus-electron forces and the repelling forces between polarized charge inside orbital electrons and inside atomic nuclei. The viability of multiple electrons in a single orbit as Bohr hoped for, is made possible by charge polarization inside the electrons and nucleus.

In a companion paper on gravity and magnetism as due to charge polarization inside electrons and inside atomic nuclei, I have tried to show that such polarization can explain not only the mechanism of light and radio transmission but also: 1)the apparent increase of mass of electrons moving at nearly the speed of light as a decrease in the rate of increase of charge polarization inside the electron as it is forced to move at such velocities. 2) that the superluminal orbital movement of a mass of 10^{-56} kg of charge, twice that of the electron, around a core of half this charge but positive and of mass equal to the electron mass of 9.1×10^{-31} kg. can explain the magnetic property of a moving electron and the apparent increase in mass to infinity at velocities approaching the speed of light. 3) That the gravitational field of the Earth, the moon and other planets and stars and the Galactic center is due to charge polarization inside the atomic nuclei of atoms and ions in these bodies.

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