

The Inertial Mass Reduction Device

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Abstract

It is possible to reduce the inertial mass, and hence the gravitational mass, of a system/object in motion, by an abrupt perturbation of the non-linear background of local Spacetime (equivalent to an accelerated excursion far from thermodynamic equilibrium, analogous with Symmetry-breaking). The physical mechanism which drives this diminution in inertial mass is based on the negative pressure (hence repulsive gravity) exhibited by the polarized local Vacuum Energy State (local Vacuum polarization being achieved by a coupling of accelerated high frequency vibration with accelerated high frequency axial rotation of an electrically charged system/object) in the close proximity of the system/object in question. In other words, inertial mass reduction can be achieved via manipulation of quantum field fluctuations in the local Vacuum Energy State, in the immediate proximity of the object/system. Therefore, it is possible to reduce an air vehicle's/spacecraft's inertia, that is, its resistance to motion/acceleration by polarizing the Vacuum in the close proximity of the moving air vehicle/spacecraft.

Polarization of the local Vacuum is analogous to manipulation/modification of the local Spacetime topological lattice energy density. As a result, extreme speeds can be achieved.

It is possible to envision a hybrid aerospace / undersea vehicle, which due to the physical mechanisms enabled with the Inertial Mass Reduction Device, can function as a submersible craft capable of extreme underwater speeds (lack of water-skin friction) and enhanced stealth capabilities (non-linear scattering of RF and sonar signals). This hybrid craft would move with great ease through the air/space/water mediums, by being enclosed in a Vacuum plasma bubble/sheath, due to the coupled effects of EM field-induced air/water particles repulsion and Vacuum energy polarization.

Introduction

The original concept described herein, is named the Inertial Mass Reduction Device (IMRD) and works in conjunction with the High Energy Electromagnetic Field Generator (HEEMFG) described in Navy case PAX 182. When put in practice, this system can provide the design of energy generation machinery with power output levels much higher than those currently achievable. The utilization of such high power sources for Space Power and Propulsion generation, as it pertains to reduction in the spacecraft's inertial mass as a direct result of local Vacuum polarization, is an important application of the described theoretical concept. This concept's governing physics entail the coupling of Gyration (high frequency spin), Vibration (high frequency abrupt pulsations / harmonic oscillations) and possible Curvilinear Translation (thus three modes of motion), of electrically charged systems.

There are four known fundamental forces which control matter and therefore control energy, namely the strong and weak nuclear forces, the electromagnetic force and the gravitational force. In this hierarchy of forces, the electromagnetic force is perfectly positioned to be able to manipulate the other three. A stationary electric charge gives rise to an electric (electrostatic) field, while a moving charge generates both an electric and a magnetic field (hence the electromagnetic field); additionally an accelerating charge induces electromagnetic radiation in the form of transverse waves, namely light. Mathematically as well as physically, electromagnetic field intensity can be represented as the product of electric field strength and magnetic field strength. Electromagnetic fields act as carriers for both energy and momentum, thus interacting with physical entities at the most fundamental level.

Artificially generated, high energy, electromagnetic fields interact strongly with the Vacuum Energy State (an aggregate/collective state comprised of the superposition of all quantum fields' fluctuations permeating the entire fabric of Spacetime), thereby giving rise to Emergent Physical Phenomena (in other words revolutionary/new physics), such as Force and Matter Fields Unification. According to Quantum Field Theory, this strong interaction between the fields is based on the mechanism of transfer of vibrational energy between the fields, further inducing local fluctuations in adjacent quantum fields which permeate Spacetime (these fields may or may not be electromagnetic in nature). Matter, Energy, Spacetime are all emergent constructs which arise out of the fundamental framework that is the Vacuum, Energy State.

Everything that surrounds us, ourselves included, can be described as macroscopic collections of fluctuations, vibrations, oscillations in quantum mechanical fields. Matter is confined Energy, frozen in a quantum of Time. Therefore, under certain conditions (such as the coupling of hyper-frequency axial spin with hyper-frequency vibrations of electrically charged systems) the rules and special effects of quantum field behavior also apply to macroscopic physical entities [1].

Moreover, coupling of hyper-frequency gyrational (axial rotation) and hyper-frequency vibrational electrodynamics (as used in the concept herein disclosed) is conducive to a possible physical breakthrough (Force Field Unification is feasible with the concept at hand) in the utilization of the macroscopic quantum fluctuations vacuum plasma field (Quantum Vacuum Plasma, in short) as an energy source (or sink), an induced physical phenomenon, for which the technology readiness level has been considerably advanced by a team of research engineers from

NASA JSC [2]. This research involves the use of high Radio frequency / Microwave driven resonant cavity Q-thruster technology within the context of Quantum Vacuum Plasma physics. The Quantum Vacuum Plasma (QVP) is the electric glue of our plasma Universe. The Casimir Effect, the Lamb Shift, and Spontaneous Emission, are specific confirmations of the existence of QVP [3].

It is important to note that in region(s) where the electromagnetic fields are strongest, the more potent are the interactions with the QVP, therefore the higher the induced energy density of the QVP particles which spring into existence (the Dirac Sea of electrons and positrons). These QVP 'particles' may augment the obtained energy levels of the HEEMFG system (even though they are short-lived, these 'virtual' particles have a real effect).

To be more precise, the electromagnetic fields created by the HEEMFG system, interact with the Vacuum Energy State, which is an aggregate state composed of the superposition of all quantum fields' fluctuations filling the entire fabric of Spacetime. Contributions to this Vacuum state energy density are made by the Quantum Vacuum-Zero Point fluctuations, the Quantum Chromo-Dynamics gluon and quark condensates and the newly discovered Higgs Field (exhibiting massive 126 GeV particles), among other yet undiscovered fields (Super-Symmetry). In other words, major contributions to the Vacuum Energy State are made by collectives of quantum fluctuations in fermionic fields (fields of matter), quantum fluctuations in bosonic fields (fields of force) and quantum fluctuations in scalar fields (Higgs field)).

Concept Novelty (partially presented in Navy case PAX 182)

The physical equation which describes the maximum intensity achieved by the High Energy Electromagnetic Field Generator (HEEMFG) system is described by the magnitude of the Poynting vector, which in non-relativistic form (accounting for all three modes of motion) can be written as:

$$S_{\max} = f_G (\sigma^2 / \epsilon_0) [R_r \omega + R_v v + v_R] \quad (1)$$

, where f_G is the HEEMFG system geometric shape factor (equal to 1 for a disc configuration), σ is the surface charge density (total electric charge divided by surface area of the HEEMFG system), ϵ_0 is the electrical permittivity of free space, R_r is the radius of rotation (disc radius), ω is the angular frequency of rotation in rad/s, R_v is the vibration (harmonic oscillation) amplitude, v is the angular frequency of vibration in Hertz, and the term v_R is the curvilinear translation speed (acquired via a propulsive unit of either chemical, nuclear or magneto-plasma-dynamic (VASIMR) type attached to the HEEMFG system – the integrated unit being the spacecraft).

Therefore, if we consider only rotation, given a disc configuration, with $\sigma = 50,000$ Coulombs/m², a disc (spinning/axially rotating) radius of 2m and an angular speed of 30,000 RPM, we can generate an electromagnetic (EM) field intensity (S_{\max} = rate of energy flow per unit area, or energy flux) value on the order of 10²⁴ Watts/m² (this value does not account for any QVP interactions).

Furthermore, if we couple the high frequency of rotation with high vibration (harmonic oscillation) frequencies in the range of 10^9 to 10^{18} Hertz (and above) we can obtain S_{\max} intensity values in the range 10^{24} to 10^{28} Watts/m² (and beyond). These extremely high EM field intensity values emphasize the novelty of this concept, especially suited for the design of energy generation machinery with power output levels much higher than those currently achievable.

For the case of an accelerating angular frequency of vibration ($a_{\max} = R_v v^2$), neglecting rotation and curvilinear translation, Equation 1 becomes (note intrinsic significance of acceleration):

$$S_{\max} = f_G (\sigma^2 / \epsilon_0) [(R_v v^2) t_{op}] \quad (2)$$

, where t_{op} is the operational time for which the charged electrical system is accelerating.

Close inspection of Equation 2 results in an important realization, namely: Strong local interaction with the high energetics of the Quantum Vacuum fields' fluctuations superposition (macroscopic Vacuum Energy State) is possible in a laboratory environment, by application of high frequency gyration and/or high frequency vibration of minimally charged objects (order of unity), in an acceleration mode. In this manner, a high degree of local Vacuum Energy polarization can be achieved.

To illustrate this fact, considering a high end microwave frequency on the order of 10^{11} Hertz, a surface charge density on the order of 1 C/m^2 and an operational time on the order of the inverse of the vibrational amplitude, we obtain an energy flux value of 10^{33} W/m^2 . This exceptionally high power intensity induces a pair production avalanche, thereby ensuring complete polarization of the local Vacuum state.

Local polarization of the Vacuum in the close proximity of a air vehicle/spacecraft equipped with an HEEMFG system would have the effect of cohering the highly energetic and random quantum vacuum fields' fluctuations, which virtually block the path of an accelerating spacecraft, in such a manner that the resulting negative pressure of the polarized Vacuum allows less labored motion through it [4].

Spontaneous electron-positron pair production out of the Vacuum [5, 6] is a strong indicator of Vacuum Polarization being achieved. Schwinger gives a value of the electric field (E) on the order of 10^{18} V/m for this phenomenon to take place. The mass production rate $(dm / dt)_{pp}$ of particle/anti-particle pairs can be expressed in terms of S_{max} (energy flux), namely:

$$2 \gamma (dm / dt)_{pp} c^2 = S_{max} A_S \quad (3)$$

, where A_S is the surface area from which the energy flux emanates, c is the speed of light in free space, and (γ) is the relativistic stretch factor $[1 - (v^2/c^2)]^{-1/2}$. Note that the pair production rate increases with increasing energy flux from the spacecraft's generated electromagnetic field. Therefore the level, to which the Vacuum is polarized, thus allowing less labored motion through it, strictly depends on the artificially generated electromagnetic energy flux.

If we consider the boundary condition in the close proximity of the spacecraft where the energy density of the artificially generated electromagnetic (EM) field equals the local energy density of the polarized Vacuum (caused in part by the local Zero-Point Vacuum fluctuations on the order of 10^{-15} Joules/cm³ and in part by the artificial EM field interacting with the local Vacuum Energy State) we can write the approximate equivalence:

$$S_{\max}(t_{\text{op}}/R_S) = [(h^* v_v^4) / 8\pi^2 c^3] \quad (4)$$

, where t_{op} is the operational time for which the energy flux is generated, R_S is the radius of the disc, (h^*) is Planck's constant divided by (2π) and (v_v) is the frequency of quantum fluctuations in the Vacuum (modeled as harmonic oscillators).

Furthermore, given that the left side of Equation 4 is on the order of $(\epsilon_0 E^2)$ where E is the artificially generated electric field (strength), considering the Schwinger value of (E) for the onset of spontaneous pair production, we obtain a (v_v) value on the order of 10^{22} Hertz, which matches our expectations, since the Dirac virtual pair production, results in total annihilation, yielding gamma rays, which occupy the electromagnetic frequency spectrum of 10^{19} Hertz and above.

A recent paper [7] considers the possibility of superluminal spacecraft propulsion in a Special Relativity framework. It is observed that under certain physical conditions, the singularity expressed by the relativistic stretch factor 'gamma' as the spacecraft's speed (v) approaches the speed of light (c) , is no longer present in the physical picture. This involves the instantaneous removal of energy-mass from the system (spacecraft) when the spacecraft's speed reaches $(v = c / 2)$. The author discusses the possibility of using exotic matter (negative mass / negative energy density) to bring about this effect. This may not have to be the only alternative. The artificial generation of gravity waves in the locality of the spacecraft, can result in energy-mass removal (gravity waves are propagating fluctuations in gravitational fields, whose amplitude and frequency are a function of the motion of the masses involved).

Moreover, it is feasible to remove energy-mass from the system by enabling Vacuum polarization, as discussed by Puthoff [8, 9]; in that diminution of inertial (and thus gravitational) mass can be achieved via manipulation of quantum field fluctuations in the Vacuum. In other words, it is possible to reduce a spacecraft's inertia, that is, its resistance to motion/acceleration by polarizing the Vacuum in the close proximity of the moving spacecraft. As a result, extreme speeds can be achieved.

Think of the Vacuum Energy State as a chaotic system comprised of random, highly energetic fluctuations in the collective quantum fields which define it. Considering Ilya Prigogine's Nobel Prize work [10] on far from equilibrium thermodynamics, a chaotic system can self-organize if subjected to three conditions, namely: the system must be non-linear, it must experience an abrupt excursion far from thermodynamic equilibrium, and it must be subjected to an energy flux (Order from Chaos).

An artificially generated high energy / high frequency electromagnetic field (as described in Navy Case PAX 182) can fulfill all three conditions simultaneously (especially in an accelerated vibration/rotation mode), when strongly interacting with the local Vacuum Energy State. Recall that these interactions are induced by the coupling of hyper-frequency axial rotation (spin) and hyper-frequency vibration (harmonic oscillations/abrupt pulsations) of electrically charged systems (High Energy Electromagnetic Field Generator), placed on the outside of the air vehicle/spacecraft in strategic locations.

In this manner local Vacuum polarization, namely the coherence of Vacuum fluctuations within the immediate proximity of the air vehicle's/spacecraft's surface (outside Vacuum boundary) is achieved, allowing for 'smooth sailing' through the negative pressure (repulsive gravity) of the 'void' (the Void within the Vacuum).

As an aside, Force and Matter Fields Unification [11] is feasible with the concept at hand, due to the extremely strong interactions (electromagnetic in nature) between ordinary matter and the Quantum Vacuum Plasma / Vacuum Energy State (interactions which exhibit extremely high energies on Planck length scales in the immediate proximity of the disc/spacecraft surface).

Mathematical Formulation of Inertial Mass Reduction

To re-iterate, it is possible to reduce the inertial mass, and hence the gravitational mass, of a system/object in motion, by an abrupt perturbation of the non-linear background of local Spacetime (equivalent to an accelerated excursion far from thermodynamic equilibrium, analogous with Symmetry-breaking).

In a published Physical Review Letter¹², Hayasaka and Takeuchi report the anomalous weight reduction of gyroscopes for right rotations only. At the time, the authors could not elucidate the physics behind these anomalous results. Several null result experiments followed^{13, 14, 15}, which declared the Hayasaka et al. results null and void, or at least questionable.

Closer attention to the non-zero intercept of the Hayasaka et al. expression relating the gyro's weight diminution with respect to its mass, its angular rotational frequency and its effective rotor radius, yields the possibility of a local quantum Vacuum effect, namely a negative pressure (repulsive gravity) condition being present. This is due to the non-zero intercept being of the same order of magnitude with the Fokker-Planck electron-proton thermal equilibration rate, given an approximate Hydrogen atom number density of 40 atoms/m^3 , commensurate with the local Vacuum state.

As described in Ref. 13, there were several differences between Refs. 14 and 15 with respect to Ref. 12, chief among these being the gyroscopes were spun in closed but not evacuated containers. Furthermore, the rotors were air driven rather than electrically driven, which may result in experimental inaccuracies.

The main experimental set-up difference between Ref. 12 and Ref. 13 is that the pressure range within the vacuum container in the Hayasaka et al. experiment was reported as 1.3×10^{-2} Pa to 1.3 Pa while the Nitschke et al. experiment reported a pressure range of 1 – 3 Pa in the evacuated container.

Moreover, Refs. 13 - 15 experiments did not use the same gyroscope assemblies as used in Ref. 12, nor the same experimental set-up as shown in figure 1 of the Hayasaka et al. work. Exact replication of the experimental set-up and gyro-rotational acceleration procedure used in the anomalous weight reduction experiment was not achieved by any of the null result experiments.

Consider the Hayasaka et al. expression for gyro-weight reduction, written in SI units as:

$$\Delta W_R (\omega) = - 2 \times 10^{-10} M r_{eq} \omega \text{ kg m s}^{-2}, \quad (5)$$

where ΔW_R is the reduction in weight, M is the mass of the rotor (in kg), ω is the angular frequency of rotation (in rad/s), and r_{eq} is the equivalent gyro-radius (in m).

From this relationship we see that the units of the non-zero intercept (2×10^{-10}) are (1/s).

This non-zero intercept is endemic of the physics of gyro-rotational acceleration, as we shall soon see.

As, the gyro-rotor accelerates in its rotation, there is an abrupt excursion far from thermodynamic equilibrium (within the evacuated container), given the high limit of angular rotational frequency of 1.3×10^4 rpm. Recall that the Hayasaka et al experiments were performed at room temperature (approximately 300^0 K).

We can think of the particles within the evacuated container as forming a non-thermal plasma, formed when the matter inside the evacuated container is driven far from thermal equilibrium by the abrupt gyro-rotor acceleration.

The system will now try to reach thermal equilibrium and this will be dependent on the electron-proton thermal equilibration rate. Recall from plasma physics, that Coulomb collisions between the plasma's electrons and protons will in time (once the gyro-acceleration has ceased) force the particles to randomly exchange energy, and thus drive them into thermal equilibrium. Thus, in time the particles will equilibrate at the room temperature at which the experiment was conducted (assuming a non-Maxwellian velocity distribution).

Using the Fokker-Planck formulation for the electron-proton thermal equilibration rate (f_{ep}) with units of (1/s), we can write:

$$f_{ep} = (2n\sigma_T c \ln\Lambda / \pi^{1/2}) (m_e / m_p) (k_B T_e / m_e c^2)^{-3/2} = 4 \times 10^{-8} (n / 1 \text{ m}^{-3}) (T_e / 1^0\text{K})^{-3/2} (\ln\Lambda / 10) \text{ s}^{-1} \quad (6)$$

, where n is the Hydrogen atom number density, σ_T is the Thompson cross-section (which equals $6.65 \times 10^{-29} \text{ m}^2$), $\ln\Lambda$ is the Coulomb logarithm (we set this at 10 to counteract its effect since this is a non-thermal plasma), T_e is the temperature at which the electrons and protons will equilibrate (approximately 300^0K).

Using a (n) value of 40 atoms/m^3 , which is commensurate with the density of matter in the Vacuum (approx. $7 \times 10^{-29} \text{ g/cm}^3$), we obtain a thermal equilibration rate on the order of 10^{-10} .

In light of this result, we can affirm that the non-zero intercept in the Hayasaka et al. gyro-weight reduction expression has the same order of magnitude as the thermal equilibration rate, thus matching the physics described above.

Leaving aside the inconsistency between the Vacuum of general relativity and that of relativistic quantum field theory, the Vacuum's energy density is characterized by a negative pressure, and thus a repulsive gravity, which would explain the gyro-weight reduction effect, if indeed the local Vacuum state is achieved. We define the local Vacuum state as the macroscopic aggregate /collective state comprised of the superposition of all fluctuations in the quantum fields that permeate local spacetime.

Furthermore, we can assert that since the thermal equilibration rate is a function of the inverse temperature (raised to the 3/2 power) at which thermal equilibrium is re-established, if we were to cryogenically cool the gyro-rotor (which could be made from a superconducting material) to a temperature of $(10^{-3})^0 \text{K}$ (or below) we would obtain further reduction in the gyro-weight, if the Hayasaka et al result holds valid.

As an aside, we can hypothesize that if the gyro-rotor was to vibrate uniformly (instead of rotating), and its vibration (harmonic oscillation) was to accelerate in frequency (thus inducing a state of abrupt departure from thermodynamic equilibrium), it is possible that the resulting physics would be the same as that describing the rotational acceleration, thus we may write (using a simple dimensional analysis):

$$\Delta W_R (v) = - f_{ep} M A_v v \text{ kg m s}^{-2}, \quad (7)$$

where f_{ep} is the thermal equilibration rate, A_v is the vibration amplitude and v is frequency of vibration (in 1/s).

It is true though, that the presented hypothesis on the possible equality between the Hayasaka et al. non-zero intercept and the thermal equilibration rate (which is related to the electron-proton collision frequency) does not explain why the gyro-weight reduction only occurs in the right rotation mode (since the abrupt excursion from thermodynamic equilibrium caused by the gyro-rotor's rotational acceleration should occur for left rotations as well).

Due to this inconsistency (in addition to the non-zero intercept explanation as the thermal equilibration rate), as well as the lack of exact replication of the Hayasaka et al. experiment (both set-up and procedural aspects), further investigation into the reproducibility of this experiment is in demand, which if verified/validated has important implications in the advancement of foundational physics.

In view of the described physics, it is suggested that the Hayasaka et al. experiment be repeated under the following conditions: a pressure of 10^{-4} to 10^{-2} Pa in the evacuated chamber, a gyro-rotation frequency range of 1.3×10^4 to 10^5 rpm, and most importantly, under high rates of rotational and vibrational acceleration (to ensure abrupt departure far from thermal equilibrium). It is further suggested, that the gyro-rotor be electrically charged, with a unit order surface charge density.

The results of these proposed experiments would greatly benefit new advancements in Aerospace Propulsion, since it would show that it is possible to reduce the inertial mass, and hence the gravitational mass, of a system/object in motion, by an abrupt perturbation of the non-linear background of local Spacetime (equivalent to an accelerated excursion far from thermodynamic equilibrium, analogous with Symmetry-breaking). As a result, extreme speeds can be achieved.

Enablement of Inventive Concept

The coupling of high spin frequency with high vibration frequency in order to achieve the desired inertial (gravitational) mass reduction effect, is executed in a similar manner to the enablement of the Electromagnetic Field Generator presented in Navy case PAX 182 (similar sub-systems/components), with one major difference, namely the physical mechanism by which the vibrational effects are achieved (so as to generate much higher vibrational frequencies).

Instead of using the Piezoelectric Effect from PZT modules mounted circumferentially around the electrically charged system configuration, the Inertial Mass Reduction Device (IMRD) (shown in figure 1 in an aerospace/underwater hybrid vehicle configuration) utilizes microwave-induced vibration within a resonant annular cavity. The manner and effectiveness with which the microwave energy couples with the resonant cavity inner wall is called the cavity Q-factor. This parameter can be written as the (Energy stored / Energy lost) ratio and is in the range of 10^4 to 10^9 (and beyond), depending on whether ordinary metal (Aluminum or Copper at room temperature) or cryogenically cooled superconducting material (Yttrium Barium Copper Oxide or Niobium) is used for the resonant cavity inner wall and outside mold line skin of the aerospace vehicle. One must realize that the high energy/high frequency electromagnetic field generator responsible for the inertial mass diminution effect would generate a repulsive field while in earth's atmosphere, thereby repelling air molecules in its path of ascent/flight. Consequently, once in orbital space, by local Vacuum polarization (quantum field fluctuations' modification), a repulsive gravity effect (recall the negative pressure of the Vacuum condition) would permit swift movement of the aerospace vehicle (which comes in either a cone or lenticular triangle /delta wing configurations), beyond our Solar System.

A plurality of microwave antennas (high radio frequency emitter sources) in the electromagnetic (EM) spectrum range of 300 Megahertz to 300 Gigahertz are arranged within the annular duct - resonant cavity (surrounding the crew compartment and powerplant system, which would be guarded in a Faraday-type cage, against all EM radiation effects), as portrayed in figure 2. An auxiliary propulsion unit (not shown), would provide the initial aerospace/undersea hybrid vehicle thrust and electrical power generation.

Furthermore, if the annular resonant cavity duct is filled with a noble gas such as Xenon, the microwave energy collision with the gas particles will induce a plasma state of matter (further augmenting the oscillatory vibrations experienced by the resonant cavity inner wall), thereby creating a highly non-linear environment (phase transitions / abrupt changes of state from gas to plasma, which induce Symmetry-breaking) which will intensify the aforementioned Prigogine effect (order from chaos). This will intensify the coherence of quantum vacuum fluctuations in the proximity of the outside mold line skin (electrically charged) of the aerospace vehicle, in this manner assuring a high degree of Vacuum polarization.

It is possible to envision a hybrid aerospace / undersea vehicle, which due to the physical mechanisms enabled with the Inertial Mass Reduction Device, can function as a submersible craft capable of extreme underwater speeds (lack of water-skin friction) and enhanced stealth capabilities (non-linear scattering of RF and sonar signals). This hybrid craft would move with great ease through the air/space/water mediums, by being enclosed in a Vacuum plasma bubble/sheath, due to the coupled effects of EM field-induced air/water particles repulsion and Vacuum energy polarization.

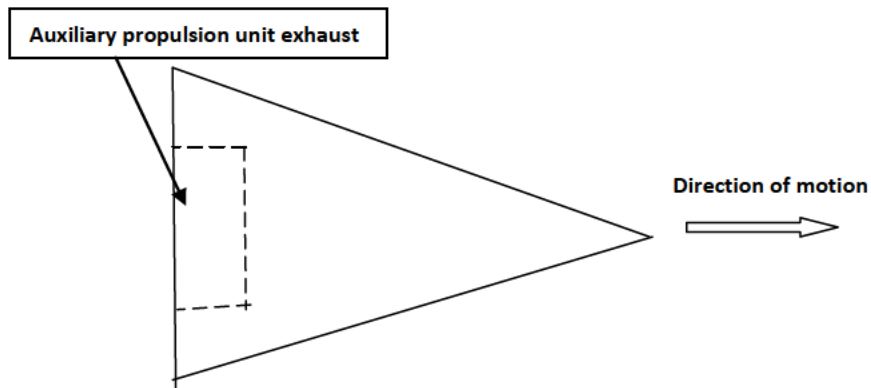


Figure 1 Hybrid Aerospace/Undersea Vehicle configuration (Top view)

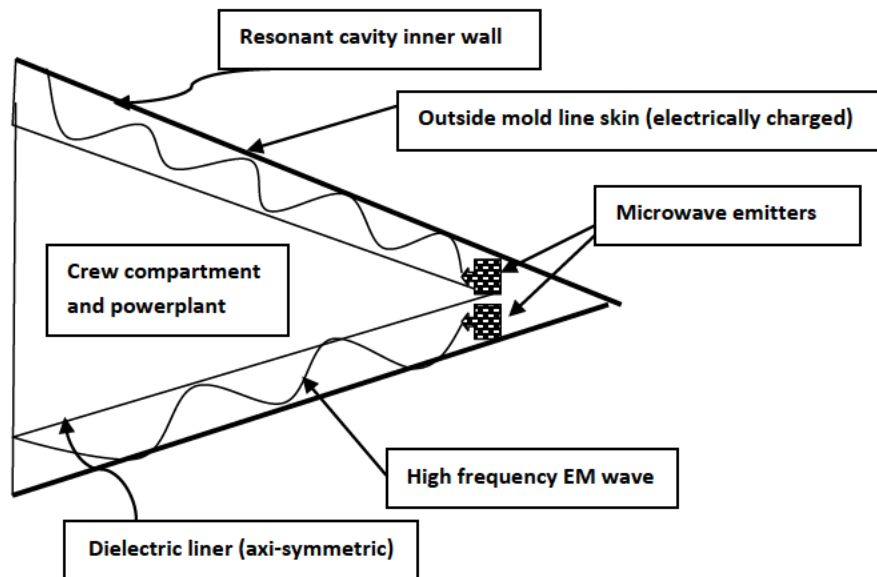


Figure 2 IMRD -Microwave Emitter configuration (Cross-sectional side view)

Conclusion

This original concept, which may represent a breakthrough/revolutionary technology, does reveal a novel approach to the design of energy generation machinery with power output levels much higher than those currently achievable by conventional means.

The utilization of such high power sources for Aerospace and Undersea Power and Propulsion generation, as it pertains to reduction in an hybrid aerospace/underwater craft's inertial mass (enabled by an Inertial Mass Reduction Device) as a direct result of local Vacuum Polarization, is an important application of the described theoretical concept.

To be more exact, the concept at hand can be utilized in the design of a device to manipulate/modify the local Spacetime lattice (topology) energy density, which can be achieved via local Vacuum Energy polarization. In this manner, extreme hybrid craft speeds can be achieved. Moreover, due to the nature of the 'emergent physics' involved, it is possible to experience spatio-temporal displacement effects.

References

1. A.D. O'Connell et al., Quantum ground state and single-phonon control of a mechanical resonator, *Nature* **464**, 697-703, April 1, 2010
2. D.A. Brady et al., Anomalous Thrust Production from an RF Test Device, measured on a low thrust torsion pendulum, AIAA/ASME/SAE/ASEE Joint Propulsion Conference, AIAA 2014-4029
3. P.W. Milonni, Quantum vacuum: an introduction to quantum electrodynamics, Academic Press, INC., San Diego, CA, 1994
4. H. D. Froning, Quantum Vacuum Engineering for power and propulsion from the energetics of space, presented at the Third International Conference on future Energy, Washington D.C. October 9-10, 2009
5. J. Schwinger, 1951 *Phys. Rev.* **82** 664
6. S.P. Kim, On Vacuum Polarization and Schwinger pair production in intense lasers, 23rd International Laser Physics Workshop (LPHYS'14), *Journal of Physics: Conference Series* **594** (2015) 012050
7. S.C. Pais (2015) , Conditional Possibility of Spacecraft Propulsion at Superluminal Speeds, *Int. J. Space Science and Engineering*, Vol. 3, No. 1 pp. 89-92 (peer-reviewed)
8. H.E Puthoff, Polarizable-Vacuum (PV) Approach to General Relativity, *Foundations of Physics*, Vol. 32, No.6, June 2002

9. B. Haisch, A. Rueda and H.E. Puthoff, Inertia as a zero-point field Lorentz force, Phys. Rev. A 49, 678 (1994)
10. Ilya Prigogine, Time, Structure and Fluctuations, Nobel Lecture, Sweden December 08, 1977
11. David Gross, The Coming Revolutions in Theoretical Physics, the Berkley Center for Theoretical Physics Lecture Series, U.C Berkley, October 19, 2007
12. H. Hayasaka and S. Takeuchi, Phys. Rev. Lett. **63**, 2701 (1989).
13. J. M. Nitschke and P.A Wilmarth, Phys. Rev. Lett. **64**, 2115 (1990).
14. J.E. Faller, W. J. Hollander, P.G. Nelson and M.P. McHugh, Phys. Rev. Lett. **64**, 825 (1990).
15. T.J. Quinn and A. Picard, Nature (London) **343**, 732(1990).