Another Alternative To Superluminal Propulsion

By: Paul Karl Hoiland

ABSTRACT:
In this article as based upon an alternative answer to the measured superluminal velocity of Neutrinos at CERN I propose an alternative approach to superluminal propulsion that on the surface does not suffer from some of the problems of the more standard Alcubierre Drive.

Even though in the general theory of relativity any space-time is locally of the type

$\eta_{\mu\nu}$ = diag (1,−1,−1,−1).

This is the well known equivalence principle. We have one of the assumptions of general relativity along with the requirement that theory reduce to Newtonian gravity. The Principle of Equivalence rests on the equality of gravitational and inertial mass, demonstrated by Galileo, Huygens, Newton, Bessel, and Eotvos. Einstein reflected that, as a consequence, no external static homogeneous gravitational field could be detected in a freely falling elevator, for the observers, their test bodies, and the elevator itself would respond to the field with the same acceleration.(1) Mathematically speaking for the observer space time is locally (but not globally) flat and Minkowskian. Assuming that the metric is Minkowskian apart from a small linear correction to the metric, Einstein's field equations reduce in the case of slow particles to Newton's field equation:

$$\nabla^2\phi = 4\pi G\rho$$

If we instead of the normal condition

$$\eta_{\mu\nu} = \text{ diag } (1, -1, -1, -1),$$

Alter the local vacuum state to one of

$$\eta_{\mu\nu} = \text{ diag } (1, 1, 1, 1)$$

Or

$$\eta_{\mu\nu} = \text{ diag } (+1, +1, -1, -1)$$

Where by in an Euclidian metric there are no speed limitations and thus an object can travel in faster than light speed with the only limit being its ability to achieve a needed thrust for that velocity.

We could consider this like a case where the universe contains different domains in which some domains are locally Lorentzian and others have some other local metric of the type above we would encounter the problem suggested by Eddington (2) where one would have to go through a static hypersurface with a metric

$$\eta_{\mu\nu} = \text{diag}\ (0, -1, -1, -1).$$

But in our case we have no barrier to cross and instead we utilize this modified space-time as long as the field that alters the dynamics of space-time is engaged to provide a path to superluminal velocities.

For our normal space-time we have the metric

$$d\tau^2 = c^2 dt^2 (1 - \frac{v^2}{c^2}), \qquad d\tau = cdt\sqrt{1 - \frac{v^2}{c^2}}$$

Where in a subluminal particle in a Lorentz space must remain subluminal. Since as the particle is accelerated to c its "effective mass"

$$m_{eff} \equiv \frac{m}{\sqrt{1 - \frac{v^2}{c^2}}}$$

becomes infinite. But in the altered space-time for all particles we have

$$d\tau^2 = c^2 dt^2 (1 + \frac{v^2}{c^2}), \qquad d\tau = cdt\sqrt{1 + \frac{v^2}{c^2}}$$

where in everything is capable of passing the velocity c.

What we must then do is find a mechanism capable to altering the local vacuum around a craft to this type of vacuum state. This would involve metric engineering which was also encountered in the original warp drive as proposed by Alcubierre and latter redefined and modified by others including myself(3). But the simplest approach to this may already be found in nature itself.

One must first accept that a "Cauchy problem" is a consequence of space time having a Lorentzian metric, not the other way around. Even though a

"Cauchy problem" can be encountered in other metric approaches. We must also assume that space time must have at least four dimensions, one of which is time. We then start with a four-dimensional interval:

$$d\tau^2 = \eta_{\mu\nu} dx^\mu dx^\nu$$

$\eta_{\mu\nu}$ Is assumed as a real constant matrix.

Our coordinate basis then is

$$\eta = \text{diag } (\lambda_0, \lambda_1, \lambda_2, \lambda_3).$$

Via changes in our units we can find

$$\eta = \text{diag } (\pm 1, \pm 1, \pm 1, \pm 1)$$

Given that the general theory of relativity does not dictate any type of boundary conditions we shall introduce to

$$\bar{h}_{\mu\nu,\alpha}{}^{\alpha} = 0.$$

Where

$$g_{\mu\nu} = \eta_{\mu\nu} + h_{\mu\nu},$$

$$\bar{h}_{\mu\nu} = \frac{1}{(2\pi)^{\frac{3}{2}}} \int_{-\infty}^{\infty} A_{\mu\nu}(x_0, \vec{k}) e^{i\vec{k}\cdot\vec{x}} d^3k, \quad \vec{k} = (k^1, k^2, k^3), \quad \vec{x} = (x^1, x^2, x^3)$$

Which yields

$$\eta^{00} \partial_0^2 A_{\mu\nu} - \eta^{mn} k_m k_n A_{\mu\nu} = 0$$

Further, by choosing

$$\eta^{00} = 1$$

we see that the only way to avoid exploding solutions is to choose

$$\eta^{mn} = \text{diag}\ (-1, -1, -1)$$

Which gives us

$$\eta^{(1)} = \text{diag}\ (1, -1, -1, -1)$$

With a second stable metric of

$$\eta^{(2)} = \text{diag}\ (-1, 1, 1, 1)$$

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We then assume that space time is topologically a 4D Torus with possibly other torus products embedded within when we extend to higher dimensions which rejects all other solutions on the grounds that the metric must be a single valued function of the space time coordinates.

Let us assume a Lorentz Space-Time with a metric

$$\eta_{\mu\nu} = \ \text{diag}\ (+1, +1, +1,\text{-} +1).$$

We will also stipulate that both Lorentz space-time metrics are valid and one more stable than the other and that some energy kick is needed to transition to such a region. Again we define the velocity:

$$\vec{v} \equiv \frac{d\vec{x}}{dt}$$

We then dissect

$$A_\alpha$$

Into temporal and spatial parts:

$$A_\alpha = (A_0, A_1, A_2, A_3) \equiv (A_0, \vec{A}) \equiv (\frac{\phi}{c}, \vec{A})$$

we can define a magnetic field:

$$\vec{B} = \vec{\nabla} \times \vec{A}$$

And the electric as:

$$\vec{E} = -\frac{\partial \vec{A}}{\partial t} + \vec{\nabla}\phi$$

We then derive that

$$d\tau^2 = c^2 dt^2 (1 + \frac{v^2}{c^2}), \qquad d\tau = c dt \sqrt{1 + \frac{v^2}{c^2}}$$

For subluminal and superluminal states. The spatial equations becomes

$$\frac{d}{dt}\left(m \frac{\vec{v}}{\sqrt{1 + \frac{v^2}{c^2}}} \right) = q\left(\vec{E} - \vec{v} \times \vec{B} \right)$$

Hence we conclude that a particle can be accelerated to a velocity close to the velocity c in a Lorentz space, enter into an Euclidean space accelerate further in this region to velocities above the speed c and emerge in a Lorentz space in which it will remain above the speed c for ever unless it is decelerated in an Euclidean space again.

We can also stipulate that an energy condition change was needed to initiate the Euclidean space from out of the normal Lorentz space metric who's property was such that even though it is unstable and decays rapidly the velocity kick does remain stable.

We must then formulate what type of energy kick is needed to achieve this temporal transition from one state to another. Asher Yahalom in(4) has stipulated that such an energy kick may explain the superluminal velocity measurements on the light muon neutrinos at CERN as reported in (5). It has also been stipulated by this author(6) in an unpublished work that decay of certain exotic KK state neutrinos into selectrons and then Gravitinos could account for the slowdown effect commonly called the Pioneer Effect via a difference in C within our system to that beyond Jupiter. Both of these events involve high energy particles seeming to have the ability to alter our normal Lorentz space metric. Both involve neutrinos produced by such high energy processes. One requires a simple modification of normal space-time and the other involved effects of brane lensing and higher dimensions. The first involved a measured velocity

$$\frac{v-c}{c} = (2.48 \pm 0.28(stat.) \pm 0.30(sys.))10^{-5}$$

While the other involves a difference of 8 meters per second implying in either case an altering of Lorentz invariance which in turn supports the general idea that C can be a variable and not a constant under certain conditions. The second, given the entire solar output only yields an 8 meter per second change in C is only offered as a general support of the idea that the metric of space-time can be altered. But, the first seems to be more applicable to the eventual design of a superluminal drive than the second and avoids some of the major pitfalls of the original Alcubierre warp drive(see: Hoiland, Paul K, Problems With Warp Drive Examined, http://www.docstoc.com/docs/73414412/Problems-with-Warp-Drive-Examined). Another aspect in all this would be a short lived inflation field. To say that space expands exponentially means that two inertial observers are moving farther apart with accelerating velocity. In stationary coordinates for one observer, a patch of an inflating universe has the following polar metric

$$ds^2 = -(1 - \Lambda r^2)dt^2 + \frac{1}{1 - \Lambda r^2}dr^2 + r^2 d\Omega^2$$

it has a zero in the dt component on a fixed radius sphere called the cosmological horizon. Objects are drawn away from the observer at r = 0 towards the cosmological horizon, which they cross in a finite proper time. This means that any inhomogeneities are smoothed out or flattened. This flattening could in a very rapid short duration alter the normal metric of space-time into a Newtonian one in a small local region.

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