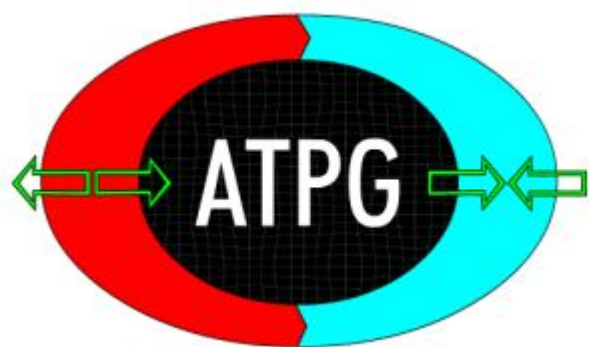


Advanced Theoretical Propulsion Group

The official newsletter of the Alcubierre Warp Drive Discussion Forum

Issue 2

December, 2001



Group Motto: *“Ex Somnium Ad Astra”*¹

Contents

Spacetime	
Warp Bubbles without volume elements	2
On the Warp Drive Horizon ‘Problem’	4
Miscellaneous	
The Woodward Effect?	6
A Call to Arms	7

¹motto established by Simon Jenks

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Editorial

This is the second edition of the group newsletter, and yes there are still bugs left and right to work out, however with some patients hopefully they'll be weeded out in time. In physics the accepted view of the world always has the possibility of being turned upside down, and recently the mythical Higgs particle seems to have gone the way of the dodo. Without the Higgs particle physicists seem to be at a complete loss to describe the origin of mass. In this edition this of the ATPG newsletter the topics included cover zero expansion warp drives to controllable warp drives, and perhaps one day in the not so distant future the warp drive will be turned upside down gaining acceptance and perhaps even funding. It is also the one year anniversary of the formation of the Yahoo Club **Alcubierre Warp Drive**, we can only hope that group has many more success in the future and that it will remain strong.

-eh

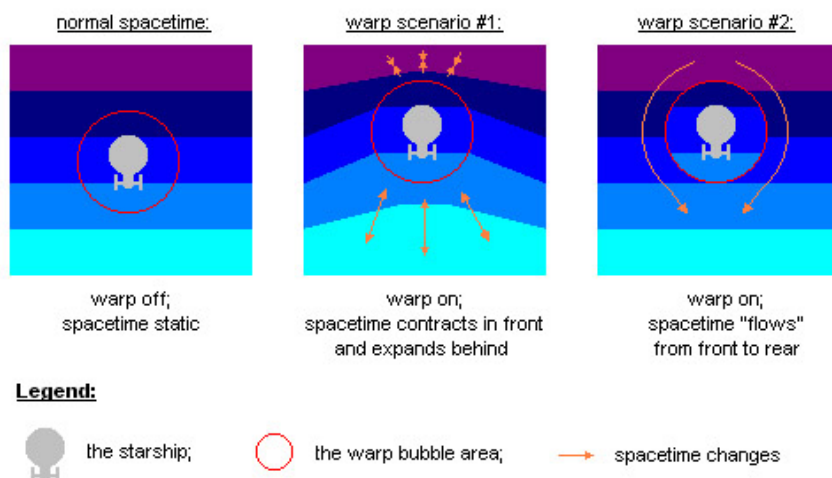
Erratum

In the last issue I gave the Casimir effect with π as opposed to π^2 , I apologize for that typographical error (as well as a number of spelling errors and sentence fragments). Also I modified the conventional \hbar and replaced it with the less descriptive form h, sorry for any confusion this may have caused, but this is a personal author convention of mine.

Warp Bubbles

Contributor: Technomanic, Michael Kuntzmann

The accepted matter for allowing a *warp drive* in General Relativity (GR) is by the expansion and contraction of a suitable volume element. This is the propulsion method suggested by Miguel Alcubierre, one of the ATPG proposed a volumeless expansion element by introducing a hypothetical exotic bubble around the spaceship in question. While interesting the group as a whole pre-



ferred to stay within the frame work of GR. However a researcher from Portugal recently addressed this issue [1], suggesting warp drive with zero volume expansion. The problem with this exploration was that researcher used *prerelativity* physics for this study, as such it can not be applied to GR, which happens to remove stress energy from local spacetime hypersurface, while maintaining it globally (however the author leaves a large amount of ambiguity in this area, so the intent is not clear).

The problem left by [1], is that the local hypersurface (again created with prerelativity physics) becomes causally disconnected from the global ones, suggesting that there is no volumeless expansion warp drive using spacetime.

baby universes

Although a volumeless expansion is ruled out by Special Relativity (SR) and GR it is not necessarily ruled by quantum mechanics. A quantum theory of

spacetime using quantum foam periodically produces baby universe whos laws are independent of the macroscopic one we are all aware. From one of these baby universes it is possible to conceive that the speed of light c may vary to some arbitrary value c' in a baby universe. The problem is that the quantum fluxations taking place are microscopic in nature, the only way to generate such effects on the macroscopic scale is to form an event horizon in a macroscopic region, thus isolating it from the rest of the universe. However introducing quantum theory to explain spacetime affects is problematic at best, bringing up more questions than answers.

Reference

- [1] Natario J. Warp Drive with Zero Expansion gr-qc/0110086

Group Publication # : 2

Contributor: Loupwarp, Fernando Loup, et al.

One of the problems concerning the application of a working warp drive spacetime for interstellar travel is formation of horizons as a ship reaches light speed. This causes part of the energy-mass within the fore warp shell to become casually disconnected to the inner most region as a ship begins to travel at velocities equal to or greater than light. The method to get around this problem was chosen by Fernando Loup, simply move the horizons occurring in the warp shells outward. The warp drive horzion problem was studied in detail by

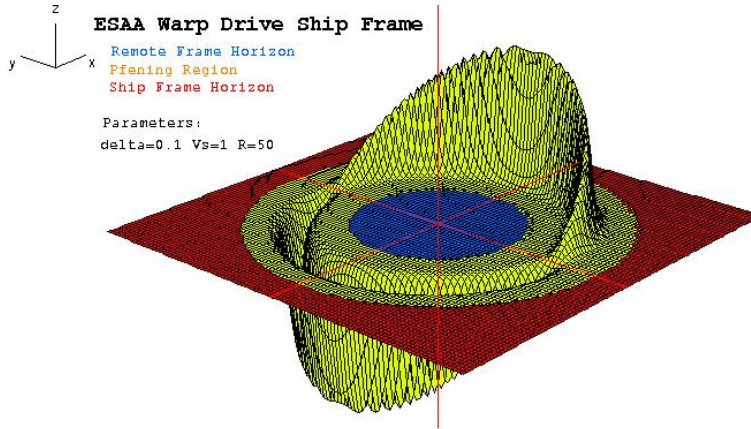


Figure 1: Figure produced by Ufokier, Michael Stabno

W. Hiscock [1], where a horzion can be given from $H(r_s) = A^2 - v_s g_{00}$, in a continues spacetime a horzion forms when $H(r_s) = 0$. While moving the horizons outside the warp shell regions, the ship frame still remains disconnected from the remote frame, making communication impossible when the ship velocity $v_s \geq c$. Currently the group is looking for away to justify this mathematical solution with some physical backing, currently this area is being explored with due speed. Currently it has been suggested that it maybe possible to use spacetime to generate the negative energies densities to physically expand the Hiscock horizons. A similar conceptions was invented by a group member independently [2], we are hopeful that these similarities may resolve the warp drive control problem.

Reference

- [1] Hiscock W. Quantum Effects in the Alcubierre warp drive spacetime. *Class. Quantum Grav.* **14** (1997) L183–88. gr-qc/9707024
- [2] Ridgely C. A macroscopic approach to creating exotic matter physics/0010027

The Woodward Effect?

Electromagnetic mass reduction, fact or fiction, the principle by James Woodward [1] can be summed up by

$$\Delta\rho_0 = \frac{GM_U/rc^2}{4\pi G\rho_0 c^4} \frac{d^2 E_0}{dt^2} \quad (1)$$

where M_U is the mass of the universe, since the theory rest on the application of Mach's Principle. Looking at (1) it is clear that the "Woodward Effect" is based on the classical Newtonian theory of gravitation

$$\nabla^2\phi = 4\pi G\rho, \quad \phi = \frac{GM}{r} \quad (2)$$

Equation (1) shows that the local medium has a mass (energy density) of order ρ_0 , and that any increase in energy density E_0 in time would be carried by M_U , which is applicable in a Machian view. However it is strange to add a relativistic definition of gravitation and mass into a Newtonian theory (unless one wants an accurate signaling velocity). It is also argued that negative energy can be generated if E_0 is greater than ρ_0 a less complicated derivation of (1) can be given from

$$\Delta m_0 = \frac{\beta 2\pi f P_0}{2\pi G\rho_0 c^2} = \frac{\beta P_0}{G\rho_0 c^2} \quad (3)$$

which states that the matter density of an object can change if the second partial derivative of its energy density E_0 is also changed.

In plain english as a piezoelectric crystal² is supplied energy E_0 as it accelerates (the cause of the time variance) from a gravitational source ρ increase in mass. However as it the crystal falls back due to gravitational forces and due to its periodic function $E = 0$, then the crystal has less mass then when it accelerated from the gravitational source (earth). This is of course a violation of conservation laws and is the source of mass decrease in the "Woodward Effect," of course the introduction of Mach's Principle prevents any conservation violation. The validity of this effect rest on the nature of energy reduction, is there a true mass decrease or is the excess energy simply radiated away. If a true physical effect, the "Woodward effect offers a way to generate negative energy densities without the need to induce the Casimir Effect.

Reference

Online Source: [Quantum Cavorite](#),

²a crystal that changes shape when an electrical force is applied.

Work Three: A Call to Arms

While the details of the current work on horizons is being wrapped up we are eager to discuss the heart-matter of the warp drive, is it physically possible. We have set out to show that there is a strong theoretical background supporting the possibility of warp drive, however its practical application appears anything but physical, require astronomically large amounts of negative energy. In the next proposed group research we wish to address the issue of negative energy and exotic matter in spacetime for scales large enough to allow for energy requirements of the warp drive spacetime. We are interested in studying a wide range of fields for this, ZPF, Casimir forces, Woodward effect, de Sitter spaces, but please no “anti-gravity.” Currently the most compelling research on large amounts of negative energy densities in spacetime arrive from scalar fields, and this will likely become the focus of discussions.