

RUDIMENTARY WARP DRIVE PROPULSION

By John R. Cipolla, Copyright August 29, 2015

Research has shown that an analogy exists between potential vortex flow and the generation of space-time curvature around massive objects as predicted by Einstein's theory of General Relativity (GR). The analogy between GR and potential vortex flow is based on results from potential vortex experimentation, GP-B researcher statements, free-surface shape extracted from Schwarzschild's metric, a unit analysis of the curvature and energy-momentum components of potential vortex flow and the analogous components from Einstein's Field Equations and black hole dynamics compared to potential vortex dynamics. This research indicates that gravity control and rudimentary warp drive is possible if space-time possesses the properties of a superfluid.

An implication for the existence of a superfluid potential vortex substratum is that interesting fluid mechanical characteristics of space-time can be revealed. A superfluid is a state of matter in which matter and therefore space-time behaves like a fluid with zero viscosity. Specifically, an interesting by product of a superfluid substratum is the Magnus effect. The Magnus effect is the force exerted on a rapidly spinning cylinder or sphere moving through air or another fluid in a direction at an angle to the axis of spin. The sideways force is responsible for the swerving of balls when hit or thrown with spin. For example, if an object composed of energy-momentum rotates in the gravitational field of another massive object a Magnus¹ effect based on the superfluid of space-time will impart a sideways force on the object and an associated acceleration in the substratum. In exactly the same way the surrounding fluid is deformed by a spinning object, space-time will be compressed on one side of the object and expanded on the other side of the object generating an imbalance in space-time. The deformed space-time surrounding the spinning object could be called a warp bubble that uses the pressure imbalance within space-time to propel an object perpendicular to the field lines of the surrounding superfluid. Speeds approaching the speed of light are not practical but exotic materials are not required for a device based on this technology. The analogous Magnus effect in General Relativity that uses the principals of fluid mechanics¹ to model space-time

around a circular cylinder with circulation is defined as a **uniform flow** plus a **doublet** plus a **vortex** as follows.

$$v_r = \frac{1}{r} \frac{\partial \psi}{\partial r} = U_\infty \cos \theta \left(1 - \frac{a^2}{r^2} \right). \quad (1)$$

$$v_\theta = \frac{\partial \psi}{\partial r} = -U_\infty \sin \theta \left(1 + \frac{a^2}{r^2} \right) + \frac{K}{r}. \quad (2)$$

$$K = \sqrt{GMr} \text{ And } K = \beta U_\infty a \quad (3)$$

$$p = p_\infty + \frac{1}{2} \rho V^2 \quad (4)$$

Where vortex strength, $K^{2,3}$ is defined at the surface ($r = a$) of the rotating mass-energy.

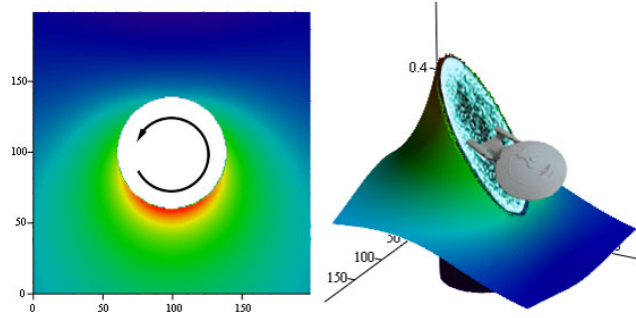


Figure-1, Superfluid Magnus effect warp bubble caused by a rotating mass-energy pressure field (p)

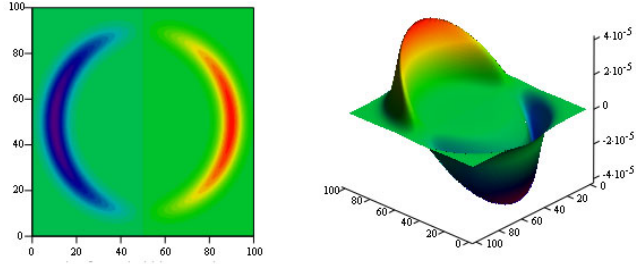


Figure-2, Negative energy warp bubble⁴ top view and isometric view compared to superfluid results

The associated Magnus force acting on a warp bubble and the associated material object within a warp bubble is expressed by the following relationship that finds an exact analogy with inviscid fluid mechanics. Please see Figure-1 for the superfluid results.

$$F = \rho U_\infty (2\pi K) L. \text{ Where it can be shown that } K = a^2 \omega = \sqrt{GMa}. \quad (5)$$

Force F in Eqn. 5 is the resulting **warp drive propulsive force** acting on the material object within the warp bubble. Proof of the hypothesis that space-time can be modeled as a superfluid is provided within General Relativity. Standard textbooks on General Relativity routinely discuss modeling space-time as a perfect fluid^{5, 6}, a substance

exhibiting no heat conduction or viscosity and characterized only by mass density ρ and pressure p . The stress-energy tensor for a perfect fluid in the local frame of reference is.

$$T_{\mu\nu} = \left(\rho + \frac{p}{c^2}\right) U_\mu U_\nu + p \eta_{\mu\nu} \quad (6)$$

The stress-energy tensor in matrix form where the diagonal terms represent the characteristics of a perfect fluid or superfluid is.

$$T_{\mu\nu} = \begin{bmatrix} \rho & 0 & 0 & 0 \\ 0 & p & 0 & 0 \\ 0 & 0 & p & 0 \\ 0 & 0 & 0 & p \end{bmatrix} \frac{erg}{cm^3} \quad (7)$$

Finally, according to General Relativity the curvature⁶ of space-time due to the presence of a rotating mass-energy field becomes the following.

$$R_{\mu\nu} = 8\pi \frac{G}{c^4} T_{\mu\nu} \quad (8)$$

Where in matrix form, the four-dimensional curvature of space-time for a perfect fluid or in our case a superfluid becomes.

$$R_{\mu\nu} = \begin{bmatrix} R_{1,1} & 0 & 0 & 0 \\ 0 & R_{2,2} & 0 & 0 \\ 0 & 0 & R_{3,3} & 0 \\ 0 & 0 & 0 & R_{4,4} \end{bmatrix} \frac{1}{Tm^2} \quad (9)$$

Equations 6 to 9 indicate there is underlying proof within General Relativity that space-time can be considered a perfect fluid and that gravity control and rudimentary warp drive is possible if space-time possesses the properties of a superfluid. Figure-1 illustrates the proposed superfluid Magnus effect warp drive theory and Figure-3 illustrates the rotating mass-energy system operating within the solar system.

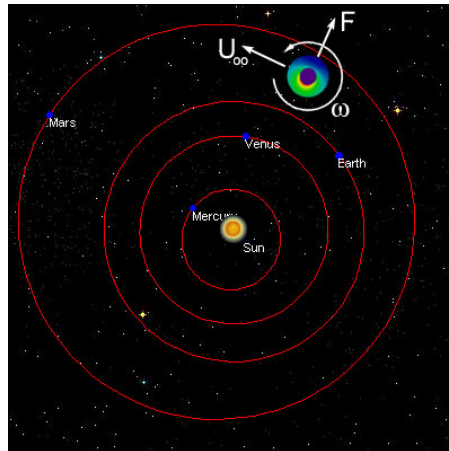


Figure-3, Superfluid warp drive operating in the solar system. Super high rotation rate using phased arrays.

By comparison, Figure-2 illustrates the more complex warp drive⁴ theory proposed by Alcubierre. The following is a brief description of Alcubierre's warp drive proposal that discusses its similarity with the superfluid Magnus effect warp drive. According to General Relativity, gravity and acceleration are not distinguishable and are caused by the curvature or metrics of space-time. The Alcubierre warp bubble illustrated in Figure-2 is a specific warp metric solution of General Relativity and is a combination of positive and negative energy fields that pushes and pulls our starship forward to bring our destination to us just like a conveyer belt. Figure-2 illustrates Alcubierre's metric solution compared to the rotating field of mass-energy solution proposed in Figure-1. The exotic ingredient required to make an Alcubierre warp bubble is negative energy, which has the unusual property of being able to make ordinary matter fall up in a gravitational field. According to General Relativity the space-time in front of a warp bubble is compressed pulling our destination to us. At the same time the space-time behind a warp bubble is expanding pushing us to our destination. The compression and expansion process happens in an instant and at many times the speed of light making faster than light travel possible. The combination of positive and negative energy produces an expansion of space behind the bubble and a contraction of space in front of the bubble. In other words, creating space behind the bubble pushes us to our destination and destroying space in front of the bubble pulls us to our destination. This mechanism allows us to travel many times faster than the speed of light relative to the Earth without exceeding the speed of light in our local frame of reference, the warp bubble. The warp bubble itself is made of fields of positive energy at both ends and a band of negative energy around the middle. These energy fields create huge gravitational effects so powerful the warp bubble can distort space-time without having to accelerate the traveler to achieve faster than light velocity. The main requirement, negative energy also called **vacuum energy** is a property of a vacuum where subatomic particles smaller than an atom dart into and out of existence almost instantaneously. According to the rules of quantum mechanics negative energy creates a negative quantum pressure that propels the warp bubble and therefore our starship forward. The ability of Alcubierre's warp drive to distort space-time is superficially similar to the ability of the superfluid Magnus effect warp drive to distort space-time.

However, the superfluid Magnus effect warp drive does not require negative energy and is purely dependent on “electro-mechanical” systems to compress and expand space-time.

References

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