

Superluminal Spaceflight, Negative Mass, Closed Time Like Curves, Manipulation of Inertia by Advanced Electromagnetic Fields and Speculations on Time and Energy

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ABSTRACT

It is known that light photons in a laser can accelerate a spacecraft imparting momentum upon a light sail, here one considers the properties of superluminal nature of light as shown in many experiments, where the momentum of superluminal laser theoretically might accelerate a spacecraft faster than light. Next one considers a patent on time travel creating negative mass, one speculates upon this, with references to experiments that have created negative mass. Then one considers post-selection in relation to set up an experiment that uses 3 quantum states, entangled particles to create a loop in time of a closed time like curve. Then there is presented experiments done, where manipulation of inertia by advanced electromagnetic fields produces thrust, I suggest with this, by feeding advanced energy into such a device to produce thrust through time not space. And lastly there are speculations of time and energy, where energy is considered as a dimension.

Keywords: superluminal; laser; negative mass; closed time like curves; energy; dimension

INTRODUCTION

In the first part of this paper, superluminal spaceflight, one considers the concept of superluminal lasers, in regard to spaceflight. In normal lasers it has been considered in the literature that a beam of laser, can impart momentum to a light sail on a spacecraft, theoretically accelerating the spacecraft to light speed. Here I consider a superluminal light beam accelerating a spacecraft to superluminal speeds. One introduces how lowering the refractive index of the vacuum, where light becomes superluminal. I consider doing this by the vacuum state in a cavity of Casimir plates, where the speed of light would be superluminal. Then one considers other ways of getting superluminal light, examples one gives where in experiments light has been demonstrated to be superluminal and how this is exhibited in tunnelling, where photons can be accelerated through the light barrier.

I consider the use of light sails, and show the disadvantage of sending a laser beam to a spacecraft from Earth, and how impractical this is, because the Earth is rotating and moving round the Sun, how does one keep the laser aimed at the spacecraft. And consider the laser instead fixed to the spacecraft, and where one shows different views if this is practical and regarding the laser beam at the back of the spacecraft, and the question, would it accelerate or not?

One then moves on to photonic rockets, where a spacecraft carries antimatter as fuel. Such photonic rockets would reach the speed of light.

From this I consider an spacecraft that produces its own antimatter as a source, without carried as a fuel and then considerations are given to engineer the vacuum, so that when the photonic energy is produced from annihilation of antimatter, a atomic caesium gas is used to accelerate the photons, (being the annihilation products) to superluminal speeds, that impart there momentum to the spacecraft, producing superluminal speeds.

The 2rd part of this paper, negative mass, one considers the patent of Roland Arthur Smith [24] 'Time machine propulsion', is composed of rings of copper coils connected to a power supply, inside two rings within each other and another ring, that all rotate within each other, with a small piece of mass within it to create an gravitational field through centripetal inertial effects of rotation of all the rings within each other, to generate a negative gravity field, causing the small piece of mass to have less than zero mass. That causes objects to travel backwards in time. I of course have my doubts weather this would work. And less than zero mass would be negative mass. Intrigued by this, I set out the idea of creating negative mass from Casimir plates, where the plates in the cavity are fixed and works like a laser. Where the walls of the cavity are mirrored inside the plates, where the negative energy in the Casimir cavity is amplified to produce a negative energy laser beam, that is fired at another negative energy beam, to create negative mass.

Because it is known, that aiming two laser's at each other, mass is created and expressed in the relation, $m = E/c^2$. I consider the exotic properties of negative mass, that moves in the opposite direction of an applied force, and show that experiments have been conducted [26] [27], where negative mass has been created and exhibit motion against the application of a force. And consider that this is an easier way of producing negative mass to the idea of Roland Smith's patent of time travel. I further consider other ways of generating negative energy, such as squeezed quantum vacuum by ultrahigh intensity lasers with the use of mirrors separating positive and negative energy and using two lasers aimed at each other to create negative mass.

3rd part of this paper, closed time like curves. Here one considers for an experiment of using 3 quantum state particles all entangled by post - selection. The first two quantum state particles are entangled in usual post - selection experiment, but here is included a 3rd particle that is entangled with the other two particles, creating a loop in time, or a closed time like curve. Owing to the difficulty of entangling 3 particles in this way, I attempt the same idea with lasers with post - selection with the angle of polarized states, where the laser is split up in a circle, creating 3 polarized states. Such an experiment that could be done now, creating closed time like curves.

4th part of this paper, I here introduce two papers of experiments on the manipulation of inertia by electromagnetic fields. It follows that the EM field can modify the inertial properties of a generating device, there variation producing forces on the device without any exchange of mass-energy with the surrounding medium. Here I had the idea of passing advanced energy from the near-field of an antenna, (which can be quite powerful) where the advanced energy is converted into a voltage in the device, composed of a ring of and coil composed of electric insulation, capacitor plates and high K dielectric which creates EM momentum, but with advanced energy may create advanced EM momentum not through space but through time, because advanced energy travels into the past.

5th part of the paper, speculations on the nature of time and energy. Here I consider the nature of time and consider the past, present and future has an energy state. That energy might be a dimension, that this might explain the elusiveness of energy being understood. That energy is only understood as the capacity to do work, but that in itself it is not understood. But the behaviour of energy, e.g. non-locality might be understood better when energy is considered as a dimension.

1 SUPERLUMINAL SPACEFLIGHT

The solar sail concept of using Sunlight to accelerate a spacecraft or laser beamed from Earth on a light sail for interstellar travel is well known. All this is based on the fact that light carries momentum, that is imparted to the spacecraft:

$$P = \frac{E}{c} = \frac{hf}{c}$$

P = momentum

It is also known that the reason light is at the speed of light is because of the index of refraction of the vacuum, that slows down the speed of light, otherwise light would go faster than light:

$$c[c = (\epsilon_0\mu_0)^{-\frac{1}{2}}]$$

By lowering the refractive index of the vacuum, light travels faster than light, to superluminal speeds. This has been demonstrated in tunnelling experiments, where the refractive index of a potential barrier is lower and light or electrons are superluminal. Here then is the concept of changing the index of refraction of the vacuum to produce a superluminal laser beam on a light sail, imparting momentum, to reach speeds greater than light. Because light has momentum, and this should be true when the light is travelling faster than light. Theoretically using light to accelerate a spacecraft would reach to accelerate a spacecraft would reach the speed of light. So theoretically using superluminal photonic laser, a spacecraft would reach superluminal speed.

Let's look at some of the concepts of using lasers to accelerate spacecraft in a paper [1] by K. Bae, where he shows through experiment, able to manoeuvre an IU cubsat with in a laboratory environment. The principal of this is photonic laser thruster on an air track, by thrust amplification by recycling photons, between two high reflective mirrors located separately in two pacing satellites, was proposed to amplify the photon thrust. In this paper their study conclusively demonstrated the potential of a photonic laser thruster, to revolutionize future space endeavours by drastically enhancing manoeuvrability of spacecraft. The present achievements firmly established the technological foundations for a series of flight demonstrations, that include permission flight and actual mission demonstrations, with photonic laser thruster.

This proves more than anything that lasers do impart momentum to objects. The basic principle here in producing thrust of the photon thruster by amplifying the momentum transfer of photons by bouncing or trapping photons between two high reflective mirrors, that form an optical cavity. One might lower the refractive index of the vacuum here in the optical cavity to produce photonic speeds greater than light.

They overcome the technological challenges of passive optical cavity photon thruster, and there is no difficulty in injecting the power into the cavity, because the laser beam is directly framed within the cavity, and is highly stable against the perturbations in cavity parameters, such as cavity length. So, the optimum design of the photonic laser thruster is different from that of typical laser cavity.

This conception can just as well be used for superluminal photonic laser thruster. In another paper [2] by Young K. Boe, 'Prospective of photon propulsion for interstellar flight', he talks of manned spacecraft accelerated by laser on Earth to distant star systems, would reach at least 10% speed of light, $v \sim 0.1 = 30'000km/sec$. The drawbacks here is keeping the laser aimed at the spacecraft, the Earth is rotating on its axis and the Earth is moving round the Sun. And how do the crew return to Earth at their destination. K. Boe, suggests using mirrors that would beam the distant laser light from Earth back on the spacecraft to travel back. But the alignment from Earth of the laser, on these mirrors of the spacecraft has to be perfect. And if they miss the alignment of the laser on the mirrors, they can't radio back to Earth light years away, the radio signal would take years to get to Earth and back. I think this is totally impractical, I think it would be better if the laser is fixed to the spacecraft, and this applies to superluminal laser beam on the ship. Before I consider wherever this works on not, I consider further the work of Young K. Boe.

Young K. Boe, says further in his paper, that the maximum total photon energy available for propulsion E_{ph} is:

$$E_{ph} = \alpha\gamma\delta M c^2$$

γ = gamma, M = mass

Total photon flux can be directed at 100% efficiency, the total photon thrust T_{ph} :

$$T_{ph} = \frac{E_{ph}}{c} = \alpha\gamma\delta M$$

And maximum attainable velocity V_{max} of the photon propulsion system for $V_{max} \ll c$:

$$V_{max} \approx \frac{T_{ph}}{M} = \alpha\gamma\delta c$$

The above theoretical limits posed by photon propulsion with onboard photon generation can be overcome, if the photons generated and the spacecraft are physically separate.

One can write the above equations for photons at superluminal speeds. We know that the speed of light depends on $c [c = (\epsilon_0 \mu_0)^{-\frac{1}{2}}]$ the vacuum permittivity ϵ_0 and permeability μ_0 which effects the light speed. One could engineer the vacuum to increase the light speed to be superluminal by decreasing the vacuum refractive index.

$$c^* = \left[1 + \frac{\Delta c}{c_0}\right] c_0$$

Where $c^* > c_0$

One can write the maximum photon energy at superluminal speeds, available for propulsion $-E_{ph}$ here $-E_{ph}$ is negative energy:

$$-E_{ph} = \alpha\gamma\delta M c^2$$

γ = gamma and M = mass

Total photon flux can be directed at 100% efficiency, total superluminal photon thrust T_{ph} :

$$\alpha\gamma\delta M = \frac{-E_{ph}}{c^*} = T_{ph} > 0$$

The maximum superluminal attainable velocity V_{max} of the photon propulsion system for $V_{max} \gg c$:

$$\alpha\gamma\delta c = \frac{T_{ph} > 0}{M} \approx V_{max} > 0$$

According to special relativity the highest velocity of the rocket exhaust particle can have in the light velocity is $c = 3 \times 10^8 m/sec$ Therefore photons are the ultimate rocket fuel that will produce extremely high specific impulse I_{sp} :

$$I_{sp} = \frac{F_T}{gM}$$

F_T = Photon thrust, g = gravity acceleration constant and M = mass flow rate.

For superluminal speeds $c^* > c$.

$$\frac{F_T > 0}{gM} = I_{sp} > 0$$

Interestingly to note that at speeds near c nearly 100% of light energy is converted to the spacecraft kinetic energy, as if the spacecraft acts like a black hole in the moving direction. But how greater will these effects be at superluminal speeds!

Engineering the vacuum, lowering the refractive index.

To get light at superluminal speeds for rocket propulsion, how is one going to engineer the vacuum to lower the refractive index for light to be faster than light? From a paper [3] by Eric W. Davis, Teleportation physics, it's said on page 11, that engineering the space-time vacuum provides a second solution that also satisfies the definitions of vacuum teleportation. That the concept of engineering the vacuum was first introduced to the physics community by Lee (1981), that Lee stated: "The experimental method to alter the properties of the vacuum may be called vacuum engineering...if indeed we are able to alter the vacuum, then we may encounter some new phenomena, totally unexpected".

This new concept is based on the now - accepted fact that the vacuum is characterized by physical parameters and structure that constitutes an energetic medium which pervades the entire extent of the universe. We know from quantum field theory that light propagating through space interacts with the vacuum fields (vacuum quantum field fluctuations).

The observable properties of light, including the speed of light, are determined by these interactions. Vacuum quantum interactions with light lead to an effect on the speed of light, that is due to the absorption of photons (by the vacuum) to form virtual electron - positron pairs followed by the quick re-emission (from the vacuum) of the photons. The virtual particle pairs are very short lived because of the large mismatch between the energy of a photon and the rest mass-energy of the particle pairs. A key point is that this process makes a contribution to the observed vacuum permittivity ϵ_0 (and permeability μ_0) constant and therefore, to the speed of light.

$$c [c = (\epsilon_0 \mu_0)^{-\frac{1}{2}}]$$

or by the relation:

$$c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$$

The role of virtual particle pairs in determining the $\epsilon_0(\mu_0)$ of the vacuum is analogous to that of atom/molecules in determining the relative permittivity ϵ (and μ) of a dielectric material. We know that the absorption/re-emission of photons by atoms/molecules in a transparent medium is responsible for the refractive index of the medium, which results in the reduction of the speed of light, for photons propagating through the medium. This absorption/re-emission process also known in physics as a scattering process. We know from experiment that a change in the medium leads to a change in $\epsilon(\mu)$, thus resulting in a change of the refractive index. The key point arising from this analogy is that a modification of the vacuum, produces a change in $\epsilon(\mu)$, resulting in a subsequent change in c , and hence a corresponding change in the vacuum refractive index.

Scharnhorst (1990) and Latorre et al have since proved that the suppression of light scattering by virtual pairs (coherent light-by-light scattering) in the vacuum causes an increase in the speed of light, accompanied by a decrease in the vacuum refractive index. This very unique effect is accomplished in a casimir effect capacitor cavity (or waveguide), whereby the vacuum quantum field fluctuations (zero-point fluctuations or ZPF) inside have been modified, (becoming anisotropic and non-translational invariant) to satisfy the electromagnetic boundary conditions, imposed by the presence of the capacitor plates (or waveguide walls). The principal result of this modification is the removal of the electromagnetic zero-point energy (ZPE) due to the suppression of vacuum ZPE modes with wavelengths longer than the cavity/waveguide cutoff ($\lambda_0 = 2d$, where d = plate separation). This removal of free space vacuum ZPE modes suppresses the scattering of light by virtual particle pairs, thus producing the speed of light increase (and corresponding decrease in the vacuum refractive index). We know from standard optical physics and quantum electrodynamics (QED) that the optical phase and group velocities can exceed c under certain physical conditions, but dispersion always

that the signal velocity is $\leq c$. But recent QED calculations (Scharnhorst, 1990 and Latorre et al, 1995) have proved that in the casimir effect system the dispersion effects are much weaker still than those associated with the increase in c . So that the phase group and signal velocities will therefore all increase by the same amount. Note that in general, no dispersion shows up in all of the modified vacuum effects examined by investigators.

It's also known that because ZPE is lower inside the casimir plates, that this is a form of negative energy. To get light superluminal in a laser for space propulsion, that might impart momentum to a light sail, to reach superluminal speeds. In a paper I wrote [4]'Can one transmit energy faster than light', I argued that the reduction of the refractive index of the vacuum, ZPF field is what cause's light to be faster than light, giving an explanation of the mechanism of tunnelling and considering the engineering of the vacuum to send energy faster than light.

For light photons propagating in a Friedmann-Robertson-Walker (FRW) vacuum (i.e. a homogeneous and isotropic Robertson-walker gravitational background Eith Friedmann cosmology):

$$\frac{c^*}{c_0} = \left(1 + \frac{11}{45} \alpha^2 G \frac{\rho_r + P}{m_e 2} \right) > 1$$

$$(\hbar = c_0 = \epsilon_0 = \mu_0 = 1)$$

c^* is the modified vacuum speed, G is Newtons constant, ρ_r is the energy density and P is the pressure of radiation-dominated universe and ($P = \frac{\rho_r}{3}$). Here the speed of light is increased. We regard $c^* >$ (vacuum refractive index < 1) when modified vacuum has lower energy density. Latorre et al (1995) found a single unifying expression:

$$\frac{c^*}{c_0} = 1 - \frac{44}{135} \alpha^2 \frac{\rho}{m_e 4}$$

$$(\hbar = c_0 = \epsilon_0 = \mu_0 = 1)$$

Where α is the fine structure constant ($\approx \frac{1}{137}$), e is electron charge ($e^2 = 4\pi\alpha$), and where ρ is the energy density of the modified vacui. We can recast the above equation in a more useful form. We subtract one from both sides, do some algebra and then define the ratio of the change in the speed of light Δc is a modified vacuum to the speed of light in free space c_0 :

$$\frac{c^*}{c_0} - 1 = \frac{c^* - c_0}{c_0} \equiv \frac{\Delta c}{c_0}$$

$$\frac{\Delta c}{c_0} = - \frac{44}{135} \alpha^2 \frac{\rho}{m_e 4}$$

$$(\hbar = c_0 = \epsilon_0 = \mu_0 = 1)$$

After some algebra and rearranging, we arrive at the final result:

$$\frac{c^*}{c_0} = 1 - \frac{44}{135} \alpha^2 \frac{\rho}{m_e c_0^2} \left(\frac{\hbar}{m_e c_0} \right)^3$$

And:

$$\frac{\Delta c}{c_0} = 1 - \frac{44}{135} \alpha^2 \frac{\rho}{m_e c_0^2} \left(\frac{\hbar}{m_e c_0} \right)^3$$

$$c_0 = 3 \times 10^8 \text{ m/s}, \quad m_e = 9.11 \times 10^{-31} \text{ kg}, \\ \alpha = 1/137$$

And:

$$c^* = \left(1 + \frac{\Delta c}{c_0} \right) c_0$$

As we can see from the last equation, we have c^* superluminal speed of light. Let's now consider the momentum of our photons, for laser pulse spacecraft:

$$P = \frac{E}{c} = \frac{hf}{c}$$

If we now change the refractive index of the vacuum, to get superluminal speed for momentum of our photons, for laser pulse spacecraft:

$$\frac{-E}{c^*} = \frac{h(-f)}{c^*} = P > 0$$

Where $-E$ is negative energy and frequency $(-f)$ is negative, producing superluminal momentum $P > 0$. Here we have expressed the momentum of a photon and can apply this to a laser, where the refractive index of the vacuum ZPF has been lowered, where superluminal laser imparts its momentum to the spacecraft light sail. Resulting in superluminal speed of the spacecraft.

Other ways of getting superluminal light

Because there may be difficulties in modifying the vacuum to have low refractive index, for superluminal speed of light for a spacecraft, using casimir plates. That light leaving the casimir plates might go back to the speed of light? And how to engineer this so that the laser at superluminal speed imparts its momentum onto the light sail, that in other experiments light becomes superluminal without the need for casimir plates. Also, the gap between the casimir plates is too small to be practically used in this way.

Tunnelling might be exploited for space propulsion, where the speed of photons or electrons is superluminal in the potential energy gap. For example, in a paper by Walker [5] shows on page 33, that EM fields in the near-field of a transmitter will be superluminal. But this is in the radio frequency range rather than visible light, that is superluminal in the near-field. Walker says in his paper: Some physicists accept that the phase velocity and group velocity in these systems can be superluminal, but that the information speed is less than the speed of light. It has been shown [in his] in this paper that although group speed can differ from information speed, provided the noise is small, and the method of modulation is known, group speed can be approximately the same as the information speed.

Walker concluded in his paper: The analysis presented in [his] paper has shown that the field generated by an electric or magnetic dipole, and also the gravitational fields generated by a quadrupole mass source, propagate superluminally in the near-field of the source and reduce to the speed of light, as they propagate into the far-field. The group speed of the waves produced by these systems has also been shown to be superluminal in the near-field. Although information speed can be less than group speed in the near-field, it has been shown that if the method of modulation is known and provided the noise of the signal is small enough, the information can be extracted in a time period much smaller than the wave propagating time.

Walker goes on: This would therefore result in information speed only slightly less than the group speed, which has been shown to be superluminal in the near-field of the source. It has also been shown that Relativity theory predicts that if an information signal can be propagated superluminally, then it can be reflected by a moving frame and arrive at the source before the information was transmitted, thereby enabling causality to be violated.

So, Walker has shown that electromagnetic radiation in the near-field is superluminal. But that for space propulsion, this would not be practical, because its radio waves that are superluminal, which has low energy, unlike visible light. Other scientists who have considered superluminal speed, such as tunnelling, is shown by Takaaki Musha [6] in his book, 'Tachyon Universe'. Takaaki Musha obtained the wave function of a particle at superluminal speeds: ($v > c$)

$$\psi^* = C \cdot \exp \left[-\frac{\omega}{2c} l \sqrt{\beta^2 - 1} \left(\frac{\beta}{\beta^2 - 1} - \log \left(\frac{\hbar \omega}{c} \right) - \log(1 + \beta) \right) \right]$$

Where C is a constant, and $\beta = v^2/c^2$

And Takaaki Musha showed the penetration probability through the light barrier of the tunnelling photon can be estimated to be:

$$T \approx \frac{|\psi^*|^2}{|\psi|^2} = \exp \left[-\frac{\omega}{c} l \sqrt{\beta^2 - 1} \left(\frac{\beta}{\beta^2 - 1} - \log(\hbar \omega/c) - \log(1 + \beta) \right) \right]$$

This it is considered that highly accelerated particles can tunnel through the light barrier within a finite time. Some physicists have claimed that it is possible, for spin-zero particles to travel faster than the speed of light when tunnelling [9]. This apparently violates the principle of causality, since there will be a frame of reference in which it arrives before it has left. In 1998, F. E. Low reviewed briefly the phenomenon of zero-time tunnelling [7]. So, if photons can be accelerated through the light barrier, or particles can, then one can have the possibility of accelerating a spacecraft to superluminal speeds.

On page 19 of Takaaki Musha's book [6], he gives an equation of superluminal momentum of a particle moving inside the atomic nucleus:

$$\Delta P^* = \frac{\hbar}{L} \left(1 - \sqrt{1 - \frac{m_*^2 c^2 L^2}{\hbar^2}} \right) \approx \frac{m_*^2 c^2 L}{2\hbar}$$

Where L = size of atomic nucleus, m_* is mass faster than light and the uncertainty relation for the superluminal particle:

$$\Delta P \cdot \Delta t \approx \frac{\hbar}{v - v'}$$

Where v and v' are the velocities of a superluminal particle, before and after measurement. The distance of the particle emitted from the atomic nucleus travelling in an FTL state can be obtained from the above equation of the uncertainty relation for the superluminal particle:

$$\Lambda = V_* \Delta t \approx \frac{4\hbar^4}{m_*^4 c^4 L^3}$$

Where L is the distance of the atomic nucleus.

Takaaki Musha argues here, that according to the uncertainty principle, one may conclude that the light particle emitted from the nucleus has the possibility to travel temporally as a tachyon. Then page 20 of his book [6] Tachyon Universe, Takaaki Musha shows experimental results from experiments on Tritium β decay, which shows that the electron neutrino rest mass seems to be negative, which implies that the electron neutrino has imaginary mass. One thought appeared to me about this, could one use Tritium β decay to accelerate a spaceship to superluminal speeds? But in practice, perhaps this is not possible?

Other examples where superluminal behaviour is exhibited, where it has been shown by Gunter Nimtz [8][9] that tunnelling through a potential barrier are superluminal in the barrier. Takaaki Musha [10] in a number of experiments, shows in his paper, that photons travel at superluminal speeds in the electromagnetic near-field of the source. And showed you can use tunnelling to travel through the light barrier for spacecraft [11]'The possibility of FTL space travel by using the quantum tunnelling effect through the light barrier'. So perhaps one can use tunnelling of particles or photons to propel a spacecraft to superluminal speed?

In a paper by Takaaki Musha [10] 'Superluminal speed of photons in the electromagnetic near-field, recent advances in photonics and optics', he shows that the photon to tunnel through the light barrier, he shows the difference of momentum ΔP of the photon in an original state at the source and the photon in a superluminal state can be estimated to be $\Delta P - P$, where P is momentum of the photon in a superluminal state. Can one use the momentum of superluminal photons to accelerate a spacecraft?

Where the photons impart their momentum to a light sail on a spacecraft?

E. Recami, claimed that tunnelling photons, can move with superluminal speed [12]. Chu and S. Wang at BT Bell labs measured superluminal velocities of light. Steinberg, Kwait and Chiao did an experiment, where they measured the tunnelling time of light with an optical filter, confirmed superluminal speed [14]. In another paper, by Wang, Kuzmich and Dogariu[15], they used gain-assisted linear anomalous dispersion to demonstrate superluminal light propagation in atomic caesium gas. They measure a group - velocity index of $n_g = -310 (\pm 5)$. In practice, this means that a light pulse propagating through the atomic vapour cell appears at the exit side so much earlier than if it had propagated the same distance in a vacuum, that the peak of the pulse appears to leave the cell before entering it. In this situation, the group velocity of the light pulse can exceed c and can even become negative.

Because the group velocity is negative, may imply negative energy and travel backwards in time, with the effect before the cause, that is leaving the cell before entering it. The refractive index of the caesium gas must be lower, causing the light pulse to be superluminal. The question here is, can this superluminal light propagation carry momentum to accelerate a spacecraft (upon a light sail) to superluminal speeds? Here and in the other above examples of these experiments, for superluminal speeds of light, one does not need casimir plates to lower the refractive index to make light superluminal, but in the material used for the experiment.

So, the refractive index must be lower in the atomic caesium gas. They find that a negative change $\Delta n = -1.8 \times 10^{-6}$ is the negative refractive index occurs over a narrow probe frequency range of $\Delta \nu = 1.9 \text{ MHz}$ between two gain lines. Using the expression of the group - velocity index, we obtain the result $n_g = -330 (\pm 30)$ in that frequency region. The observed superluminal light propagation is a result of the wave nature of light:

$$c = \frac{1}{\sqrt{\mu \cdot \epsilon_0}}$$

For our spacecraft, one could have the caesium gas in a cavity at the back of the ship, against the walls, were the light pulse being superluminal adds its momentum to the walls of the ship, because if it was at a distance and not at the walls of the spacecraft, the light pulse might leave the caesium gas and revert back to light speed.

One can write the equation for the momentum of a photon:

$$P = \frac{E}{c} = \frac{hf}{c}$$

And for superluminal speed:

$$\frac{-E}{c^*} = \frac{h(-f)}{c^*} = P > 0$$

Where $c^* > c$

Here the momentum is faster than light, the energy is negative $-E$ and the frequency is also negative $-f$. We have light that is greater than the speed of light $c^* > c$, caused by the refractive index of the medium, and one can add a new term describing effects happening before their cause, i.e. the light pulse leaving the caesium gas before it entered it:

$$\frac{-E}{c^*} = \frac{h(-f)}{c^*} = P > 0 = [(x^2 - x'^2) - c^2(t^2 - t'^2)] > 0$$

But the momentum $P > 0$ or $P > c$ should still be impressed on the walls of the ship.

In another experiment, by Romain Tirole, Stefano Vezzoli, Emanuele Galiffi, Iain Robertson, Dries Maurice, Benjamin Tilmann, Stefan A Maier, John B. Pendry, and Riccardo Sapienza [16] 'Double-slit time diffraction at optical frequencies', where they beamed a laser pulse that was diffracted by Indium-Tin-Oxide (ITO) and sent to a detector, they found the laser pulse going backwards in time. Although this work reproduces well the period and amplitude of the oscillations of the double slit experiment, they say it fails to capture the asymmetry observed in the experiment spectrum. (Because time here is not asymmetrical but symmetrical). Where more oscillations are visible on the red side of the spectrum, they attribute this to the time evolution of the phase of the complex reflection coefficient, which causes a Doppler shift of the spectrum, often dubbed time refraction. The permittivity modulation is computed by calculating a negative shift in the plasma frequency $-f$.

This is why one had negative frequency $-f$ and energy $-E$ in the above equation, because the light pulse, and its momentum is faster than light, being superluminal in the caesium gas, and therefore going backwards in time.

If one used a laser pulse on a light sail of a spacecraft for superluminal speeds, (where they found the laser pulse going backwards in time), the laser pulse might accelerate the ship into the past? One notes out of interest one could do a similar experiment of getting the laser pulse going back into the past and encountering itself and arranged, so that when the laser reaches the past, it cancels its own propagation at the beginning of the experiment, here then, one might create a causal paradox! And such an experiment could be done.

Light Sails

Using a superluminal laser based on Earth to propagate a spacecraft, using a light sail is impractical. First, it's impossible to lower the refractive index through the vacuum of space to

reach superluminal speeds. Even using lasers at the speed of light is impractical. 1st the laser has to be aimed at the spacecraft, but that the Earth is constantly rotating, but that the Earth is orbiting the Sun, which makes aiming the laser on the spacecraft totally impractical. 2nd even if this was overcome, arriving at the target star, no thought has been given on how the crew would get back home. There be no laser aimed from the alien planet to accelerate them home, and even if they used an laser from Earth with mirrors to get home, the crew could not immediately communicate with Earth if the laser from Earth missed there light sail as there be several light years away, even if they were 4 light years away, there have 4 years before the signal gets to Earth, and another 4 years to wait for a reply, making it 8 years long wait.

It seems therefore more practical to have the laser fixed to the spacecraft, even if one could engineer the vacuum to get a laser with superluminal speed, so the spacecraft would accelerate its light sail to faster than light speeds. But one drawback here is that the light sail might be damaged by interstellar dust grains, at such superluminal speeds. One might find a way of protecting the light sail from such bombardment? Another weakness is the fact that one can't use wires for holding the light sail at such high superluminal speeds, perhaps using metal girders to hold the light sail in place would be better. But this is not sounding any better, a friend commented that having the laser fixed to the spacecraft would not accelerate it. I asked Takaaki Musha [17] director of advanced science-technology research organization in Japan, he said that if the laser was fixed to the spacecraft that it would be accelerated. I also asked Iver Hakan Brevik, of the Norwegian university of science and technology, department of energy and process engineering, and he told me, that this problem involves the laws of momentum conservation, for a closed mechanical system. If the laser is attached to the spacecraft, we have just such a system. If the laser emits radiation in the backward direction, momentum conservation means the system is accelerated towards the right. The maximum velocity attainable is the velocity of light.

I suppose with the idea that one could engineer the vacuum to reach superluminal speeds, but I find it difficult to conceive that a laser emitted from the back of the spacecraft would accelerate it? Perhaps Iver Brevik is right? The only way to clear this up, is to test this experimentally the two ideas, either having the laser attached to the spacecraft to a light sail, or at the back of the spacecraft. But for large superluminal speeds the use of a light sail seems impractical, would need shielding from dust grains from the interstellar medium, perhaps the solution is to have the laser attached to the back of the spacecraft, but I have my doubts that even this would work. So, as we have found, there are lots of issues with accelerating spacecraft with laser and superluminal lasers, now I want to turn to another possibility, Photonic Rockets.

Photonic Rockets

Eugen Sanger thought up the notion of the pure photon rocket, using antimatter. In 1953 Sanger began work on his idea of the photon rocket, originally conceived in 1929 [21][22]. He listed three possible constructions; 1) partial photon engines, such as the photonic fission rocket; 2) pure photon engines, with which the total mass of fuel is converted into directed electromagnetic radiation (antimatter) and 3) Photon-ramjet plasma, so that the cost of fuel is near zero. The photon rocket appears to be the ultimate rocket propulsion system possible, as there is no hope of a vehicle containing its own energy source, and propellant being any better than this system (within our present-day knowledge of physics. Here a direct beam of electromagnetic radiation is used to produce thrust, and an exhaust velocity equal to the speed of light results. However, the system is completely beyond modern capabilities. The rocket would require powers of 300MW per Newton of thrust, and for acceleration at one Earth gravity, it would have to produce powers of the order of 3×10^9 W per kilogramme of vehicle mass. Having generated this power it would be necessary to reflect it away from the vehicle with efficiencies such that only 1 part in 10^6 was absorbed, otherwise the vehicle would be destroyed. The only method of achieving this so far suggested is by using an electron gas as a mirror, and even this raises many doubts.

In order to achieve suitable mass ratios in a photon rocket, it is necessary to convert mass very efficiently into energy. One way of doing this, is matter-antimatter annihilation. And Sanger has thought of this [22]. Sanger considered the key problem of astronautical technology is therefore the production of ever more powerful engines that can use ever higher energy densities. Thus, he arrived at the provocative thesis: Absolute distance, however breathtakingly great they may seem, are for space travel a secondary consideration, because there are no, "absolute distances"! That is shown precisely in interstellar distances, which even a light ray - from the terrestrial point of view, must travel for years, even millions of years to cross. But at very high flight velocities from the spaceship point of view, the distance to be covered shrinks the nearer the velocity approaches the speed of light.

In other words, just like a photon that does not experience time, from its frame and millions of light years for a photon is but an instant, for a crew travelling at the speed of light, the distance travelled (millions of light years) would be but an instant for the crew, because like the photon time does not exist at the speed of light, and would not exist for the crew at light speed. Since according to Einstein's relativity, it is completely possible to reach within a few years of life of the crew, the fixed star systems that are, from our terrestrial perspective, millions of light years distant.

Sanger's physically well-founded thesis on the possibility of space travel, at virtually the speed of light, aroused to his astonishment a tremendous

sensation and outcry among scientists, even to the point of sheer hysterical and personal animosity. That abated only after Nobel prize winner Max Born, speaking as a high academic authority in the area of relativity theory, reluctantly admitted in February 1958, that there was no logical fallacy in Sanger's theory of space travel using photon rockets. Born could not resist, of course, sneering at Sanger's work as a "victory of the understanding over reason". This statement is an example only as a deliberate low blow against Sanger's self-conception and philosophical conviction.

Can one use the photon rocket idea, if one could engineer the vacuum refractive index in the reaction chamber of the rocket, so that the energetic photons, high energy gamma rays reach superluminal speeds and impart this momentum to the rocket, to reach superluminal speeds. The problem is how does one engineer the vacuum, and the other problem is carrying so much antimatter fuel, let alone the issues involved in containing this antimatter in magnetic fields.

One way round this, is an idea presented in a paper by Valeriu Dragan [23]'Optimisation of a quantum pair space thruster'. This paper proposes the use of quantum pair formation for generating a working mass. This is different than conventional antimatter thrusters, since the material particles generated are used as propellant, not as energy storage. Two methods are compared, laser and positron-electron quantum pair formation, the later will be shown to offer better momentum above certain energy levels. The system consists of a high energy laser that fires a beam of photons through a chamber containing heavy gas particles in order to generate the positron-electron pair. The chamber is at all times subject to a perpendicular magnetic field, which causes the two opposite charged particles to deviate in opposite directions. After capturing the two particles, they are guided further using magnetic fields and injected into a particle accelerator. In this case (they) chose the Betatron as it does not have the synchronization issues encountered in synchronizations, making it ideal for accelerating particles from very low velocities to very high, relativistic velocities. After reaching the desired optimal velocity in the particle accelerators, the particles are exhausted via two magnetic nozzles in order to generate thrust.

Further development of the quantum pair drive is made by providing an optimal exhaust velocity for maximizing energy efficiency. The velocity was found to be very close to the velocity of light in vacuum: $v_m = 0.9985 \cdot c$. This is very good, but one wants to get to superluminal speeds. But one can change this spacecraft into a pure photon rocket, where positron-electron particles are brought together in a reaction chamber, from the magnetic nozzles and annihilated. In the reaction chamber is placed atomic caesium gas, against the walls of the reaction chamber, where the energetic photons become superluminal and impart their momentum to the walls of the reaction chamber, and expelled outwards from the caesium gas, where the photons

might revert back to light speed, where the spacecraft might reach superluminal speeds.

This has certain advantages over Sanger's pure photon rocket, in that it does not need to carry fuel in the form of stored antimatter, but produces it as already explained. This seems to be an ideal set up for a photon rocket to reach speeds faster than light. So, I think I choose this idea for a superluminal photon rocket, as can be seen in what has already been said in this paper, there are many issues and involved disadvantages and advantages in using superluminal light, to accelerate a spaceship by the light's momentum to superluminal speeds.

2 NEGATIVE MASS

There is a patent by Roland Arthur Smith, [24] 'Time machine propulsion'. It says in the abstract, that the invention relates to a propulsion device, for a spacecraft, wherein matter is accelerated to increase its mass and therefore its gravity, which can be used to pull objects through space. It uses copper coils in an enclosure with a small piece of mass, that responds to ferro-magnetism. It's made of a larger ring stack configuration in an enclosure. The copper coil is connected to a power supply, as used to pull a small piece of mass at velocities dependent on the number of turns of copper wire. This invention is placed at the front of a space vehicle, and everything will fall towards the gravity source.

The explanation goes on to say, the manner of using the ring shape within another ring shape produces a way of travelling backwards in time, is activated or moved the small piece of mass within the smaller ring generating some gravity. To activate the larger ring to move the smaller ring within the larger ring, further increasing the mass of the small piece of mass. Turn off the smaller ring and then turn off the larger ring. This generates a negative gravity field or causes the small piece of mass to have less than zero mass. This causes objects to travel backwards in time within that new negative gravity field.

But I see, that less than zero mass would be negative mass, and negative mass has properties that it moves in the opposite direction to which it is accelerated. So, the Author of this patent did not realize the negative mass would move in a opposite direction in the ring? Also, I wonder if using copper wires and a ring structure rotating would really create and gravitational field. But rotating objects do create inertial forces, which are the same as gravitational fields. So, the principle might work? The only way of finding out is to do an experiment to test it out? Personally, I don't really believe this invention would work, (but I could be wrong?) especially for time travel. But I here explore the issue of creating negative mass, for the same purpose time travel, in creating negative gravitational fields, because it's interesting.

But to make time travel into the past in this invention depends on creating negative mass. So, I thought of alternative ways to create negative mass. In the casimir effect, you got negative energy. If there's a

way to convert this negative energy into negative mass, in creating negative gravitational fields in the arraignment of that patent of Roland Smith?

So, the question, how to convert the negative energy in between the casimir plates to produce negative mass? If one could amplify the virtual photons in the gap of the casimir plates by light amplification by stimulated emission of radiation, to act like a laser, where the casimir plates are fixed, so that the plates don't close and the inner sides of the plates are mirrored in the principle that the lasers work, but for negative energy, that creates constructive interference of negative energy frequencies, that might be enhanced to a coherent beam, one might create a negative energy laser, where the beam of negative energy fires out of a cavity or hole in the casimir plates, creating a coherent negative energy laser beam. And having another identical arrangement, where both negative energy laser beams are fired at each other to create negative mass.

That negative mass created by negative energy might propagate into the past and appear before it set of, effect arising before cause. Because negative energy propagates into the past? But here I am unsure about this.

Of cause the gap between the casimir plates are too small to create such a negative energy laser? In any practical sense seems impossible, but one might achieve it with miniaturization. Another way to obtain negative energy is to squeeze quantum vacuum by ultrahigh intensity lasers. Davis and Puthoff [25] proposed a method by use of an ultrahigh intensity laser, coupled with a fast-moving mirror. By their method, negative energy can be generated by an array of ultra-fast rotating mirror system to create the squeezed state of electromagnetic field. Both pulses (positive and negative) are equal in time interval release. Rapidly rotating mirrors is then set up, would serve the purpose of separating the positive and negative energy, if the beams hit the mirrors at a very shallow angle.

Then one has to have two identical arrangements of this set-up, and aim both negative energy beams at each other, to create negative mass. Roland Smith [24] said in his patent, it may be possible to use only one atom of iron as the small piece of mass in the invention for time travel. So, one would not need a lot of negative mass. I am sure the created negative energy beams aimed at each other might create a small piece of negative mass for this invention, to test if this would travel into the past?

And object with negative inertial mass would accelerate in the opposite direction to that which it was pushed. (Non-gravitational) positive mass attracts both other positive masses and negative masses. Negative mass repels both negative masses and positive masses. Two objects of equal and opposite mass would produce a constant acceleration of the system, towards the positive mass object, creating a runaway motion. They would accelerate without limit, (except a relativistic one).

The total mass, momentum and energy of the system would remain zero. Thomas Gold hinted that the runaway liner motion could be used as a perpetual motion machine, if converted to circular motion.

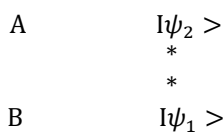
Forward used the properties of negative mass to create the concept of diametric drive, a design for spacecraft propulsion using negative mass, that requires no energy input, and no reaction mass to achieve high acceleration. The overwhelming consensus among physicists is that antimatter has positive mass and is effected by gravity like normal matter.

Negative mass has been created in experiments [26][27]. In both experiments the negative mass has been found to accelerate in the opposite direction to that which a force is applied. This confirms theoretical predications of scientists. Such negative mass can be created then, without trying to create negative energy, which might travel into the past with casimir plates or squeezed light. There is no indication from these experiments that negative mass travels into the past, like negative energy? In [26] the negative mass hydrodynamics was created in a spin-orbit-coupled Bose-Einstein condensate. The other [27] negative mass was created my mass exciton polaritons induced by dissipative light matter coupling in and atomically thin semiconductor.

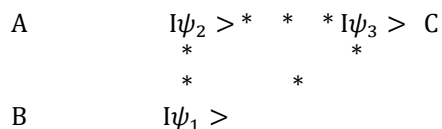
Such negative mass particles to Roland Smiths patent of time machine propulsion, to travel into the past, were he said one iron atom could be used as mass in the machine, where he said the normal iron mass would become less than positive mass, is negative mass. I guess if one used similar methods as Roland Smith patent idea, to use negative mass and generate a negative gravity field that causes objects to travel backwards in time, within the negative gravity field. Of course, in Roland Smith's invention, his motion of the small mass in a smaller ring, but as its the negative mass, it would move in the opposite direction of the applied force. Roland Smith was not aware of this perhaps, and there are other ways of creating negative gravity field with negative mass to perhaps, travel backwards in time.

3 CLOSED TIME LIKE CURVES

Closed time like curves or loops in time have been in the realm of scientific theory, but here I outline an experiment using post-selection to create a closed time like curve. In post-selection the entangled non-local state $I\psi_2 >$ effects $I\psi_1 >$ in the past:



But if one can get 3 particles entangled, we have the state:



Effectively creating a loop in time, where the past state $I\psi_1 >$ has to be entangled with the future state $I\psi_2 >$ as in post-selection. But $I\psi_1 >$ has to also be entangled with the future state $I\psi_3 >$ which is also entangled with state $I\psi_2 >$. I have read different papers that show more than two particles can be entangled with each other, but not in the outline I give here. It seems difficult to entangle 3 particles like this. Luckily if one uses lasers and polarized states, then this can easily be achieved. In a paper by Jing-Hui Huang, Xiang-Yun, Xue-Ying Duan and Guang-Jun Wang [28] they outline in their experiment, recently biased weak measurements (BWM) has shown higher precision than both conventional measurements and standard weak measurements (SWM) in optical metrology. In this [They] propose a scheme of detecting rotation velocity in Sagnac's interferometer with BWM. In particular, BWM employ an additional reduction of photons in the post-selection by introducing a pre-coupling, and the remaining photons have been shown to be extremely sensitive to the estimated parameter. In addition, [there] numerical results show that the scheme with BWM can obtain a higher sensitivity than the scheme with SWM.

Here I am only going to consider SWM, and use part of their experiment, and adapt it to my experiment. Here a white laser (WL) is beamed in a pre-selection through a (GF) Gaussian filter with the central wavelength λ_0 and the full width at half maximum, $\Delta\lambda^2$ passing through a polarizer P1 with optical axes 45° . From here the laser beam goes into a coupling area passing through a polarizer beam splitter, where injected into a Sagnac's interferometer with horizontally polarized component $IH >$ and vertically polarized component $IV >$, sent in a circle through common mirrors M1, M2, M3. And then the beam is sent into post-selection through a quarter wave plate QWP with optical axis set at -45° into a polarizer P2 optical axis set $\ell - 45^\circ$ and then sent into a spectrometer.

What I suggest in there experiment, is creating a loop in the laser, where after pre-selection of P1 is placed a polarized beam splitter PBS that sends half of the beam outwards to another polarized beam splitter PBS and the beam is sent into post-selection area of the experiment, into the quarter wave plate with optical axis set at -45° , that goes into P2 polarizer and is detected in the spectrometer. In this way one has created a loop, in other words one splits the laser, creating an extra beam that is also fed back to join the original beam at post-selection at the end of the experiment, effectively linking all the polarized states, creating a loop in time. What would be difficult to entangle 3 quantum state of particles, can be done with 3 polarized states of a laser. Would this create closed time like curves? But as I have shown here, such an experiment can be done.

4 MANIPULATION OF INERTIA

There are two papers by Hector H. Brito, Sergio A, Elaskar, [29][30] both named 'Direct experimental evidence of electromagnetic inertia manipulation thurusting', where they manipulate inertia in a device

by electromagnetic fields to produce thrust. They have proved this experimentally. They used a separate supply of 100V-AC, 30kHz, to their 900 turns parallel mounted toroidal coils and to three parallel mounted 10nF-mm wide annular capacitors, allows for a total EM momentum around 5 E-11 Ns (peak), by using $BaTiO_3$ ceramic dielectrics ($\epsilon_r \approx 4400$).

They also repeated the experiment with a common supply of 200v-AC at 39kHz to their 900 turns parallel mounted toroidal coils in series etc. They got positive results from there experiment. It follows that the EM field can modify the inertial properties of the generating device, there variation producing forces on the device without any exchange of mass-energy with the surrounding medium. A propulsion concept based upon this kind of inertia manipulation mechanism was subsequently drawn, an electromagnetic inertia manipulation (EMIM) thruster was engineered up to "proof of concept" level. Experiments were designed and performed, yielding by spectral analysis techniques, in an exploratory phase. In a second phase, with a slightly modified experiment, sharper and clearer evidence of sustained thrust had been found, as observed in frequency domain plots. Direct evidence of EMIM sustained thrust seemed to emerge from the obtained results.

They also searched for interfering effects to their experiment, such as electrostatic coupling to surroundings, magnetic coupling to surroundings, self-magnetic coupling, air motion, power supply induced electromagnetic interference, geomagnetic influence. All these interferences to the experiment giving false readings were ruled out by testing. They found that a change of the mechanical momentum exactly balances the change of the EM field momentum. Momentum is then being exchanged within the whole closed system.

$$T \cong \int_{V_m} \frac{\partial g^{(f)}}{\partial t} dV = - \int_{V_m} \frac{\partial}{\partial t} (D \cdot B) dV$$

Where T = thrust vector N, g = electromagnetic momentum density Nis/ m^3 , v = velotage, V = volume m^3 , D = electric displacement vector C/m^2 , B = magnetic induction vector T.

According to this equation, EM inertia manipulation becomes a theoretical possibility. This allows for jet-less propulsive effects by means of EM fields manipulation.

I notice in their device for experimentally producing there thrust effects, that its composed of a power supply in voltage, coil, superconductor, capacitor plates, and high K dielectric. This is a similar arrangement to an experiment by Takaaki Musha's Honda experiment, by feeding electrical energy into a capacitor, dielectric to get weight reduction [31] of 3% of the capacitor. From this idea I wrote a paper [36]'The possibility of mass shift into the past', were one sends advanced energy into the capacitor of Takkai Musha's Honda experiment, to see if one gets mass shift into the past.

Because advanced waves are travelling into the past. One can produce advanced waves outlined by the person who discovered them, by Bajlo [32]. In these experiments Bajlo was the first person to detect advanced waves, and he did this by making the receiver (absorber) smaller than the transmitter. He used aerial transmitters at radio frequency's for his experiment, making the receiver smaller means that the advanced waves don't cancel out. The dipole transmitter he used was both producing advanced and retarded waves into free space. The advanced waves were detected before the arrival of the retarded waves. What happens is that the advanced waves appear from infinity to converge to a point on the antenna in advanced time before the retarded waves. Where you have effect arising before cause. But Bajlo regards advanced waves as outward going waves into the past, and not incoming waves, and one can see that the advanced waves must be coming from the past to converge at the antenna due to our thermodynamic direction of time flow of energy into the future. And outgoing as negative energy time flow into the past, that one has two-time flows, one into the past, one into the future. Supporting the retarded and advanced solutions of Maxwell's equations.

One notices the device of using electromagnetic fields to manipulate inertia to produce thrust, is made up of a dielectric, capacitor plates and superconductor. This has similar components of Takaaki Musha's Honda experiment of feeding an electrical field into a capacitor to cause mass-shift weight loss. One could feed advanced waves or energy after Bajlo's arrangement into the device of electromagnetic momentum generator, where now advanced electromagnetic fields manipulate inertia, producing thrust not through space but through time? That is into the past, because an advanced electrical field travels into the past.

Also, the advanced energy also could be fed into the capacitor plates, with weight loss as well as a temporal thirst through time in manipulating inertia through advanced electromagnetic fields. Inertia is also considered by relativity as a form of gravity, that one is manipulating. There are other ways of generating advanced energy, Madey [33] wrote up a patent of generating advanced waves from the near-field of an antenna, (EM fields in the near-field of an antenna travel faster than light) to be used to make instantaneous communication. One could use this as a source of advanced energy for the device as well.

In feeding advanced energy that is travelling into the past, into the device that manipulates inertia by advanced electromagnetic fields, one has to convert the advanced energy into a voltage. They used in there device a separate supply of 100V-AC at 30Hz to three 900 turns parallel mounted toroidal coils and three parallel mounted 10nF-8mm wide annular capacitors, allowing for a total EM momentum around 5E-11Ns (peak) by using $BaTiO_3$ ceramic dielectric ($\epsilon_r \approx 4400$). A maximum average thrust around 0.5 E-5N should be obtained according to the equation:

$$\langle F \rangle = \frac{\epsilon_r \omega n I V d}{2c^2} \sin\phi$$

To convert the advanced energy into voltage, which would be an advanced voltage propagating into the past to three 900 turns parallel mounted toroidal coils and three parallel mounted annular capacitors, a circuit consisting of a rectifier to convert the advanced RF input signal to DC voltage. The DC voltage is connected with a charge pump to boost the input DC voltage to higher output voltage. The advanced output voltage will be regulated by a regulator to generate a required advanced DC voltage into the device. To produce an advanced electromagnetic field manipulating inertia, creating a thrust that travels temporally through time into the past, and not through space? It's not known what happens if one sends advanced voltage into toroidal coils and capacitors? Experiments would need to be done to see if an advanced field is created. But the same laws of Physics that apply to normal retarded fields should be expected to operate for advanced fields as well in the device, except that the direction of advanced fields are travelling into the past, and retarded fields are travelling into the future.

Now the equation can be re-written:

$$\frac{\epsilon_r \omega n I^A V^A d}{2c^2} \sin\phi = F > 0$$

Where I^A = advanced harmonic current, V^A = advanced harmonic voltage, and $F > 0$ = thrust or force propagating into the past.

Bajlo detected advanced waves that are electromagnetic and propagate into the past. The advanced waves that Bajlo detected and Madey [33] suggested in his patent in using the near-field, that the advanced waves are weak. One can choose to use the advanced waves from Madey's patent, he suggests that advanced waves in the near-field have a longer wavelength than the far-field (and he had detected advanced waves but never published his results) and this is how Madey worked out how to separate the advanced wave from the retarded wave, so the advanced field is not cancelled out.

One can convert the near-field of the antenna into an electrical current as already explained, the next problem is how to make advanced field more intense or stronger to get a higher advanced voltage. Changing the advanced wave into an electric current, one can also use a Deuuen cell electrical transducer to provide electromagnetic force by converting other forms of energy into electrical energy. A transducer converts a signal in one form of energy to a signal in another. The process of converting one from of energy to another is known as transduction.

One way to get stronger or more intense advanced waves in the near-field, that is in the vicinity very close to the antenna, the energy level can rise dramatically with only a small decrease in distance towards the antenna.

The near-field of a transmitter is remarkable for reproducing classical electromagnetic induction. So, one could also use this natural state to create an advanced electrical field, with a high energy level.

The amplitude of other components (non-radiative/non-dipole) of the electromagnetic field close to the antenna may be quite powerful, and this could be amplified with a transformer, to create strong or intense advanced electromagnetic fields.

Thus, the near-field only transfer energy to very nearby receivers, and when they do, the result is felt as an extra power drawn in the transmitter. As an example of such an effect, power is transferred across space in a common transformer or metal detector by means of near-field phenomena (inductive coupling) is a strictly short-range effect. But one could use such effects to transfer strong or intense advanced energy into the device. And increase in the power level say from 1W to 300KW proportionally increase the field strength level in the near-field region.

So, one can convert the advanced energy into a more powerful voltage. A radio frequency power harvesting system can capture and convert advanced electromagnetic energy of the near-field into usable direct advanced current (DC) voltage. The key units of an RF power harvesting system are the antenna and rectifier circuit that allows the advanced RF power or advanced alternating current (AC) to be converted into DC advanced energy. This can be fed into the device to manipulate inertia by advanced electromagnetic energy to produce thrust through time and not space, that is into the past. I say again, there's nothing to rule out by the laws physics that you can use advanced energy this way, just as you can with retarded energy, one would expect this, only that advanced energy is travelling into the past.

Unlimited energy

In two papers [34][35] by Garret Model, Ayendra Weerakody, David Doroski, and Dylan Bartusiak, in experiments they had a breakthrough in getting energy from the vacuum ZPF. That this could be the unlimited energy to power the device that manipulates inertia by advanced electromagnetic field to produce thrust through time and for space travel.

Using a submicron optical cavity casimir plates (fixed so they can't close) on one side of a metal-insulator-metal (MIM) tunnelling device induces a measurable electrical current between the two metal layers with no applied voltage, involving the fast capture in there devices is consistent with a model in which an energy ΔE may be accessed from the zero-point fluctuations for a time Δt , following a $\Delta E \Delta t$ uncertainty-principle-like relation governing this process. On the principle of Heisenbergs uncertainty principle virtual particles appear from the vacuum and this energy must be paid back into the vacuum, appearing and disappearing, the larger the mass of the particle, the shorter the time to be repaid.

In other words what they have done with their device is to borrow the energy from the vacuum and not pay it back, by capturing it. So, there getting energy from the vacuum. They show in their data that when an MIM structure adjoins a thin optical cavity, electrical power is produced. There extensive range of tests show that real power is provided, and the results are not due to experimental artefacts. They argue that the source of these optical modes could be the quantum vacuum, which gives rise to the Casimir force, the Lamb shift, and other physical effects. And that it was argued that the use of energy from the vacuum field does not violate fundamental laws of thermodynamics [37]. The amount of energy produced was the same of a typical solar cell, but with more research in the future, it might be possible to get more energy. They say that the amount of ZPF vacuum energy, the size of a light bulb is enough to boil all the Oceans of the Earth several times over.

They carried out a set of tests to determine whether the measured electrical output could be the result of some sort of experimental artefact. There results support the conclusion that the source of the electrical output is not due to measurement effects or errors, transient stored charge, characteristics of the structure not related to the optical cavity, electromagnetic pick-up, electrical leakage through the optical cavity, or thermoelectric effects in the electrodes or in the device itself. All evidence is that the device itself produces the measured output.

They tested the device over a period of four hours, and they found there is a continuous current. In other words, this offers the potential of unlimited energy for the world. But I can see that this offers the potential in the future for spaceflight, with a spaceship not having to carry fuel and having a limitless supply of energy.

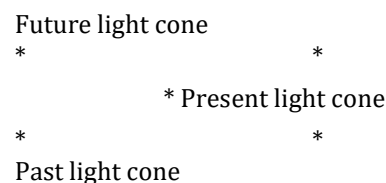
The reason I included this, in this paper, is in relation to what has been described in this paper to the experimental evidence of manipulating inertia by electromagnetic fields to produce thrust [29][30]. Such a device as this could have unlimited form of energy from the vacuum ZPF energy from the device, for getting energy from the vacuum. And an unlimited energy source to produce the advanced energy from the near-field of an antenna to be converted into voltage, in the manipulation of inertia by advanced electromagnetic fields to produce a thrust through time, not space, into the past.

5 SPECULATIONS ON TIME AND ENERGY

Energy is a scalar, mass is a scalar, means that energy and mass can move through time, because time is a scalar, because temporal motion is a scalar. Temporal motion can be like energy at the speed of light, (but time is frozen or does not exist at the speed of light for a photon, it does not experience time). A speed in time for an electron is a combination of spatial speed and temporal speed. Temporal speed is always faster than light, like energy. That energy has to be negative travelling backwards in time and non-local, (faster than light).

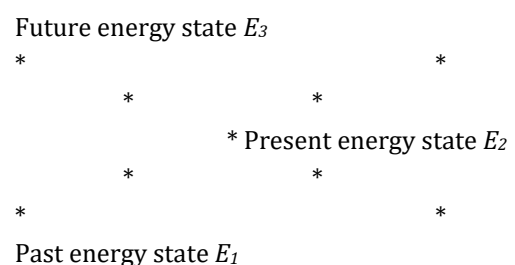
Tunnelling is non-local through an energy barrier, is faster than light, and is travelling into the past. This temporal motion or energy that's negative and moving backwards in time, is something that is hard to visualize for many people. What characterizes this motion backwards in time, or that is temporal motion? But are we not already under an form of temporal motion in our lives from the present to the future and the temporal flow or the speed of time is at the speed of causality, that is the speed of light.

I feel that energy and time might be fundamentally related to each other. Again, one result of this is Planck's constant, $E t = h$ this is how Planck derived the relation of time and energy to equal h . The flow of time from the present, past and future may be a scalar quantity and also energy. Einstein's block model of the universe makes such moments, events through time to be static and already determined in the future and past of all our actions, that one could visit. The speed of causality is the speed of light and can be represented as a snapshot of the temporal flow of time, in a space-time diagram:



In some sense because advanced waves travel into the past or that the quantum state $|\psi_2\rangle$ of a particle in post-selection influence the past state of particle $|\psi_1\rangle$ in the past, shows in some sense that the past survives in the temporal flow of time, that it is fixed, and that it has reality not just a subjective motion. So the past survives and can be visited. One struggles to consider in one's mind what this temporal movement or flow of time is, only calling it as having a scalar quantity, having a magnitude, but no direction in our spactal experience.

Noethers theorem and the principle of least action must apply to energy, that energy is conserved through time, from $|\psi_2\rangle$ to the past of $|\psi_1\rangle$. Regarding the flow of time of this temporal motion of the past surviving, must be a conserved quantity and the conservation laws of energy must apply to the flow of time. One can write out the energy states applied to the past, present and future, past E_1 , present E_2 , and future E_3 . In each state energy conservation laws apply, in any temporal movement from the present to the past say. The above can be represented in a space time diagram:



Each energy state of the past, present and future must be conserved. Once the present becomes the past, its fixed in the past, it still has an energy state, and exists in some sense in the past. This goes for the future and the present also. In what sense can one ask is the past and future still exist and be visited?

In post-selection, closed time like curves CTC, always sends pure states to pure states. They do not create entropy. So, any temporal motion into the past, as an energy state, does not create entropy while influencing or tunnelling into the past. Closed time like curves behave like an ideal, noiseless quantum channel that displaces systems in time without affecting the correlations with external systems. The reason perhaps there is no entropy while going back in time, is exactly because something is going back in time, the opposite direction of entropy increase?

Obviously if one goes back in time to the past, one would experience it as the present moment, entropy and the 2nd law of thermodynamics would operate in that experience of the present moment in the past. In each present now, of the past, present and future, the 2nd law of thermodynamics operate with that present now we all experience, with no distinction with our own present now in the present. What is interesting here is the nature of energy to time, in the past, present and future, and if one travels in time, one only experiences the past, present and future in our own personal present while we are there, and so does the energy state of that time and the 2nd law of thermodynamics.

Although this all may seem rather obvious, or trivial to some, in talking of the nature of time and energy, we need to be very clear about what we mean, to avoid confusion. If the past is fixed, in the sense that one can go back and visit it, what one can ask is its state of energy being fixed in the past, from our present temporal motion in the present? What are its laws of entropy and thermodynamics? One can ask in what sense does the past exist as a reality that one can visit it, and what is its energy state being fixed in the past?

Relativity acknowledges that some events as past and others future, no matter what frame of reference is selected. How does one reconcile this view, where now is not regarded as absolute to the nature of time. If the present now and time is not absolute, but relative with different observers having a future now and a past now, how does this reconcile to the block model of the universe. If everything is determined, the future and past according to the block model of the universe, that the past is real, becomes your present, that it could be someone else's future?

To take the space-time view seriously is indeed to regard everything that ever exists, or ever happened, at any time or place, as being as real as the contents of the here and now.

There is, in fact a way in which the tensed and tenseless theories of time could both be true, but on different levels. Suppose, now, that we juxtapose the

block universe conception of four-dimensional space-time with the tensed concept of the passage of time, both of which are found to be perfectly intelligible. Then it would likewise make perfect good sense to posit an overarching dynamic mach of time, with respect to which this four-dimensional block universe itself undergoes change, in the same manner as is envisaged in the tensed view of ordinary time?

If the past and future exist as concrete reality out there in the continuum, then our perceptions of the present is like the narrow view we have only of the visible part of the electromagnetic spectrum. Where all the other frequencies exist and we are not aware of them, is analogous of us only being aware of the present and not of the past or future, even though the past and future exist as a reality out there.

In a paper [38] by Yakir Aharonov, Sandu Popescu, Daniel Rohrlich and Lev Vaidman, they show that particles outside an energy barrier have negative kinetic energy, and that post-selection particles might have negative energy in influencing the past state of a particle, but certainly any influence travelling into the past will have negative energy.

If negative energy is propagating into the past, and positive energy is propagating into the future, this shows the temporal nature of energy, and determines the direction of that energy through time, or determines the temporal direction of energy. Therefore, one can conclude that energy has a temporal direction or movement to the future or into the past. Therefore, energy has a temporal direction through time as a scalar. Energy must go with the time flow, forwards or backwards in time (there being two flows of time) and must be connected to the temporal motion of time.

Energy may be fundamentally related to the temporal direction, motion or speed of time, into the past or future. But asking where the past is, if its fixed in the past and what this state amounts to in terms of energy, is difficult to conceive. But travelling to the past would be one's own present moment, and energy would be related to the normal causal flow of time. Then for example the past would be the whole universe of the past and the same for the future. The past and future may exist in fixed states, that can be visited, if we visited the past or future, were only experience in our own present moment now. In what state the past or future exist in our present now, we have no idea, only as somewhere else on the space-time continuum. But the past and future must have an energy state along that space-time continuum. Again, the best analogy I can come up with is that we are only aware of the visible part of the electromagnetic spectrum, in the same way we are only aware of the present now, and not of the past or future.

The principle of conservation of energy is a consequence of a function which remains unchanged when a specified transformation is applied under time translations.

But energy temporally moves in the direction of time, backwards and forwards. What is this state of energy that is conserved through time? In other words, energy is conserved temporally with the direction of time, where ever is propagating into the past or future. Energy is very mysterious, they don't know what it is, only known as the capacity to do work and transform into other forms of energy through the temporal direction of time.

One can regard everything as just energy and everything - all matter follows the direction of time. Then everything has a scalar field ϕ and has temporal motion that we call the passage of time. The energy in atoms exist forever, there is an absolute amount of energy and mass in the universe, there is no friction in the atomic/quantum domain. If energy exists forever one can write:

$$\phi \sim E \rightarrow \infty, \quad \phi \sim t \rightarrow \infty, \quad \text{Therefore: } \phi \sim Et \rightarrow \infty$$

What is it about energy that makes it last forever? And that it may be fundamentally related to the temporal direction of time?

If one accepts the block model of the universe, the future and past already are fixed in time. This is a static view. Can one regard energy in this static view that lasts forever? Energy is always in motion, being stuck in the present we only perceive the present moment which is the temporal movement of time, and not experience the past or future. How does energy fit into this block model of the universe. We don't experience the past being fixed in the past from our present temporal moment of now. A block model of the universe has the past and future already fixed, but we don't experience it, even though the past is proved to exist in post-selection experiments.

Energy may be transformed into many forms all the time in the present temporal moment/direction of time. But it exists forever and is conserved through time. This is an aspect of energy that does not change and appears in Noethers theorem as a conservation law. Emmy Noether was a German Mathematician who in 1918 proved the following fundamental connection. That every continuous symmetry of a physical system corresponds to a conservation law. Elements of energy that change through time: is the transformation of energy into different forms of energy in the temporal moment of now, all the time. Elements of energy that don't change through time: it is conserved and that it lasts forever.

I have found an equation that expresses the past, present and future as our present now. If we experience say the past, expressing energy moving with that temporal motion of time, that energy lasts forever and the causal movement in the past, present and future. First considering the simple form using perturbations, the essence of Noethers theorem is generated the notion of ignorable coordinates, one can assume that the Lagrangian L (principle of least action) is invariant (a function which remains unchanged when a specified transformation is applied) under small perturbations (warpings) of

the time variable t and the generalized coordinates q , one may write:

$$t \rightarrow t' = t + \delta t, \quad q \rightarrow q' = q + \delta q$$

One may also write this for energy:

$$E \rightarrow E' = E + \delta E$$

If one considers that energy and time are fundamentally related to each other we have the expression:

$$Et \rightarrow Et' = Et + \delta Et$$

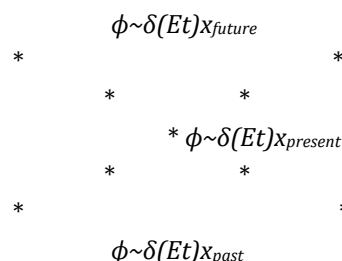
The term δEt I apply in my equation:

$$c^2 = \frac{1}{t} \int_{Et^\circ}^{Et^\infty} \phi \sim \delta(Et)x_{past}, \phi \sim \delta(Et)x_{present}, \phi \sim \delta(Et)x_{future},$$

Because c is the speed of causality, the speed of time in the present moment, is equal to $\frac{1}{t}$, c in the equation makes

$\phi \sim \delta(Et)x_{past}, \phi \sim \delta(Et)x_{present}, \phi \sim \delta(Et)x_{future}$ all have a present moment now, in the past, present and future, for someone in the past, or the present or future. For that's what we would experience if we visited say the past, in reference to that past, and outside the reference frame of c we experience the passage of time, in the past, present and future. But in the reference frame of light c a photon, time does not exist. The term $\int_{Et^\circ}^{Et^\infty}$ shows that energy and time lasts forever. That is why one uses the infinity symbol ∞ there. δ is a small change in energy and time at points $x = x_1, x_2 \dots x_n$ and energy goes in the direction of time through small change δ and ϕ is a scalar, meaning magnitude. Temporal speed (speed in time is a scalar ϕ) therefore in the equation $\phi \sim \delta(Et)x$ is a temporal motion or speed in time or a change of energy and time and position. Energy and time are a scalar, meaning they have magnitude, where each moment in time has an energy, the past, present and future. I think this equation expresses causality in the past, present and future.

It can be represented with a space-time diagram, where we have the term $c^2 = \frac{1}{t}$ related to the speed of causality in the space-time diagram, not in the frame of light, if it were in the frame of light time would not exist in the space-time diagram, so its viewed outside the reference frame of light, as in all space-time diagrams:



In my equation I am assuming that energy moves with the temporal movement of time or causality or the passage of time. But then how does one account for the fact that from the reference frame of a photon, where time does not exist, that the energy of the photon does not experience time? How can that energy transform or propagate the photon if there is no time for the photon? Would the energy be frozen from a photon's reference frame? We know from our reference frame that photons do propagate, and we experience the passage of time. But for a photon's reference frame there is no passage of time.

This is a problem that has to be addressed. From the reference frame of a photon, does its energy propagate without time. But there can be no change or propagation of energy if time does not exist for a photon. How to solve this contradiction if I am assuming that energy is fundamentally related to the passage of time and causality, where the speed of light from our frame, is the speed of causality. I think this is a problem that no one has seriously addressed up to now, and I certainly have never come across this in all the literature.

This reminds me of the equivalence paradox, from the book by Moray B. King, page 59 [42] He explains this paradox where, here a uniformly accelerated charge is recognized to radiate. However, a charge suspended at rest in a uniform gravitational field does not. According to general relativity, a uniformly accelerating system in free space should, the principle of equivalence seems to be violated. This problem has been discussed in the literature at the classical level without adequate resolution. For example, Rofhuch, Atwater and Ginzburg conclude that radiation is a function of the acceleration of the observer in relation to the source charge. But as Ginzburg asks, what are photons, and what propagates at the velocity of light if it can be made to appear or disappear depending on the acceleration of the observer? Boulware similarly suggests that the way out of the paradox is to deny that the concept of radiation is the same in the accelerated and unaccelerated frames. This interpretation likewise throws out the independent existence of light by linking it to the motion of the observer.

Regarding my equation, in correspondence with Takaaki Musha [43] a scientist in Japan, he wrote me a letter, he said, By the way on the structure of time, you proposed $\phi \sim Et$ (ϕ : scalar field of time). But I have derived the following equation from the wave equation as: $\frac{d\phi}{\phi} = -i \frac{E}{\hbar} dt$ ϕ : time wave function (i.e. scalar field of time), which is similar to your idea. Please see my paper, [44]"time wave function of the Universe". From equations in my paper (1) $i\hbar \frac{\partial \psi}{\partial t} = H\psi$ and (2) $i\hbar \frac{\partial \psi}{\partial t} = E\psi$ and the relativity equation, $E = \frac{mc^2}{\sqrt{1-\beta^2}}$ and $dt = \sqrt{1-\beta^2} d\tau$, where $\beta = \frac{v}{c}$, t is a proper time and τ is the absolute time of the universe. I obtained equation (5.1) which is shown above. Then we have: $\int \frac{d\phi}{\phi} = -\frac{i}{\hbar} \int E dt = \log \phi$ from which we have $\phi = C \cdot \exp(-\frac{i}{\hbar} \int E dt)$

that is like your equation. (i.e. my equation $\phi \sim \delta(Et)x$ from what you seen earlier in this paper). He says further in his letter to me, then the energy exists forever, the time wave function does not become infinite and the following equation is not valid for the time wave. $\phi \sim Et \rightarrow \infty$ According to this equation, positive energy propagates forward and negative energy propagates backward and we can see there are two streams of time, forward time and backward time. That last equation is what I wrote, in my letter to him. As we can see, Takaaki Musha found similarities to my equation to his, which I found interesting. Here is my whole equation:

$$c^2 = \frac{1}{t} \int_{Et^*}^{Et^\infty} \phi \sim \delta(Et)x_{past}, \phi \sim \delta(Et)x_{present}, \phi \sim \delta(Et)x_{future},$$

If there was no Big Bang and the universe is infinite, then that point on the 4th dimension of time would be $t = \infty$ and infinite moment or instant of everything that has ever happened in the universe etc, even if the universe has no beginning or end. Can one conceive of a single point on the 4th dimension of time containing infinity in that single instant of time. That single point of the 4th dimension would contain all times that have ever happened, that can be visited. But that single point of the 4th dimension considered to be infinite of all events through all time of the whole universe, may be considered of the time for the whole universe. This infinity of simultaneity of all events that have ever happened in a single point in the 4th dimension is a conceivable way of thinking of the whole passage of time for the whole universe, can be considered a global view of time.

When we think of time, the past, present and future, we must think of these states as whole realities of the whole universe. Relativity is a local theory and can't deal with considering of time for the whole universe in a global sense. So, there is a problem with both local and global views of time in relation to the whole universe. It's the same with energy, relativity as a local theory can only deal with energy in a local sense, not globally of the whole universe. Because of post-selection experiments shows that the past exists in a real sense, as a fixed reality in the past.

But the passage of time must be considered as a whole global reality of the universe. Both local and global views of time contradict each other, light is the speed of causality and is the speed of time, of the passage of time that we experience. But to travel at the speed of the passage of time, time does not exist. I am reminded also by this, of the disappearance of gravitational fields in free fall due to the principle of equivalence. An observer in free fall from there reference frame, gravity disappears, and the observer in this frame is regarded at rest. But for an observer on the ground from there frame, they see that person falling under the influence of the gravitational field, is like the same sense that time from the frame of a photon disappears, but from an observer not in the frame of the photon experiences the passage of time.

Regarding a charge in a gravitational field of acceleration on Earth suspended, does not radiate, but should under acceleration on the ground, the radiation of the charge also disappears. Dose one notices the similarity of all these examples.

One thing all the 3 examples above have in common is that there all forms of motion, moving with the speed of causality or light, that is the passage of time disappears in the frame of a photon, just as gravity disappears. For a photons frame everything else in the universe is simultaneous as a moment of a single point in the 4th dimension. Even if that everything simultaneous is 13.8 billion light years of a journey, of the universe, that photon takes, is but a moment or instant from a photons frame of reference. From the 4th dimension of time the whole history of the universe from its beginning to its end is but, a single point in the 4th dimension of time.

Perhaps the equivalent paradox of the charge not radiating, and the gravitational field appearing and disappearing depending on the motion of an observer frame reference, a clue to the problem of how time does not exist for a photon, and how can a photon's energy propagate when time does not exist for a photon?

Regarding the analogy I made, that from the frame of a photon, time disappears, may be analogous to a observers frame in free fall, where a photon can be regarded at rest, and an observer in free fall can be regarded at rest, gravity disappears and the equivalence paradox of an charge suspended at rest in a uniform gravitational field that does not radiate, one can wonder if time, gravity and radiation of a charge are all disappearing in hyperspace or a higher dimension, where they all go into an area of space-time inaccessible to a co-moving observer. Perhaps this may explain why the energy of a photon can propagate when time for a photon does not exist, that the energy of the photon is in a dimension in hyperspace and so can propagate.

Because mass increase or energy increase with relativistic speed or acceleration, where does the energy come from? It might be from the ZPF field, and one could write down the simple relation:

$$m = \frac{a < c}{t} = E$$

There is something about the nature of acceleration close to the speed of light that produces energy increase. But what is it about the above equation reminds me of another equation of power:

$$P = \frac{\Delta E}{t}$$

P is power, and ΔE is energy transferred over time, so one can write:

$$m = \frac{\Delta E}{t} = a < c$$

Then one can re-write this:

$$\Delta E_{increase} = \frac{\Delta m}{t} = a < c$$

This says that the transfer of energy increase is equal to change in mass, over time, equal to the acceleration less than the speed of light. Regarding this equation, if one wanted to work out Δm or $\Delta E_{increase}$ at relativistic speed one would use the equation: $E = \frac{mc^2}{\sqrt{1-v^2/c^2}}$ But my equation comes out of the question of where energy increase comes from under relativistic acceleration, that's why I wrote it the way I did. My equation is simply saying energy increase $\Delta E_{increase}$ is equal to change in mass Δm over time t , is equal to acceleration under the speed of light $a < c$.

Regarding my equation one can make t the subject:

$$t = \frac{\Delta m}{\Delta E} = a < c$$

One can say that everything in the universe is under acceleration or a form of motion and so is energy, even when objects seem to be at rest. And object on the surface of the Earth is under acceleration, due to the principle of equivalence, and an observer in free fall, from there frame will regard themselves at rest, yet there under a form of motion under gravity, yet from their point of view gravity has disappeared. And time is slowed in gravitational fields, so one can write:

$$t = \frac{\Delta m}{\Delta E} = a = g$$

Here the mass increase Δm produces a gravitational field or inertia g , and that gravity is acceleration, and time t is slowed with increase in mass Δm . In local frames of reference objects appear at rest, but globally, from a global frame of reference, such objects are not at rest. An object on the Earth may appear at rest, but the Earth is rotating and is moving round the Sun. The solar system may appear at rest, but the Sun is moving with all the stars around the galaxy, that is rotating, and the whole galaxy is moving with other galaxies. Regarding the nature of acceleration and velocity, I point out an interesting paper [39] by E.R. Caianello, 'Maximal acceleration as a consequence of Heisenberg's uncertainty relations'. I feel this is a important paper, that it regards some of the nature of acceleration as fundamental and reveals clues on things that I as yet can't grasp, due to the nature of acceleration and energy. The main points they show in this paper are that particles are extended objects, not mathematical points. $\Delta E \leq E$, $\Delta v \leq c$, that energy is velocity in the present temporal moment. That fundamental length or time could be related to particles as extended objects. That gravitation coincides exactly with maximal acceleration i.e. the Planck length, and that acceleration is gravitation. I will come back to this paper later.

Considerations of energy as a dimension

The best way I found considering energy as a dimension was from the paper by Brian Fraser [40] 'Beyond Einstein: non-local physics'. In his paper $E = mc^2$ expressed in non-local form:

$$\frac{E}{\left(\frac{1}{c}\right)^1} = \frac{m}{\left(\frac{1}{c}\right)^3}$$

Here mass is a 3-dimensional form of energy. The dimensions of all terms in pure space-time dimension can be expressed as energy = dimension.

		space time dimensions
c	= speed of light,	=s/t =1 or 2 dimensions
1/c	= energy,	=t/s =1 or 2 dimensions
m	= mass,	=t ³ /s ³ =3 dimensions
E	= energy,	=t/s =1 or 2 dimensions

So, energy as a dimension can be in 1 or 2 dimensions, but that mass can be 3 dimensions. If mass can be represented as a ratio of time/space, then mass is not an irreducible fundamental substance. The unanalysable fundamental substance must be a relationship between space and time (i.e. motion). Time/space t/s must be a speed in relation to space. So, energy must be a speed in time relative to space and this must be a dimension. Both space and time must be 3-dimensional and space must progress like time, and there must be locations in space just as there are locations in time, just as there are locations in space.

t/s = E = speed in time = energy = dimension
 So $\phi \sim (t/s) = E = \text{dimension}$, also,
 $\phi \sim (t^3/s^3) = m = \text{speed in time} = \text{dimension}$
 Spatial speed has dimensions of c(s/t), and temporal speed has dimensions of 1/c = energy = t/s.

The speed of light is the speed of causality $\frac{\delta x}{\delta t} = c$, therefore:

$$\frac{\delta x}{\delta t} = c^2 = \frac{1}{t}$$

$$= \int_{Et^0}^{Et^\infty} \phi \sim \delta(Et)x_{past}, \phi \sim \delta(Et)x_{present}, \phi \sim \delta(Et)x_{future}$$

= dimension

The speed of causality is the speed of time, passage of time, past, present and future, with the temporal speed of time. We also have the temporal speed of energy or a magnitude ϕ scalar, considered as a dimension. What is fundamental about this nature of temporal speed of time and energy (or acceleration), we have the past, present and future, has its present moment now, including energy and the 2nd law of thermodynamics in the present moment now, in the past, present and future as in my above equation, again one can consider energy for each state of the past, present and future.

The above will be related to the time dimension. If energy is a dimension, then negative energy is there travelling into the past. Both positive energy and negative energy are part of that dimension.

Meaning that energy must include the past, present and future as part of that dimension. The fact that we are not aware of the past or future, is that these energy states might go to a different part of this same dimension.

If energy is a dimension, then c is also an energy and part of this dimension. At light speed, from c, reference frame, time and space become zero, and what you are left with is energy E = c of 1-dimension. There is only energy of the photon left, how does this energy propagate if there is no space and time?

In our own reference frame of c, it exists in 3-dimensions and fills all space. If everything is energy, then everything is this energy dimension of the whole universe. One way one can consider how a photon can propagate if there is no time for the photon, is to say that, in the same way that gravity disappears in free fall, and from that frame can be regarded at rest, that for c where time disappears, the photon can be regarded at rest, and that the energy of that photon is a dimension, and because of this dimension or hyperspace that a photon can propagate without there being time for that photon. In a paper by H. E. Puthoff [41], 'Inertia as a zero-point Lorentz force', they have demonstrated how the ZPF may be shown to give rise to the inertial mass of a particle. That the ZPF could thus serve as the Machian cosmic reference frame. This may in turn be related to the cosmic distribution of matter in the context of the model of dynamically balanced absorption and remission of ZPF radiation by mass distributed over cosmological space, (non-local origin of inertia). One can consider the equations from the paper by Caianiello [39] 'Maximal acceleration as a consequence of Heisenberg's uncertainty relations':

$$\Delta E \cdot \Delta t = \frac{\hbar}{2}$$

$$\Delta E \cdot \Delta f(t) \geq \frac{\hbar}{2} \frac{df}{dt}$$

f = electric flux from higher dimension, where inertia comes from.

$$f(t) = f(v)$$

$$\Delta E \leq E$$

$$\Delta v \leq c$$

$$\frac{\hbar}{2} |a| \leq \Delta E \cdot \Delta v \leq mc^2 \cdot c$$

$$A_{max} = 2 \frac{mc^2}{\hbar}$$

A_{max} = maximal acceleration.

Therefore:

$$\text{dimension} = ZPF = \Delta f(t) = \frac{1}{\Delta E} \geq \frac{\hbar}{2} \frac{df}{dt}$$

Then one can write:

$$\phi \sim G \frac{c^2}{\sum_i \frac{m_i}{r_i}} = A_{max} = 2 \frac{mc^2}{\hbar} = ZPF = \text{dimension}$$

They say in there paper: Ferretti's proof adds strength to the question whether it makes sense to use theories in which lengths smaller than his limit appear (and cause trouble!) i.e. they mean that of length cannot be more precise than quantum noise. Coming to numbers, we (they) remark that, when gravitation is implied, his limit coincides exactly with that obtained from our maximal-acceleration hypothesis, i.e. the planck length. It seems to us that the present, naive approach bypasses this type of argumentations. It also appears that in models which should use this notion much has to be re-thought: if for nothing else, because acceleration is gravitation, and accelerated frames belong already there.

This is why I added A_{max} to the equation of Mach's principle, because acceleration is gravitation. One can also show that the speed of causality is related to ZPF:

$$\frac{\delta x}{\delta t} = c = \varepsilon_0 \mu_0 = ZPF$$

The non-local origin of inertia related to electric flux f from a higher dimension has maximum acceleration (of particles). That ZPF could be Machian cosmic reference frame, (where ZPF has accelerated reference frame) that arises from a higher dimension, that's leaked into our dimension, i.e. ZPF. If ZPF serves as a Machian cosmic reference frame, this would be a global reference frame, to something that is non-local.

The speed of gravity and electric fields are clearly faster than light:

$$\nabla \times E = -\frac{\partial B}{\partial t} \leftrightarrow \oint_c E \cdot dl = -\frac{d}{dt} \iint_s B \cdot ds$$

This says that a time changing magnetic flux through the area enclosed by a loop of wire will induce a voltage in the loop. In other words, a change in a magnetic flux is "felt" instantaneously (non-local) everywhere by a wire loop enclosing the flux, even if the loop is extremely large. There is no mathematical term suggesting a propagation delay. In fact, the integral sign, depicting a global quantity, implies that the voltage in each segment of wire appear all at once! If energy is a dimension, the kind of behaviour explained above can be easily be understood if energy is considered as a dimension.

And if energy is a dimension, when we use energy in a wire, (Tesla also transmitted energy without wires) when light travels, energy travels in the direction of motion of electrical and magnetic fields, the same is found for electrical and magnetic fields around wires. It's the fields that transfer the energy not the wires. Any time the electric and magnetic fields are parallel the energy is travelling this way. Its the fields not the electricity that carry the energy.

It's what happens around the wires that's important, electrons in the wire travel too slow, light is transferring the energy not the electrons. What is it about this mysterious substance called energy that

travels outside the wires? What is energy, all we know of it as the capacity to do work. The problem above becomes better understood when one thinks of energy in terms of a dimension, in explaining the transmission of energy outside the wires. This also explains why light bulbs light up under pylons with no wires. This was Tesla's idea of transmitting energy without wires.

The behaviour of energy is strange, and if you had advanced electrical and magnetic fields you might transfer energy into the past, but this is true of advanced waves.

If energy was a dimension, it could appear miraculously. If energy were 4-dimensional in could in our 3-dimensions appear and dematerialize at will, transfer from locked rooms and appear from nowhere (and all the time being conserved). This could explain energy being transferred outside the wires, and why a change in a magnetic flux is "felt", instantaneously (non-local) everywhere by a wire enclosing the flux.

If energy is a dimension, in regard to negative energy that travels to the past, and positive energy that travels to the future, both directions in time would relate to that dimension, which means that energy is linked to the past, present and future.

In 1926, Oskar Klein, in Nature [45] wrote a paper, where he talks of his 5-dimensional theory, and says that the differential equation underlying the new quantum mechanics of Schrodinger can be derived from a wave equation of a 5-dimensional space, in which h , does not appear originally, but is introduced in connexion with a periodicity in the 5th dimension. Although incomplete, this result, together with the considerations given here, suggests that the origin of Plancks quantum may be sought just in this periodicity in the 5th dimension. First in response to this, I have seen other papers, where scientists have considered that energy is a 5th dimension, therefore the origin of Plancks quantum may come from energy that has 5-dimensions, that is the ZPF or vacuum energy. Therefore, my consideration that energy is a dimension, might be in 5-dimensions. Therefore, one can write out ones equation again:

$$5th - dimension = ZPF = \Delta f(t) = \frac{1}{\Delta E} \geq \frac{\hbar}{2} \frac{df}{dt}$$

f = electric flux from 5th dimension.

Also in the same year that Oskar Klein had his paper in Nature 1926, and regarding where he's says that the differential equation underlying the new quantum mechanics of Schrodinger can be derived from a wave equation of a 5-dimensional space, since 1926 every time a physicist has taken the complex conjugate of the simple Schrodinger equation to calculate a quantum probability, he's actually been taking account of the advanced wave solution to the equation and influence of waves that travel backwards in time, without ever knowing it.

So, the probability wave or wave-function ψ can travel into the past. The two complex numbers are then multiplied together to give the probability. But for equations that describe how a system changes as time passes, this process of changing the sign of the imaginary part i and finding the complex conjugate is equivalent to reversing the direction of time, so one can write:

$$-\frac{\hbar}{2m}\nabla^2\psi + V\psi = -i\hbar\frac{\partial\psi}{\partial t}$$

It's known that Bajlo detected advanced waves [32] that to be travelling into the past, such waves must have negative energy, that Casimir plates contain negative energy. So, if energy has 5-dimensions and one has also negative energy into the past, means that this 5-dimensional theory of Oskar Klein (as an energy) must also be part of the dimension of time, that is these 5-dimensions of energy extend into the past and future. Therefore, I feel to make progress work must be done on Oskar Klein (and Kaluza) 5-dimensional theory to include time.

CONCLUSIONS

1. Superluminal spacecraft

After considering ways to accelerate spacecraft with superluminal laser light, one considered other ways of generating superluminal light. One chose a pure photon rocket of a quantum pair drive, which produces an optimal exhaust velocity very close to the speed of light, by changing this spacecraft into a pure photon rocket. Where electron/anti-electrons are produced, so that instead of carrying it as fuel, would not just be expelled but brought together and annihilated. The energy of annihilation would be sent through an atomic caesium gas against the walls of the reaction chamber and quickly expelled from the spacecraft, where energetic photons become superluminal in the caesium gas, and impart their momentum to the walls of the reaction chamber, and expelled. Thereby allowing the spacecraft to reach and become superluminal.

2. Negative mass

Here one considered Roland Arthurs Smith's patent of time travel, that supposedly creates negative mass, gravitational field to travel backwards in time. One considered alternative ways of creating negative mass from negative energy, but considered ways of creating negative mass from experiments that have actually created it. And using this as an alternative means for time-travel in regard to Roland Arthur Smith's patent.

3. Closed time like curves

One considers here creating a closed time like curve with 3 polarized states of a laser, related to each other by exploiting the properties of post-selection, considered here that such an experiment can actually be done, to test out this idea.

4. Manipulation of inertia

Regarding the work of Hector H. Brito, Sergio A, Elaskar, where in experiments they created thrust in a device by manipulating inertia by electromagnetic fields. One suggests an adaption of their experiment,

where one feeds advanced energy into their device, from the near-field of an antenna (where the energy is quite strong) and converting this into advanced voltage of such a device, to manipulate inertia with advanced electromagnetic energy to create a thrust through time and not space.

5. Speculations on time and space

Here one considered the nature of time as energy states, of the past, present and future, and one considered that energy might be a dimension, that all is known about energy is the capacity to do work. But to consider it as a dimension, allows one to pin down its elusive nature, and that considering energy as a dimension may explain many unexplainable phenomena such as non-locality in quantum physics.

REFERENCES

- [1] Young K. Bae, 'Summary of research', Y. K. Bae corporation, 218 W. Main St., Suite 102, Tustin, CA 92780, (9/30/15).
- [2] Young K. Bae, 'Prospective of photon propulsion for interstellar flight', Elsevir, Physics procedia 38 (2012) 253-279.
- [3] Eric W. Davis, 'Teleportation physics study', Air force research Laboratory, (Approved for public release) Eric W. Davis, Warp Drive Metrics, 4849 San Rafael Ave. Las Vegas, Nv 89120 (August 2004).
- [4] Anthony Maccini, 'Can one transmit energy faster than light', International Journal of Scientific Advances, Volume: 3/Issue: 6/Nov-Dec 2022. www.ijscia.com
- [5] William D. Walker, 'Superluminal electromagnetic and Gravitational fields generated in the nearfield of dipole sources'. Norwegian university of science and technology (NTNU).
- [6] Musha T, Book:'Tachyon Universe', Lambert Academic publishing, page 16.
- [7] F. E. Low. 'Comments on apparent superluminal propagation'. Ann. Phys. 7 (7-8) 1998, p660-661.
- [8] Gunter Nimtz, 'Erratum to: on virtual phonons, photons, and electrons'. Found Phys. 40, 122-123 (2010).
- [9] Gunter Nimtz, 'Tunnelling violates special Relativity', arXiv: 1003.3944v [quant-ph] 20 Mar (2010).
- [10] Musha T, 'Superluminal speed of photons in the electromagnetic near-field, recent advances in photonics and optics'. Vol 2, Issuel, pages 36-39 (2019).
- [11] Musha T, 'The possibility of FTL space travel by using the Quantum tunneling effect through the light barrier', Journal of space exploration, Special issue/Vol 6 Issi, May 15 (2017).

- [12] Recami E, 'A birds-eye view of the experimental status-of-the-art for superluminal motion'. *Foundation of Physics*, 32: 1119-1135 (2001).
- [13] Brown J., 'Faster than the speed of light', *New Scientist*. 146: 26-30 (1995).
- [14] Steinbarg AM, Kwiat Pg, Chiao Ry, 'Measurement of single-photon tunneling time'. *Physical Review Letters* 71: 708-711 (1993).
- [15] L. J. Wang, A. Kuzmich and A. Dogarin, 'Gain-assisted superluminal light propagation', *Nature/Vol 406 p277-279/ 20 July 2000/ www.nature.com*
- [16] Romain Tirole, Stefano Vezzoli, Emanuele Galiffi, Iain Robertson, Dries Maurice, Benjamin Tilmann, Stefan A. Maier, John B. Pendry, Riccardo Sapienza. 'Double-slit time diffraction at optical frequencies (2023).
- [17] Musha T, Director of advanced science-technology research organization, Japan.
- [18] Iver Hakan Brevik, of the Norwegian university of science and technology. Department energy and process engineering.
- [19] E. Sanger, 'Nuclear photonic rockets', space flight, pp. 187-207, McGraw Hill Book co., 1965.
- [20] E. Sanger, 'Pure photon rockets pp. 255-261 in Ref [20]
- [21] A. Bond, Book: 'Journal of the British Interplanetary Society, Project Daedalus'. (1978) The British Interplanetary Society, 27/29 South Lambeth Road, London, SW8 1SZ.
- [22] Gunter Beyes, 'Eugan Sanger: Astronautical pioneer and trailblazer'. *Eir Science and technology Eir Volume 14, Number 9, February 27, (1987).*
- [23] Valeriu Dragan, 'Optimisation of a quantum pair space thruster'. *INCAS BULLETIN, Volume 4, Issue 2/2012 pp 29-35.*
- [24] Smith JR, 'Time machine propulsion', United States Patent Application, Pub. No.: US 2016/0079813 A1, Pub. Date: Mar. 17, 2016.
- [25] Davis EW, Puthoff HE. 'Experimental concepts for generating negative energy in the Laboratory'. In proceedings of space technology and applications international forum (STAIF - 2006), EI-Genk MS. AIP Conference Proceedings, Melville, New York. 1362-73p (2006).
- [26] M.A. Khamehchi, Khalid Hossain, M. E. Mossman, Yongping Zhang, Th. Busch, Michael McNeil Forbes, and P. Engels, 'Negative-mass Hydrodynamics in a spin-orbit-coupled Bose-Einstein condensate'. *Chorus, Phys. Rev. Lett.* 118, 155301 - Published 10 April (2017).
- [27] M. Wurdack, T. Yun, M. Katzer, A. G. Truscott, A. Knorr, M. Selig, E. A. Ostrovskaia, & E. Estrecho. 'Negative-mass exciton polaritons induced by dissipative light-matter coupling in atomically thin semiconductor'. *Nature communications*, Published online: 23 February (2023) <https://doi.org/10.1038/s41467-023-36618-6>.
- [28] Jing-Hui Huang, Xiang-Yun, Xue-Ying Duan and Guang-Jun Wang, 'Enhancing the sensitivity of amplification of rotation velocity in Sagnac's interferometer with biased weak measurements'. *arXiv:2110.11060v 1 [quant-ph]* 21 Oct (2021).
- [29] Hector H. Brito, Sergio A. Elaskar, 'Direct experimental evidence of electromagnetic inertia manipulation thrusting'. 39th AIAA/ASME/SEA/ASEE Joint propulsion conference and exhibit, 20-23 July 2003, Huntsville, Alabama.
- [30] Hector H. Brito, Sergio A. Elaskar, 'Direct experimental evidence of electromagnetic inertia manipulation thrusting'. *Journal of propulsion and power*, Vol. 23, No. 2. March-April 2007.
- [31] Musha T, 'Explanation of dynamical Biefeld-Brown effect from the standpoint of ZPF field', *JBIS*. Vol. 61, pp. 379-389, (2008).
- [32] Bajlo D. 'Measurement of advanced electromagnetic radiation'. *Zenodo doi: 10.5281/zenodo.24-283.*
- [33] Madey, 'Instantaneous communications systems'. United States, Patent Application Publication, Pub. No.: US 2017/0012680 A1, Pub. Date: Jan. 12, 2017.
- [34] Garret Moddel, Ayendra Weerakody, David Doroski, and Dylan Bartusiak, 'Casimir-Cavity - induced conductance changes', *Physical Review Research* 3, L022007 (2021).
- [35] Garret Moddel, Ayendra Weerakody, David Doroski, and Dylan Bartusiak, 'Optical---cavity-induced current', *Symmetry*, 22 March, (2021), 13, 517, <https://doi.org/10.3390/sym13030517>.
- [36] Maccini A. 'Notes: The possibility of mass shift into the past', *International Journal of scientific advances*, Volume: 3/Issue: 6/Nov-Dec 2022, Available online: www.ijscia.com
- [37] Cole, D. C.; Puthoff, H. E. 'Extracting energy and heat from the vacuum'. *Phys.Rev.E*(1998) 48, 1562-1565.
- [38] Yakir Aharonov, Sandu Popescu, Daniel Rohrlich and Lev Vaidman, 'Measurements, Errors, and Negative kinetic energy'. *Physical Review A*, Volume 48, Number 6, December 1993.

- [39] E. R. Caianiello. 'Maximal acceleration as a consequence of Heisenbergs uncertainty relations'. Lettere Al Nuovo Cimento, Vol. 41, N. 11 10 Novembre 1984.
- [40] Brian Fraser, 'Beyond Einstein: Non-local physics', (Popular Format; a) TX8-760-669, BeyondEinstein_2rd_ed. Pdf
- [41] Bernhard Haisch, Alfonso Rueda, H. E. Puthoff. 'Inertia as a Zero-point-field Lorentz force'. Physical Review A. Volume 49, Number 2, February 1994.
- [42] Moray B, King, Book: 'Tapping the zero-point energy'. Adventures unlimited press (2002).
- [43] Private correspondence.
- [44] Takaaki Musha, 'Time wave function of the universe', International Journal of scientific advances, Volume:3/Issue: 6/Nov-Dec 2022, Available online: www.ijscia.com
- [45] Bernhard Haisch, Alfonso Rueda, H. E. Puthoff, 'Inertia as a zero-point-field Lorentz Force', Physical Review A, Volume 49, Number 2, (February 1994).
- [46] Oskar Klein, 'The Atomicity of electricity as a quantum theory Law', Nature, p516 October 9, 1926.