THE ELASTIC LIMIT OF SPACE AND THE QUANTUM CONDITION

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PREFACE

The Department of Energy completed a review of the electrolytic cold fusion process in 2004.[1] The results of the review were mixed. A negative bias was imposed because the process of cold does not fit into existing theoretical constraints. Established models associate the fusion process with very high energies. The required energy is found in the interior of the sun or in a nuclear explosion. Fusion reactions cannot proceed at the mild conditions found in the laboratory. Conventional science has a material limitation. It cannot describe the path of the quantum transition. The quantum transition is a magical moment. The electromagnetic, nuclear, and gravitational fields interact strongly during the transition. No one currently knows how this happens. While at the Power Gen 95 exhibition this author observed that the Clean Energy Technologies cold fusion electrolytic cell required preheating. The heating induced thermal vibrations in the cell. This author then discovered that the cold fusion reaction takes place in the domain of 50 nano-meters. The product of the thermal frequency and the 50nm dimension is one megahertz-meter. While visiting at N.A.S.A. Marshall this author discovered that E. Podkletnov stimulated a superconductive spinning 1/3 of a meter in diameter disk at three megahertz. It was claimed that the experiment produced a strong gravitational anomaly. The product of the stimulation frequency and the diameter is again one megahertz-meter. This author suspected that the stimulation had something to do with the quantum transition. In the year 2000 at a meeting of the American Nuclear Society, this author presented his theorem. The theorem states; "The gravitational, nuclear, and electromagnetic motion constants converge in a Bose condenstate that is stimulated at a dimensional frequency of one megahertz-meter."[2] The theorem describes the path of the quantum transition. It demonstrates that nuclear transitions can occur in macroscopic quantum objects. This author has now extended this work. This paper demonstrates that the process of cold fusion is an affect of the transitional quantum state.

ABSTRACT

The quantum condition describes the angular momentum of a quantum system.   The angular momentum is an integer multiple of Planck's constant. Bohr and Einstein sought a classical explanation for the quantum condition. Schrödinger incorporated Bohr's quantum condition and determined the intensity of the atomic spectrum. Rutherford searched for a solution, gave up, and began his work with the nucleus. Over one hundred years have passed since a classical connection was sought.   None of the great scientists has discovered a classical explanation for the quantum condition. The mystery remains today and is embodied in the duality of particles and waves.

This author has discovered a classical link to the quantum condition. The link is the elastic limit of space.   The introduction of the elastic limit reveals the path of the quantum transition and provides insight into the duality of particles and waves.

Convention represents the matter wave as the superposition of an infinite number of component waves. The Fourier addition of component waves localizes the matter wave. Waves, other than the matter wave, are localized by restraining forces. This author proposes that the natural forces are pinned into the structure of matter (restrained) at a discontinuity produced by the elastic limit of space. Reflections are produced at the discontinuity. The superposition of the incident and reflected wave is the deBroglie wave of matter.

INTRODUCTION

The spring constant K in a mechanical system is conceptually equivalent to the reciprocal of the capacitance (1/C) in an electrical system. This relationship is exhibited by equations one and two.

Force = - (the spring constant)(displacement)   Equation #1

Intensity = - (1/capacitance)(charge)   Equation #2

A spring has a limit to its elasticity. It breaks down when stretched beyond its limits. Space also has a limit to its elasticity. Space breaks down when the intensity of a force field exceeds this finite limit. The elastic limit of space is qualified by a minimum of capacitance. This author defines a minimum of stray capacitance as the quantum of capacitance.

THE ELASTIC LIMIT AND THE ELECTRON'S ENERGY OF FORMATION

The relationship between energy E, voltage V, and capacitance C is given by equation three.

$E = (1/2) C V^2$ Equation #3

The relationship between capacitance C, charge Q, and voltage V is given by equation four.

$Q = CV$ Equation #4

Substituting equation four into equation three yields equation five.

$E = (1/2) Q^2 / C$ Equation #5

The energy "E" is the rest energy of the electron. The charge "Q" is that of one electron. The solution of equation five gave the quantum of capacitance C_q. This quantum expresses the elastic limit of space.

$C_q = 1.56 \times 10^{-25}$ Farads   Equation #6

The elastic limit of space was derived. The elastic limit is expressed in units of reciprocal capacitance. Matter forms when the intensity of a force field exceeds the elastic limit of space. An analogy can be made between a localized matter wave and a mechanical

wave stuck on a broken spring. [3] The electrical field experiences the elastic limit of space through a maximum of intensity.

THE ELASTIC LIMIT OF SPACE AND THE GRAVITATIONAL FORCE

Size is a relative measure when it comes to most things. No general principle of relativity applies to the size of the universe and to the size of elementary particles. The sizes of these entities can only be the unique values that they are. This author will demonstrate a link between the geometry of the universe and the quantum condition. The electrical capacitance (C_u) of a sphere with a radius of 13.4 billion light years (r_u) is given by equation seven. [4]

$$4 \pi e_0 r_u = 1.4 \times 10^{16} \text{ Farads} \qquad \text{Equation \#7}$$

The universe contains an equal number of positive and negative charges. The net electrical field produced by these opposing charges is zero. An isolated electrical charge experiences no force. The only force experienced by an isolated particle is the force of gravity. An electrical potential accelerates electrons in a conductor. A gravitational potential accelerates matter within the universe. On the largest scale, the universe behaves like a giant conductor of matter. The gravitational force between a proton and an electron is 2.27×10^{39} times weaker than the electrical force. The quantum of capacitance was determined by reducing the capacitance, determined in equation number seven, to account for the weakness of the gravitational force. This was done by dividing the capacitance of a sphere as large as the universe by the gravitational coupling constant. Equations eight and nine derived the elastic limit of space with this technique.

$$C_q = C_u / [(2\pi)^2 \ 2.27 \times 10^{39}] \qquad \text{Equation \#8}$$

$$C_q = 1.5 \times 10^{-25} \text{ Farads} \qquad \text{Equation \#9}$$

A factor of 2π is a geometric constant related to the surface of a hyphere. A second factor of 2π results from the non-centric nature of the universe. The gravitational force and the geometry of the universe determine the stiffness of space. The gravitational force experiences the elastic limit of space through its weakness and the geometry of the universe. The elastic limit of space links the quantum condition to the geometry of the universe.

THE ELASTIC LIMIT AND THE NUCLEAR RADIUS

The height of the Coulombic potential wall is determined by the capacitance and the electrical charge of a nucleon. The electric charge is point like. The intensity of the electric field reaches a maximum at the dimensions of the proton. The strong and weak nuclear forces also experience this geometry. This geometry exists at the elastic limit of space. Equation ten expresses a relationship between the quantum of capacitance and the capacitance of an isolated sphere.

$$4\pi e_o r_p = 1.56 \times 10^{-25} \text{ farads} \qquad \text{Equation \#10}$$

Solving equation number ten for r_p yields equation eleven the radius of the proton.

$$r_p = 1.409 \times 10^{-15} \text{ meters} \qquad \text{Equation \#11}$$

The radius of the proton was determined with a technique employing the elastic limit of space. The strength of the nuclear and electromagnetic forces becomes equal at a radius of 1.409 Fermi meters. This equalization in the strength of the forces allows energy to be exchanged and nuclear reactions to proceed. The strong and weak nuclear forces experience the elastic limit of space through the geometry of the nucleons.

THE ELASTIC LIMIT OF SPACE AND THE COMPTON WAVELENGTH OF THE ELECTRON

The Compton frequency is fundamental a quantum vibration. A classical solution that yields the Compton frequency of the electron is equation number twelve.

$$M_{-e} \, c^2 / h = 1.24 \times 10^{20} \text{ Hertz} \qquad \text{Equation \#12}$$

The Compton frequency of the electron is a property of simple harmonic motion. The elastic constant K and the mass of the electron (M_{-e}) determine the frequency of the electron's simple harmonic motion.

$$(1/2\pi) \, (K / M_{-e})^{1/2} = 1.24 \times 10^{20} \text{ Hertz} \qquad \text{Equation \#13}$$

The elastic constant K is a function of force and displacement. The maximum of force that can be exerted between two electrical charges was determined, in Equation #14, from the compressive displacement length (r_p) given in Equation #11.

$$\text{Force} = q^2 / [\, 4\pi \, e_o \, (2 \, r_p)^2 \,] = 29.05 \text{ Newtons} \qquad \text{Equation \#14}$$

A maximum of 29.05 Newtons of force is produced at 1.409 Fermi meters of displacement. Substituting (29.05 / r_h) for the elastic constant k yields equation #15.

$$(1/2\pi) \, ((29.05 / r_h) / M_{-e})^{1/2} = 1.24 \times 10^{20} \text{ Hertz} \qquad \text{Equation \#15}$$

A solution of equation #15 yields r_h the radius of the hydrogen atom.

$$r_h = .529 \times 10^{-10} \text{ meters} \qquad \text{Equation \#16}$$

The radius of hydrogen's ground state electron has been determined in Equation #16 with a technique employing the elastic limit of space. This solution shows that that the elastic limit of space imposes stiffness limitations. These limitations prevent the electron from being drawn into the nucleus.

THE ELASTIC LIMIT AND THE PATH OF THE ATOMIC TRANSITION

The elastic limit of space (C_q) expresses itself through the analytics presented in this paper. This author assumes that the elastic limit of space varies inversely with the isotropic capacitance of a quantum system. The capacitance of the system now determines the Compton frequency (F_c) of the electron. The downshifted Compton frequency of a quantum system (F_d) was determined in Equation #19 from the capacitance of an isolated sphere (C_s).

$$F_d = 2\pi \, r \, F_c \, [\, C_q / C_s \,] \qquad \text{Equation \#19}$$

The result is 1.094 megahertz-meters. This dimensional frequency expresses the

relationship between the downshifted Compton frequency (F_d) and the circumference ($2\pi r$) of a centric atomic system. The units also express velocity. The velocity is half the velocity of the ground state electron in hydrogen. Equation number seven expresses the capacitance of an isolated sphere. Replacing radius (r) with circumference (a) yields equation twenty.

$$C_s = 4\pi \ e_0 \ (a \ / \ 2\pi) \qquad \text{Equation \#20}$$

In order to express circumferential velocity in terms of capacitance the first derivative of equation twenty was taken.

$$d \ (C_s)/dt \ = 2 \ e_0 \ (da \ / \ dt) \qquad \text{Equation \#21}$$

The dimensional frequency of 1.094 megahertz-meters (refer to equation #19) describes the path of the quantum transition. Dividing light speed by twice the fine structure constant more conveniently represents 1.094 megahertz-meters. [c / (2*137)] was substituted for the velocity (da/dt). The substitution resulted in Equation #22.

$$e_0 \ c \ / \ 137 = 1.93 \times 10^{-5} \ \text{farads/second} \qquad \text{Equation \#22}$$

Placing the result of equation twenty two (1.93 x 10 $^{-5}$ farads/second) into the formula for the energy of a capacitor (equation #5) yields equation #23. The result of Equation #23 is Planck's constant.

$$(1/2) \ (Q^2 \ / \ 1.93 \times 10^{-5}) \ = 6.63 \times 10^{-34} \ \text{joule-seconds} \qquad \text{Equation \#23}$$

Planck's constant fundamentally describes the quantum nature of the universe. The radiative energy levels of the atom are restricted. The natural forces have vastly differing strengths, ranges, and motion constants. Energy cannot easily be exchanged between the system of forces. The flow of energy between quantum systems is aided by the stimulation of the system at its downshifted Compton frequency. This stimulation condenses the interacting states. This author's previous publications have shown that the electromagnetic, gravitational, and nuclear motion constants converge within a Bose condensate that is stimulated at a dimensional frequency of one megahertz-meter.[5,6] The convergence of the motion constants produces a strong interaction involving all of the natural forces. The elastic limit of space releases its grip on the natural forces. The fields slip, energy is exchanged, and the quantum state changes.[7, 8, 9, 10, 11, 12]

THE PHOTO ELECTRIC EFFECT

The energy of light is bundled into packets called photons. This energy carried by light is related to the frequency of the light. This energy is given by Equation #24.

$$E = hf \qquad \text{Equation \#24.}$$

The mechanics of this relationship are central mystery in modern physics. This author's understanding of the process of the quantum transition has enabled him to unravel this mystery. Local flux is pinned at a discontinuity. A discontinuity forms when the intensity of a field exceeds the elastic limit of space. The elastic limit of space is expressed in units of reciprocal capacitance. A photon is not pinned down. It does not experience the quantum of capacitance. It experiences capacitance through its non-divergent geometry. A flat plate capacitor was used, in Equation #25, to estimate the capacitance (C_f) experienced by a photon.

$C_f = e_o \, \text{AREA} / D$ Equation #25

The area swept equals the wavelength λ of the photon squared. The distance between the plates equals the distance between the positive and negative peak of a sin wave. This distance is (½) wavelength. The capacitance experienced by a photon is given in Equation #26.

$C_f = e_o \, \lambda^2 / (\lambda / 2) = 2 \, e_o \, \lambda$ farads / cycle   Equation #26

The process of quantum transition is described by the dimensional frequency of 1.094 megahertz-meters. The relationship between the frequency and wavelength of the non-centric transitional quantum state is given by Equation #27.

$\lambda = 1.094 \times 10^6$ meters/second / f   Equation #27

Substituting Equation #27 into Equation #26 yields Equation #28. Equation #28 expresses the relationship between the capacitance and frequency of a photon.

$C_f = 2 \, e_0 \, (1.094 \times 10^6 / f)$ farads   Equation #28

The energy contained by a capacitor with a charge of one is given by Equation #29.

$E = (½) \, q^2 / C_f$ joules   Equation #29

The capacitance of a photon (Eq. #28) was placed into the formula for the energy "E" of a capacitor (Eq. #29). The result (Eq. #30) yields the energy of a photon.

$E = [q^2 / (4 \, e_0 \, 1.094 \times 10^6)] \, f$ joules   Equation #30

The quantity within the brackets [ ] equals Planck's constant in joules-seconds. Substituting Planck's constant for the quantity within the brackets yields, Equation #31, the energy of a photon.

$E = hf$ Equation #31

The energy of a photon is set by the mechanics of the quantum transition. Local fields are pinned at discontinuities. Discontinuities are produced when the intensity of a field exceeds the elastic limit of space. Photons are formed when bits of the local field break away. The motion constants converge during the breakaway interval. The breakaway interval is a quantum transition. The transition is described by a dimensional frequency of one megahertz-meter. The author was able to compute the energy of the photon through an analysis of the transitional quantum state.

CONCLUSION

A discontinuity forms when the intensity of a force field exceeds the elastic limit of space. The natural forces are pinned into the structure of matter at this discontinuity. The elastic of space is a geometric property. It is expressed in units of reciprocal capacitance. Each of the natural forces experiences the elastic limit of in its own way. The gravitational force experiences it through its weakness and the structure of the universe. The electromagnetic force experiences it through a maximum of intensity. The nuclear forces experience it through the geometry of the proton and neutron. Quantum events are normally described from the vantage point of the stationary quantum states. Recent experiments have produced observables that have allowed this

author to describe quantum events from the vantage point of the transitional quantum state. During a quantum transition the elastic limit of space releases its grip on the natural forces. The velocity of the transitional quantum state, with respect to an elastic discontinuity, is fixed at 1.094 million meters per second. The velocity appears, in non-centric systems, as the dimensional frequency 1.094 megahertz-meters.

It has been shown that the elastic limit of space establishes the zero point properties of stable matter. Many new phenomena are observed as fixed parameters thaw (become variable). Conventional science has developed a bias towards looking to higher energies to find interesting phenomena. Little application can be found for the discovered high-energy phenomena. This author has introduced a new parameter, the elastic limit of space. The elastic limit of space (quantum of reciprocal capacitance) becomes variable at very low energies. The low energy affects are accessible with affordable technologies. This author believes that the understanding of the affects produced by a changing quantum of capacitance will allow man to directly control each of the four natural forces. This understanding should produce a revolution in technology.

NOTES

1. The results of the review are posted at the D.O.E.

 http://www.science.doe.gov/Sub/Newsroom/News_Releases/DOE-SC/2004/low_energy/C

2. The author's work is posted at the D.O.E.

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5.   Frank Znidarsic, "The Constants of the Motion", The Journal of New Energy Vol. 5
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       Journal of New Energy, vol, no 3. pp 5-30

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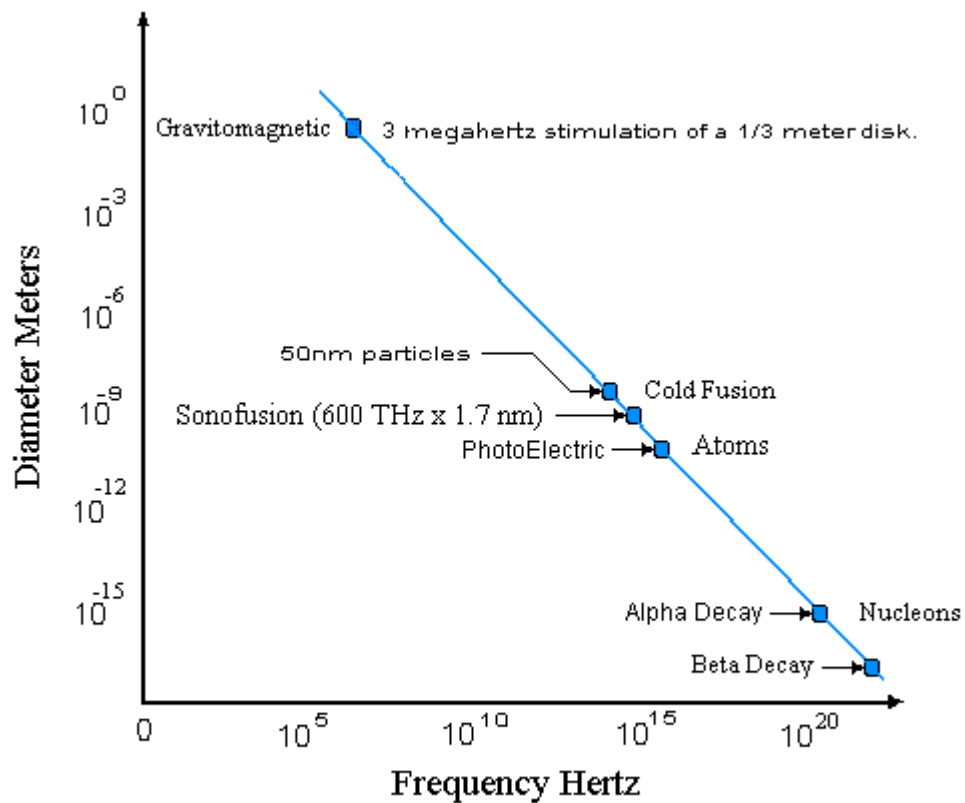12. J. Wilson, "NASA's Antigravity Machine" Popular Mechanics, December 1997

Recent developments

The European Space Agency detects a strong gravitational anomaly

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http://pubs.acs.org/cgi-bin/abstract.cgi/nalefd/asap/abs/nl060105l.html

THE MEGAHERTZ METER RELATIONSHIP