

LIGO DATA REASONABLE AGREEMENT WITH  
POLARIZABLE VACUUM THEORY MODIFIED FOR HIGH SPEED

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Abstract

A first attempt to extend Polarizable Vacuum theory of Harold Puthoff and others to high speed in deep space quickly failed the test of special relativity for all velocities other than zero. The mass function of PV theory was found to be the main cause of failure, while Puthoff's choice of invariant Planck constant was a second limitation.

Calculations at high velocity suggested the Puthoff mass function is not in agreement with his choice invariant Planck constant. A new mass function was derived in the Puthoff system holding Planck constant invariant with high speed.

Further modification to PV theory is proposed for consistency with Heisenberg Uncertainty principle in exchange of kinetic energy with the vacuum. Planck constant was allowed to vary slowly with stress energy, based on work by Niels Bohr in 1949. Relativistic factors were calculated for extending the theory to high speed in deep space transport vehicles.

Both modifications are used to predict a polarization in the vacuum can arise from high speed of prolonged acceleration, resulting in localized stress energy curvature of space. A weakness of PV theory is removed by offering high speed as a source of vacuum polarization to supplement the previous suggestions for field effect generators of the future.

In reasonable agreement with LIGO published data on merging black holes, mass energy conversion to kinetic energy is predicted to occur at high speed in the frame of action, although long standing theories require the opposite to appear in the frame of a distant observer.

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## Introduction

Polarizable Vacuum theory has offered an alternative to geometric theories of space time curvature, with some acceptance in the scientific community as a step in the right direction, but not a final theory or replacement for General Relativity. With only one adjustable parameter  $K$  to describe the vacuum response to stress energy, PV theory is the simplest of the large scale cosmologies, and the only one to express relativity in terms of local variables that can be measured locally. As such the PV theory is an attempt to move space science forward with predictions that can be tested experimentally.

In a publication H. E. Puthoff <sup>(1)</sup> and S. R. Little in 2010 gave a description of PV as it relates to deep space transport, showing that a field effect propulsion generator must be very powerful, requiring technology that is far advanced beyond the present capability of space science on Earth. <sup>(2)</sup> In principle the parameter ( $K < 1$ ) could arise from a powerful field generator, but as Puthoff pointed out in the referenced article, the power requirements are far beyond the capacity of existing equipment.

In this present work the question will be asked about how PV theory is altered locally by a fast moving deep space transport vehicle. More specifically an attempt will be made to extended PV theory with velocity terms sufficient to show the polarization parameter ( $K < 1$ ) arising from the velocity terms. An example is the accumulated speed and kinetic energy of a deep space transport vehicle under prolonged acceleration. The accumulated kinetic energy of a deep space transport vehicle will be proposed as a substitute for the field effect generator for polarizing space, noting that both types of energy must interact with the local vacuum.

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## Polarizable Vacuum with Velocity Terms

First the Puthoff system of PV will be evaluated to add a velocity term using special relativity in nearly flat space. Conventional equations of relativistic energy and momentum are used at high velocity, causing the Puthoff energy function to be modified. In this context relative velocity is compared to the

reference frame in which it is measured. Velocity of the vehicle can also be related to red shifted or blue shifted background microwaves in space, making zero velocity measurable in the vehicle at 2.7 degrees Kelvin in every direction.

Calculations start with the Puthoff system.

$$1.1) \quad E^2/E_0^2 = (1/ K)$$

1.2)

$$1.2) \quad m/m_0 = K^{(3/2)}$$

$$1.3) \quad K = c_0/c \quad \text{where } c_0 \text{ is standard light speed in nearly flat space.}$$

Special relativity requires additional equations.

$$1.4) \quad E^2 = (mc^2)^2 + (pc)^2$$

$$1.5) \quad (pc) = E(v/c)$$

Energy from (1.1) is restated in relativistic form using (1.2) and (1.4) for PV theory at high speed.

$$1.6) \quad E^2/E_0^2 = (1/ K) (1+ v^2/c^2)$$

Energy (1.6) is expressed in terms of light speed using (1.1) and (1.3).

$$1.7) \quad c/c_0 = (1/ K) (1+ v^2/c^2)$$

$$1.8) \quad (1+ v^2/c^2) = 1$$

$$1.9) \quad v = 0$$

$$1.10) \quad c = c_0$$

$$1.11) \quad K= 1 \quad \text{little or no polarization}$$

$$1.12) \quad m = m_0 \quad \text{using (1.2) for mass}$$

This exercise demonstrates that the Puthoff system of PV applies only when velocities are small or zero. The limitation arises from Puthoff's choice of (1.2) for mass. Then a stress energy curvature ( $K < 1$ ) does not occur from high kinetic energy in PV theory although it might occur from futuristic field generators or other methods not driven by velocity.

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## Polarizable Vacuum Theory Modified For Mass

Puthoff preferred an invariant Planck constant that can be used to derive a new mass function, using frequency  $f$ .

$$\begin{aligned} 2.1) \quad & dE/df = h && \text{for a large number of quantum actions.} \\ 2.2) \quad & E = h f && \text{on the same scale for each action.} \end{aligned}$$

Fundamental definitions give differentials of energy and momentum.

$$2.3) \quad dE = v dp$$

Using (1.5) for relativistic terms,

$$2.4) \quad dE^2 = c^2 dp^2$$

Integration is done using (1.1), (1.3) and (2.4).

$$\begin{aligned} 2.5) \quad & c^2/c_0^2 = E^4/E_0^4 \\ 2.6) \quad & p^2/(m_0c_0)^2 = (1 - E_0^2/E^2) \\ 2.7) \quad & (pc)^2/E_0^2 = (E^4/E_0^4 - E^2/E_0^2) \end{aligned}$$

Using 1.4 for relativistic energy a mass function is derived.

$$2.8) \quad m^2/m_0^2 = 2(c_0^3/c^3) - (c_0^2/c^2)$$

Then locally measured mass goes to zero as light speed goes to twice the standard value. It is a superluminal speed limit of  $2c_0$  above which further acceleration gives complex numbers suggesting additional dimensions more than the usual 4 have become significant and a worm hole is opened by stress in the vacuum derived from kinetic energy in the deep space transport vehicle. The square of total energy at the critical speed is twice the rest mass energy, but expressed locally as all kinetic energy. Velocity is given.

$$2.9) \quad v^2/c^2 = c/c_0 - 1 = 1/K - 1$$

So far this work has used the standard equations of special relativity to show an invariant Planck's constant  $h$  can be used with velocities in the Puthoff system of PV if a new mass function is derived. However Planck constant is a property of space and should vary when energy density changes in extreme cases. Also agreement with Heisenberg Uncertainty would be preferred for kinetic energy borrowed or loaned to the vacuum.



### Polarizable Vacuum Theory Modified For Heisenberg Uncertainty

To advance the theory on vacuum polarization Planck's constant is allowed to vary slowly with stress energy. This will produce results that disagree with Puthoff on energy and mass, but agree with Puthoff on other terms such as light speed, frequency, time, and length.

The key revision to PV theory is taken from a published speech of 1949 by Niels Bohr<sup>(3)</sup> about Einstein and Heisenberg, using time  $t$  and  $f$  frequency.

- 3.1)  $\Delta t \sim 1 / \Delta f$  From Niels Bohr
- 3.2)  $(\Delta E)(\Delta t) \leq \hbar$  Heisenberg Uncertainty using  $\hbar$
- 3.3)  $\Delta E / \Delta f \leq \hbar$

A limit of (3.3) is proposed for large scale energy interaction with the vacuum to minimize the variation of Planck's constant in a modified PV theory.<sup>(4)</sup>

- 3.4)  $dE/df = h/2\pi$  for a large number of quantum actions.
- 3.5)  $E = h f$  again on the same scale for each action.

So far this doesn't show how  $(K < 1)$  arises from  $v/c$ . To do so requires integration of the fundamental equation again for energy and momentum.

3.6)  $dE = v dp$

Using (5) for relativistic terms,

3.7)  $dE^2 = c^2 dp^2$

By integration of (3.4) and (3.7),

$$\begin{aligned}
3.8) \quad & E/E_o = (f/f_o)^{(1/2\pi)} \\
3.9) \quad & c/c_o = f^2/f_o^2 \quad \text{from relativity metric solutions} \\
3.10) \quad & E^2/E_o^2 = (c/c_o)^{(1/2\pi)} \\
3.11) \quad & E^2/E_o^2 = (1/K)^{(1/2\pi)} \\
3.12) \quad & (\hbar/\hbar_o) = (f/f_o)^{(1/2\pi-1)} \\
3.13) \quad & (\hbar/\hbar_o)^2 = (c/c_o)^{(1/2\pi-1)} \quad \text{variable Planck's constant} \\
3.14) \quad & (\hbar/\hbar_o)^2 = (1/K)^{(1/2\pi-1)} \\
3.15) \quad & dp^2 = (E_o^2/c_o^2)d(E^2/E_o^2) / (E^2/E_o^2)^{4\pi} \\
3.16) \quad & p^2 = (1/(4\pi-1))(1 - (E^2/E_o^2)^{(1-4\pi)})(E_o^2/c_o^2) \quad \text{momentum} \\
3.17) \quad & (mc^2)^2 = E^2 - (pc)^2 \quad \text{from (1.4) giving mass}
\end{aligned}$$

Velocity is calculated using (3.16) and (1.5).

$$3.18) \quad (v^2/c^2) = (1/(4\pi-1))((c^2/c_o^2)^{(1-1/4\pi)} - 1)$$

giving a velocity which does not exceed c although v can exceed c<sub>o</sub>.

This exercise demonstrates that when Planck's constant is allowed to vary, the prolonged acceleration of a deep space transport vehicle may be sufficient to polarize the vacuum and cause (K < 1) to occur naturally with acceleration.

K goes from 1.0000 to 0.2529 while v goes from zero to c in the limit.

There is a predicted limit beyond which ordinary space cannot be stressed which occurs when the kinetic energy density approaches the Planck energy.

$$\begin{aligned}
3.19) \quad & v = c_w \\
3.20) \quad & c = c_w \quad \text{in the limit} \\
3.21) \quad & (c_w^2/c_o^2) = (4\pi)^{(4\pi/(4\pi-1))} = 15.6402917334001
\end{aligned}$$

This is the predicted upper limit of velocity for not violating (1.4) and (1.5). It is suggesting a worm hole is opened by the extreme interaction of the space vehicle with the vacuum, when the kinetic energy density equals the vacuum energy density.

3.22)  $(c_w/c_0) = 3.95478087046553$

In this estimate the deep space transport vehicle requires nearly 4 years of continual acceleration equivalent to standard Earth gravity to reach this energy level. The result is suggesting that travel between stars can be achieved in much less than a life time. In the previous section the invariant Planck's constant required only 2 years to reach critical speed with the same acceleration. A physical test would decide which version is best, but requires a high speed deep space test vehicle.

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### Consequences for Actions in Super Saturated Space

So far two systems have been developed to show how relativistic space time might react to a vehicle under prolonged acceleration far from gravity of large stars and planets. It opens a great many questions about how physical laws at high speed apply to mechanical equipment and living biological organisms.

From this work it seems likely that the greatest limitations on deep space transport will not come from propulsion of the vehicle, but from unknowns about how biological organisms survive and function in space that is degenerating from supersaturation of kinetic energy, and all of the possible energy states are filled.

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### LIGO Published Observations and Polarized Vacuum Theories

Merger of black holes occurs from loss of orbital energy and angular momentum from propagation of gravity waves expressed as stress energy differences. Mass energy was also lost at high speed which was expected from predictions of other writers.

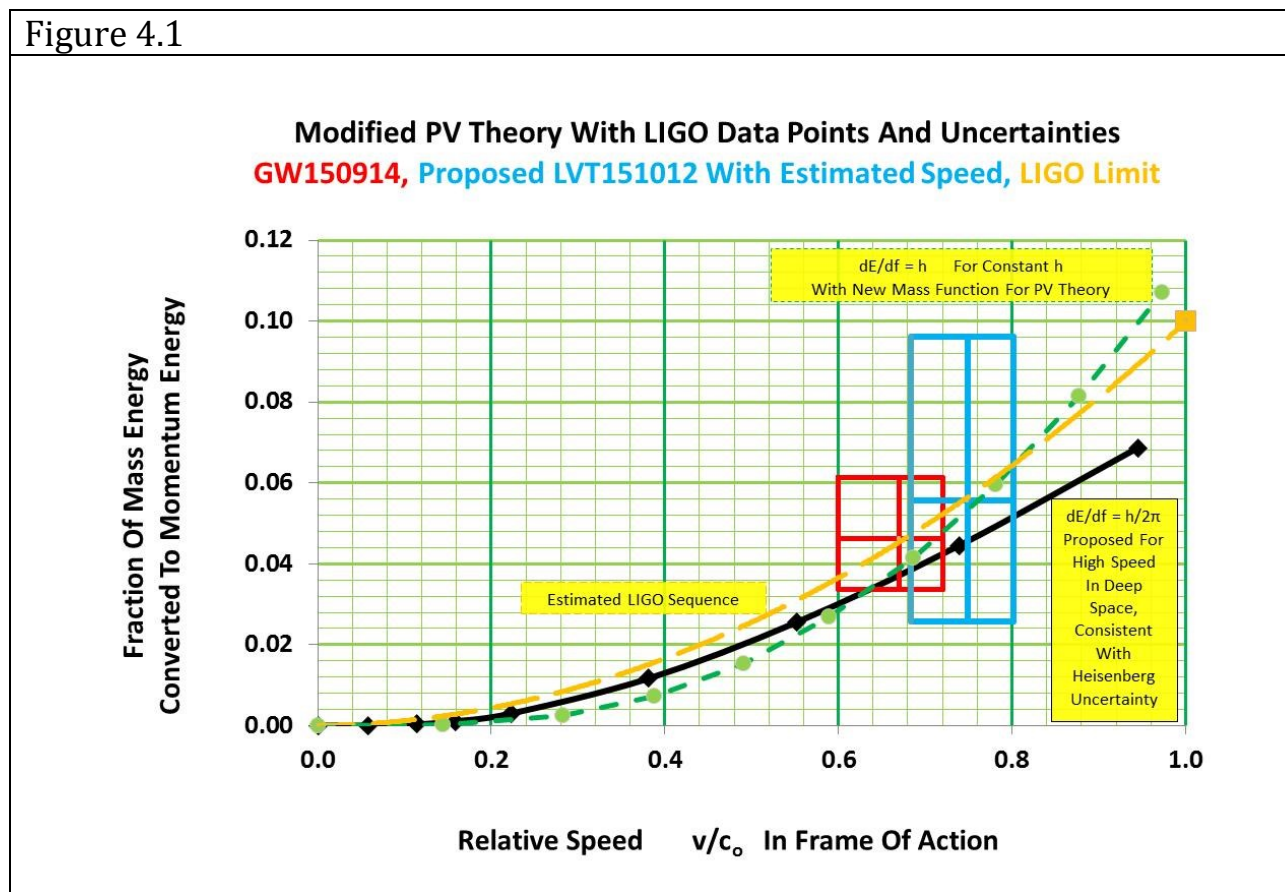
Polarizable theory, modified for high speed was compared to the published data for LIGO<sup>(5)</sup> events GW150914 which is confirmed, and LVT151012 which

is proposed but not confirmed. LIGO data was supplemented by estimates, of the unpublished merger speed for the second event, using celestial mechanics.

Both PV theories modified for high speed were found to be in reasonable agreement with LIGO publications of mass loss to kinetic energy at high speed. The second event was given a slightly higher merger speed than the first, considering closer approach over compensating the smaller masses.

Figure (4.1) shows an approximation of how LIGO data compares to Polarizable Vacuum Theory as expressed for high speed in deep space.

Figure 4.1



The figure shows reasonable agreement of LIGO data with both versions of modified Polarizable Vacuum Theory within stated limits and uncertainties. Invariant Planck's constant has slightly better agreement with the observed data, while the variable Planck's constant has better consistency with Heisenberg Uncertainty.



## Conclusions

In conclusion there is prediction for a polarization of vacuum space arising from velocity of a deep space transport vehicle under prolonged acceleration. Required power is a reasonable extension of existing technology.

The conclusion depends on a new mass function in PV theory and possibly local variation of Planck's constant under extreme bending of space.

Results are suggesting that propulsion of a deep space vehicle will become less of a limitation than human factors and design parameters.

Published LIGO observations of merging black holes are in reasonable agreement with both modified versions of Polarizable Theory.

It seems likely that local mass decreases at high speed and converts to some extent into kinetic energy. Results are suggesting there is a finite limit to local kinetic energy at which space degenerates and possibly opens a worm hole, although a distant observer may require the appearance of infinite power.

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## Limitations and Future Work

Certainly there are other ways to postulate polarization of the vacuum. Also there are many possibilities for variation of Planck's constant other than the ones used here. Only experimental evidence can identify the correct method.

Special relativity has been stretched rather far for making prediction of stress energy curvature, but with special circumstances where symmetries apply to single sources locally in the context of nearly flat space. The benefit is a result that is understandable to a large audience.

Advances in propulsion are needed, possibly a combination of stress energy field effect with magnetic field generators.

A more complete representation could be given in terms familiar to General Relativity.

## Acknowledgements

Thanks are given to Harold Puthoff for private correspondence and all of the published work on polarizable vacuum. He has not commented on these proposed modifications of PV with different mass function and variable Planck's constant.

Recognition is given to Ulla Mattfolk of Finland for help in developing the theories and recognizing the biological questions about limitations for living organisms to function under stress at the level of micro physics during high speed travel in degenerate space that is over saturated with kinetic energy.

Recognition is given to the LIGO association for published data. The LIGO data is in an early stage of development and may lead to different conclusions as the possible range is filled with observations. There is additional opportunity that some version of PV theory may become useful in evaluating LIGO candidate events.



## References and Notes

1) [puthoff@earthtech.org](mailto:puthoff@earthtech.org)

2) <http://arxiv.org/ftp/arxiv/papers/1012/1012.5264.pdf>

3) The reference to Niels Bohr is found in the 2010 Dover reprint ATOMIC PHYSICS AND HUMAN KNOWLEDGE, first published in 1961 by Science Editions in New York, shortly before Bohr died. The speech of 1949 was first published in 1949 in Contribution to ALBERT EINSTEIN: PHILOSOPHER SCIENTIST, Library of Living Philosophers, volume 7, starting on page 199. The quoted reference was to page 44 of the Dover edition for a relation of time interval to frequency interval.

4) Interpretation of the limit  $\{ dE/df = \hbar \}$  was not endorsed by Bohr, Einstein, Heisenberg, or Planck. It makes a reasonable extension of existing science in a situation where a function something like this is needed to modify PV theory for high speed consistent with Heisenberg

Uncertainty. It was published for the first time by this author (Decker) in a less formal setting of viXra: 1511.0085 on 9 November 2015.

- 5) [https://dcc.ligo.org/public/0122/P1500218/012/GW150914\\_parameter\\_estimation\\_v13.pdf3](https://dcc.ligo.org/public/0122/P1500218/012/GW150914_parameter_estimation_v13.pdf3))