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The Flow of Energy

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Abstract

In this paper, the flow of energy in materials is presented as mechanical waves with a distinct velocity or speed of transition. This speed of transition came about through the observations of cold fusion experiments, *i.e*., Low Energy Nuclear Reactions (LENR) and superconductor gravity experiments, both assumed speculative by mainstream science. In consideration of superconductor junctions, the LENR experiments have a similar speed of transition, which seems to imply that the reactions in the LENR experiment are discrete quantized reactions (energy - burst vs. continuous). Here an attempt is made to quantify this new condition as it applies to electrons; toward the progression of quantized energy flows (discrete energy burst) as a new source of clean energy and force mechanisms (*i.e*, propulsion).

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1. Introduction

Mechanical waves are a local oscillation of material; where 1) Only the energy propagates; 2) The oscillating material does not move far from its initial equilibrium position; and 3) The wave travels by jumping from one particle of the medium to another. Therefore; mechanical waves transport energy and not material. However; a mechanical wave requires an initial energy input to be created. But once the initial energy is added; the wave will travel through the medium until all the energy has been transferred.

Recent observation of the speed of transition (a measure of the flow of energy) within speculative experiments seems to indicate a mechanical wave within the atomic nucleus that is discrete or quantized. This leads to the proposal of a new quantum condition; where Planck's constant emerges as a condition

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on the speed of the electronic wave within the electronic structure of the atom. Whereby; the speed of a transverse electronic wave equals the speed of a longitudinal mechanical wave within the nuclear structure.

Nomenclature

r_e	=	2.818×10^{-15}	(the classical radius of the electron (meters))
f_c	=	1.236×10^{20}	(the Compton frequency (Hertz))
F_{max}	=	29.05	(the electrical charge force maximum (Newtons))
m_e	=	9.109×10^{-31}	(the mass of the electron (kg))
r_{+h}	=	0.529×10^{-10}	(the radius of the hydrogen atom (meters))
r_n	=	1.36×10^{-15}	(the nuclear Fermi spacing (meters))
V_t	=	1.094×10^{6}	(the transitional velocity (meters/second))

However for new phenomena to occur; the energy procuring the mechanical wave needs to be discrete (quantum) burst versa a (classical) continuous emission; thereof. Whereby; the high energy flow must occur in one burst; without bounce; and without destroying the system. This paper is an attempt to quantify this new quantum condition as it applies generally to electrons.

2. New Observational Speed Of Mechanical Waves

Two experiments seem to have similarities in their speed of transition; the Low Energy Nuclear Reactions (LENR) [1] and superconductor gravity experiments [2; 3]; both assumed speculative by mainstream science. The LENR experiment is discussed in the following to establish the equation for the speed of transition followed by a brief mentioning on the superconductor gravity experiments with an analysis given later in the paper.

2.1. *Low Energy Nuclear Reactions*

Thermal energy; nuclear transmutations (to include transmutation of heavy elements); and a few high energy particles have reportedly been produced during cold fusion experiments; *i.e.*; Low Energy Nuclear Reactions (LENR); to include the reported transmutation of heavy elements [4]. According to contemporary theory [5]; heavy element transmutations can only progress at energies in the millions of electron volts. However; the available energy at room temperature is only a fraction of an electron volt. Whereby; these experimental results do not fit within the confine of the contemporary theoretical constructs; *being widely criticized on this basis*. Further; LENR experiments [6] have produced very little; if no; radiation; another source of contention. However it is suggested that nuclear reactions can proceed without producing radiation under a condition where the range of the nuclear spin-orbit force is extends through the coulombic barrier. Whereby; the process of cold fusion may require a radical restructuring of the range and strength of the natural forces. The condition of the active nuclear environment provides some clues.

Low level nuclear reactions proceed in the domain of the reactions $r_N \sim 50\ nm\ \left(i.e.,\ 5\times10^{-8}\,m\right)$; where there is a positive thermal coefficient of frequency f_N or angular frequency $\omega_N = 2\pi f_N \sim 10^{13}$ to $10^{14}\,Hz$. The product $\omega_N r_N \equiv 2\pi f_N \times r_N$ then implies a speed V_t of transition on the order of $\sim 10^6\,m/s$. That is; a

transitional speed

$$V_t = \left(\frac{2\pi f_c}{n_i}\right) n_x r_x \Rightarrow \left(\frac{n_x}{n_i}\right)\left(\frac{2\pi \cdot r_x}{\lambda_i}\right) c \qquad (1)$$

with the thermal frequency f_N expressed as a fraction n_i of the Compton frequency $f_c = c/\lambda_i$. Noting that for $f_c = 1.236 \times 10^{20} Hz$ and $r_x = r_e/2 \approx r_N$ with $n_x = n_i$; the speed of transition $V_t \approx 1.0942 \times 10^6 m/s$.

Equation (1) then defines the speed of the mechanical wave within the dissolved deuterium of the low level nuclear reactions with respect to discrete distances $n_x r_x$ and particle wavelengths $n_i \lambda_i$; where with $r_x = r_N \sim 5 \times 10^{-8} m$ the ratio n_x/n_i is of the order of 10^{-24}; indicating that $n_i >> n_x$ in these nuclear reactions.

In classical mechanic; $V_t \to c$; such that; $n_x r_x \to \frac{1}{2\pi} n_i \lambda_i$ or $n_x \approx n_i$. That is; classically the reaction range r_x is defined by a given material and the wavelength λ_i by the particle in motion through the material. Here it is postulated that when the particle wavelength $n_i \lambda_i$ becomes discrete (quantized); so must the reaction range $n_x r_x$. Whereby; energy flow also becomes discrete (quantized); *i.e.*; energy burst vs. continuous flow; which could produce higher energy flow for brief periods than normally seen in classical systems; leading to new phenomenon of study.

3. Superconductor Analogy

For example; superconductors are discrete (quantized) electron systems. Superconductor Josephson junctions or layers existed on order of a few $nm \equiv r_J \sim 10^{-9} m$. Robertson [7] indications that the superconductor electron pair fluctuation time is $\sim 10^{14} s$; which implies (under normal conditions) a maximum electron angular frequency $\omega_e \sim 10^{14} Hz$ or electron fluctuation frequency $2\pi f_e \sim 10^{14} Hz$. Whereby; the product $\omega_e r_J \equiv r_J \times 2\pi f_e$ implies a speed V_t of transition (*i.e.*; the separation speed required to release the electron pairing energy in order to cross the junction) on the order of $\sim 10^6 m/s$.

Further; Li and Torr [8] and Torr and Li [9] published calculations of the propagation behavior of gravitational waves inside a superconductor (SC). They claimed that the phase velocity of gravitational waves in any SC material would be $\sim 10^6$ m/s. That is; the speed of gravitational energy through the superconductor is the transitional speed as defined by equation (1).

3.1. Superconductor Gravitational Anomaly

In the early 1990's; a team lead by Podkletnov [2; 3] using a two layer high T_c superconducting disk; reportedly produced a strong gravitational anomaly; which does not appear to fit within the contemporary scientific construct – *the generation of a strong local gravitational field seems to violate the conservation laws*.

3.2. Summary

The similarity in the speed of transition to the superconductor *would seem to imply that the reactions (energy burst) in the LENR experiments were discrete and on the order of electron pairing energy*. Further; the implications of the two speculative (LENR & Gravity Anomaly) experiments appear to place a minimum velocity *with respect to distance and time* from which "free" energy (*i.e.*; vacuum energy; dark energy or etc.) can be pulled from the subatomic scale ($\sim 10^{-9} m$ **)** interactions. This new understandings of the progression of an energy flow may lead to new sources of clean energy and force

mechanisms (*i.e*; propulsion).

4. The Speed of a Mechanical Wave within the Nucleus

Potential energy is given as

$$E = \frac{1}{2} K_e \left(2r_x\right)^2 . \tag{2}$$

By letting the electron elastic constant K_e emerge from the maximum electron force $F_{max} \approx 29.1\ N$ between the redistribution of electrons at an average distance r_x being of close proximity to the nucleus; it is can become discrete and given as

$$K_e = \frac{F_{max}}{n_x r_x} ; \tag{3}$$

where in classical systems $n_x = 1$.

Now by noting that; the electron elastic constant K_e equals that of the strong nuclear force at points where the expansive electromagnetic force balances the compressive strong nuclear force and expelling the electrical force to the circumference of the nucleus; the discrete speed V_t of transition becomes a product of the frequency of a harmonic oscillator and a displacement; *i.e*;

$$V_t = \frac{n_i \lambda_i}{2\pi} \sqrt{\frac{K_i}{m_i}} ; \tag{4}$$

where i indicates a given particle of mass m_i and wavelength $\lambda_i \approx r_i \sqrt{2}$ [in classical systems $n_i = 1$].

For classical neutron with mass $m_n \approx 1.6749 \times 10^{-27} kg$; radius $r_i = r_x = r_n \approx 1.36\ x\ 10^{-15} m$ and $n_i = n_x = n_n = 1$; then equations (3) and (4) can be combined to yield speed of a mechanical wave within the nucleus as

$$V_t = \frac{1}{2\pi} \sqrt{\frac{F_{max}}{2r_n} \times \frac{1}{m_n}} \times 2r_n \approx 1.0932 \times 10^6\ m/s ; \tag{5}$$

a product of the harmonic motion of the neutrons at a displacement equal to the Fermi spacing $\approx r_n$ [the neutrons radius].

5. Electron Speed Of Transition

Equations (1) and (5) imply that the energy in an atom emerges as a classical affect of a condition where the speed of light within the electronic structure of the atom equals the speed of a mechanical wave within its nuclear structure; where the equalization of velocities aligns the impedance of the interacting states. This impedance match allows energy to be exchanged; without reflection; and the quantum transition to progress.

Modes of differing impedance are evanescent and block the flow of energy. Such that; from the photo-electric effect; the speed of quantum transition of an emitted photon of frequency f_i can be given as

$$V_t \approx f_i \lambda_i ; \tag{6}$$

where the energy of a photon emerges from the interaction on the transitional wavelength λ_i to produce an electrical charge of wavelength λ_e. The simultaneous emergence of both the photon's frequency and electron energy is fundamental to Bohr's principle of complementarity; reconciling the duality of particles and waves.

When dealing with electron potential energy; capacitance must first be defined as a function of the geometry. By letting the area swept out by a light wave equal to its wavelength squared and setting the distance between the peaks in the wave's amplitude equal to one half wavelength; the capacitance experienced by such a cycle of light is given as

$$C = \frac{e_o \lambda_e^2}{\frac{1}{2}\lambda_e}. \tag{7}$$

The reduction of equation (7) expresses the geometry of the transitional quantum state in terms of its electrical capacitance as

$$C = 2e_o \lambda_e. \tag{8}$$

Combining equations (6) and (8) expresses the capacitance of the transitional quantum state in terms of its frequency as

$$C = 2e_o \left(\frac{V_t}{f_e} \right). \tag{9}$$

The energy of electron charges is expressed in terms of its capacitance as

$$E = \frac{1}{2}\left(\frac{Q^2}{C} \right); \tag{10}$$

which when combined with equation (9) gives the photo-electric energy as

$$E = \left(\frac{Q^2}{4e_o} \right)\left(\frac{f_e}{V_t} \right). \tag{11}$$

Now since the photoelectric energy relationship to the electric charge is give by

$$E = hf_e = 2\pi\hbar \cdot f_e; \tag{12}$$

whereby; combing equations (11) and (12) gives photo-electric speed of transition

$$V_t = \frac{Q^2}{4e_o h} = \frac{Q^2}{8\pi e_o \hbar} = 1.0938 \times 10^6 \, m/s \tag{13}$$

for a single charge $Q = e = 1.60 \times 10^{-19} C$; showing that the Planck constant $\hbar$ emerges as a condition on the speed of transition of electrons in a bulk mass.

6. Electron Orbital Radius

It is proposed here that the quantum structure of the atom is established at points of energetic accessibility. These points; of matching impedance; are qualified by setting the speed V_t of a mechanical wave in the nuclear environment equal to *the speed of light within the electronic structure*; were

$$V_t = \omega_e r_{or} \approx \omega_e n_x r_B . \tag{14}$$

where $r_B \approx 5.29\times10^{-11} m$ is the bohr radius. That is; the product of the electron's angular frequency ω_e and its orbital radius $r_{or} \approx n_x r_B$.

Now by letting $\lambda_e \approx \pi r_e$ and $n_i = n_e$; the electron speed of transition can be given from equation (4) as

$$V_t = \frac{n_e r_e}{2}\sqrt{\frac{K_e}{m_e}} . \tag{15}$$

Combining equations (3) and (15) then gives the speed of transition as

$$V_t = \frac{n_e r_e}{2}\sqrt{\frac{F_{max}}{n_x r_B}\times\frac{1}{m_e}} = 1.0938\times10^6\ m/s . \tag{16}$$

where the value infers the classical speed of transition with $n_x = n_e = 1$. Equation (16) then yields

$$r_{or} \approx n_B r_B = \frac{F_{max}}{M_{-e}}\left(\frac{n_e r_p}{V_t}\right)^2 = n_e^2 \times \frac{F_{max}}{M_{-e}}\left(\frac{r_p}{V_t}\right)^2 \approx n_e^2 \times r_{+h} . \tag{17}$$

As it was then noticed that

$$\frac{F_{max}}{M_{-e}}\left(\frac{r_p}{V_t}\right)^2 \approx 5.29\times10^{-11} m \approx r_{+h} ; \tag{18}$$

where r_{+h} is the ground state radius of the hydrogen atom. Whereby; the electron orbital radius r_{or} is a square multiple of the number n_e of electrons times the ground state radius r_{+h} of the hydrogen atom.

7. The Classical Debroglie Wave And The Transitional Frequency

De Broglie [10] suggested that the matter wave naturally emerges; from the superposition of the Compton wave and its Doppler shifted refection; given by

$$f(t) = sin\left(2\pi f_c t + \pi\right) + sin\left(2\pi f_c\left(1\pm\frac{v}{c}\right)t\right) . \tag{19}$$

Here we let

$$2\pi f_c t + \pi = 2\pi f_c t\left(1\pm\frac{v}{c}\right) \tag{20}$$

and replace the Compton frequency with its contemporary value of the Compton frequency to yield

$$\left(\frac{m_i c^2}{\hbar}\right)t + \pi = \left(\frac{m_i c^2}{\hbar}\right)t\left(1\pm\frac{v_i}{c}\right) ; \tag{21}$$

where v_i is the particulate mass velocity. Equation (21) can be further deduced to yield

$$ct = \pm\frac{\pi\hbar}{m_i v_i} . \tag{22}$$

This result implies that the deBroglie wave of matter be given as

$$\lambda_d = \frac{2\pi\hbar}{m_i v_i}. \tag{23}$$

Combining equation (23) with equation (6) yields the speed of transition as

$$V_t = 2\pi\hbar\left(\frac{f_i}{m_i v_i}\right). \tag{24}$$

Equation (24) specifically applies for the electrons of mass $m_i = m_e$; such that; when the mechanical wave equals the electronic wave; the particulate velocity v_i is equal to the photo-electric speed of transition; equation (13). Combining equations (13) and (24) for the electron; where $Q = e$ and $f_i = f_e$; then gives

$$V_t = \left(\frac{4\pi\hbar}{e}\right)^2\left(\frac{e_o}{m_e}\right) f_e; \tag{25}$$

where equation (25) can be applied to any electron transitional state and establishes the baseline frequency needed to obtain the transition speed; where

$$f_e = \left(\frac{m_e}{e_o}\right)\left(\frac{e}{4\pi\hbar}\right)^2 V_t; \tag{26}$$

Which for $V_t \approx 1.0938\times10^6\ m/s$; $f_e = 1.6448\times10^{15}\ Hz$; which is of the range of the LENR; but about twice that of the gravitational anomaly experiments.

7.1. Superconductor Analogy

For the electron pair ($n_e = 2$); the frequency the transitional speed $V_t \approx \omega_{2e} r_x \equiv \left(f_e/n_e\right)\times r_x$. Combining this with equations (25); yields

$$r_J \approx 2\left(\frac{4\pi\hbar}{e}\right)^2\left(\frac{e_o}{m_e}\right); \tag{27}$$

the junction spacing required for a transition speed of $V_t \sim 10^6\ m/s$. Then for $e = 3.2\times10^{-19}\ C$; $\hbar = 1.05457\times10^{-34}\ J\cdot s$; $e_0 = 8.85\times10^{-12}\ A\cdot s/V\cdot m$ and m_e=$9.11\times10^{-31}\ kg$; equation (27) yields $r_x \approx 1.3300\times10^{-9}$ m; which is the ballpark estimate for the Josephson junction gap distance in superconductors; *i.e.*; the range of range of electron pair energy transition.

8. Conclusion

The concept of a speed of transition was presented. Indications are that at speeds of transitions at or greater than $\sim 10^6\ m/s$ new phenomena can occur. The similarity in the speed of transition between the speculative Low Energy Nuclear Reactions (LENR) and Gravity Anomaly experiments appear to place a minimum velocity *with respect to distance and time* from which "free" energy (*i.e.*; vacuum energy; dark energy or etc.) can be pulled from the subatomic scale ($\sim 10^{-9}\ m$) interactions. This new understandings of the progression of an energy flow may lead to new sources of clean energy and force mechanisms (*i.e*;

propulsion).

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