Can fluid dynamics describe the behavior of vacuum space?

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Abstract

I claim that the ether that fills the vacuum space is a type of fluid that permeates everywhere in the vacuum space. Therefore, fluid dynamics can be used to describe the entire structure of the universe according to general relativity and quantum physics for describing subatomic particles.

General

In paper [**1**] I explain, using general relativity, how the fact that the ether (or– the vacuum space) exists, can explain observations such as stellar aberration and the Michelson- Morley experiment. General relativity claims that space is dragged by any celestial spinning body. Space dragging was verified by an experiment Gravity probe B. This experiment was done near Earth so the measured values of frame dragging are minuscule. However, general relativity predicts that around massive bodies such as a neutron star or a black hole, the frame-dragging is significant. A reasonable conclusion is that to be dragged the ether cannot be a void but must have a physical property- density and viscosity. The hypothesis that general relativity and fluid dynamics can be identical was suggested by T. Padmanabhan [**2**].

What is the ether?

As said above, ether existence can explain observations such as stellar aberration and the Michelson-Morley experiment. There is an additional claim that there is an ether. It relies on quantum physics. Quantum Field Theory (QFT) describes vacuum space as being non-empty at extremely small scales, even if all matter particles are removed. Vacuum space is endowed with fluctuating fields of energy such as electrical, magnetic, quark fields, etc. QFT teaches that any point in this vacuum space contains energy that has a minimum value designated as the vacuum energy. Its behavior is codified in Heisenberg's energy-time uncertainty principle. From the energy of the vacuum space, pairs of matter and antimatter particles are perpetually and very quickly generated, e.g., an up quark and its up antiquark, a down quark, and its down antiquark, electron, and positron, etc. These pairs pop out in the vacuum, exist for a very short time, and then annihilate each other. Vacuum space has measurable physical properties such as electrical permittivity and magnetic permeability. Maxwell used these parameters to calculate the speed of light in a vacuum. I hypothesize that space has additional physical properties e.g., viscosity and density. I claim this because viscosity enables space to be dragged by matter. In other words, vacuum space is not a total void but is rather "something" as suggested by the ether theory. It has been suggested by Paul Dirac that this quantum vacuum may be the equivalent in modern physics of the ether.

In paper [**7**] I claim that the matter universe has a structure that includes a central spinning neutron star (designated the Pivot) and a visible universe that orbits the Pivot. The vacuum space between the celestial bodies, inside the celestial bodies, and far away from the celestial bodies is filled with the ether. This structure of the matter universe using general relativity can explain many known cosmological observations. For example, the velocity flattening and the spiral shape of galaxies, the flatness of the visible universe, etc. Fig. 3 and Fig. 4 describe the universe based only on general relativity.

In the following paragraph, it is explained qualitatively why fluid dynamics and general relativity can be identical.

Fluid dynamics

The Navier-Stokes equations that describe the behavior of any type of fluid are given by the following equations. The first equation is the mass conservation and the second is based on Newton's law F=m* a

$$\nabla \cdot \underline{u} = 0$$

$$\rho \frac{D\underline{u}}{Dt} = -\nabla p + \mu \nabla^2 \underline{u} + \rho \underline{F}$$

Where: u=Velocity, ρ=Density, p=Pressure, μ=Viscosity, F=External forces.

The Navier-Stokes equations cover a wide range of fluid behavior. This range can be divided into regimes. The regimes are defined mathematically by the Reynolds number which is a dimensionless number.

Stokes defined it as $Re = \frac{\text{inertia forces}}{\text{viscous forces}}$. Reynolds defined this number as $Re = \frac{\rho v d}{\mu}$

This number is used to categorize the fluid system. A low Reynolds number is defined as a laminar flow described by Stokes flow. It describes the situation on the cosmological scale.

I relate here to the cosmological scale. It is shown in the following paragraph that the inertial forces $J_{pivot\_inertial}$ of the Pivot sphere are negligible compared to J_{pivot}. the viscous forces, i.e., Reynolds number are very small, this is the requirement of Stokes flow. The solution yields a steady-state spin of the Pivot sphere dragging space fluid around it.

Analyzing the structure of the Pivot universe gives: $J_{pivot} = 1.06 \cdot 10^{87} J \cdot \sec$. See (4.1 in [7]).

On the other hand, the inertial angular momentum of the Pivot is:

$$J_{pivot\_inertial} = \frac{2}{5} \cdot M_{pivot} \cdot R_{pivot}{}^2 \cdot \Omega(R_{pivot}) = 6.4 \cdot 10^{60} J \cdot \sec$$

The major part of J_{pivot} is directed to the viscous force of space. $J_{pivot} >> J_{pivot\_inertial}$. This means that the Reynolds number is very small and therefore Stokes flow is applicable for the Pivot universe.

An analytical solution of a slow-rotating sphere in a viscous fluid is given by Dominik Beck [**3**]. A schematic flow pattern around the sphere is given in Fig. 1. The similarity to the flow pattern of the ether around the Pivot, derived from general relativity, is shown in Fig. 3 and Fig. 4. In both figures the dragged space is a flat disk at the equatorial plane and spirals at both poles.

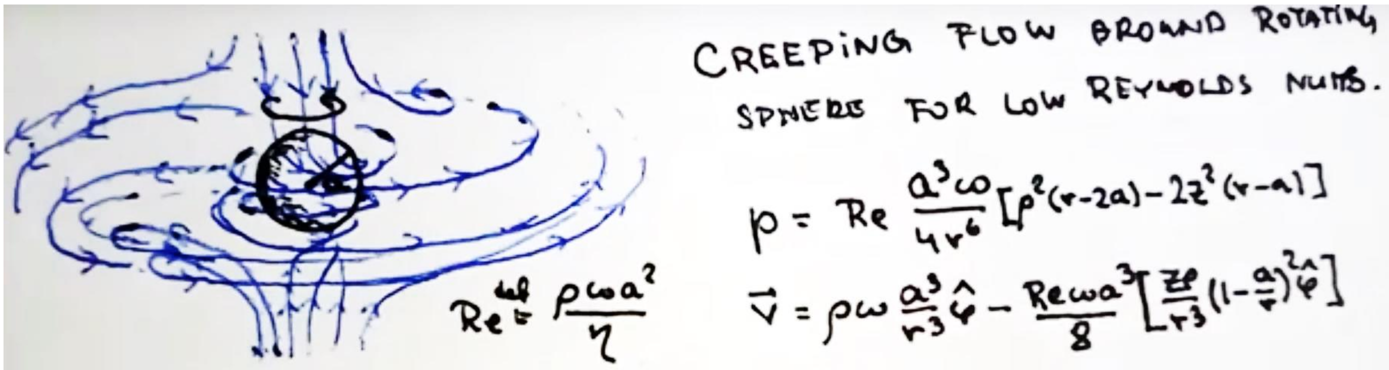

Fig. 1- Fluid flow around rotating sphere for low Reynolds number.

Figure 2 shows a CFD simulation of a flow around a slow-rotating sphere 1 meter in diameter in a viscous fluid. There is a resemblance between this shape and what is observed in the cosmos. Observing neutron stars or black holes shows that they have an accretion disk in the equatorial plane and two opposing jets around the axis of rotation.

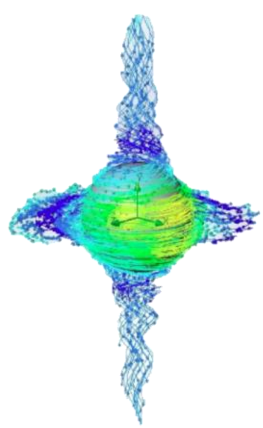

Fig. 2 – Stokes flow of a viscous fluid dragged by a spinning sphere

The following paragraph describes the Pivot universe relying on fluid dynamics. The ether is dragged by the Pivot that slowly rotates.

The value of the dynamic viscosity is an important parameter in solving Navier-Stokes equations. To find the dynamic viscosity I use the boundary layer theory. The boundary layer thickness of a rotating sphere in a viscous fluid can be estimated using the Stokes boundary layer theory. The effect of the dragged fluid diminishes with distance from the sphere. This is because the viscous drag creates a shear force that gets weaker as the distance from the sphere increases. At a certain distance, the fluid velocity becomes negligible compared to the sphere's rotation. This effective boundary is often referred to as the boundary layer. Stokes boundary layer thickness formula can be adapted to a rotating sphere in a viscous fluid:

Using the equations and parameters detailed in [7] μ_{space} can be found:

$$\eta = R_{out}{}^{2} \cdot \Omega(R_{pivot}) = 9.1 \cdot 10^{37} \cdot \frac{m^2}{s}$$ ...Kinematic viscosity of the ether using boundary layer theory for a sphere

$$\mu_{space} = \eta \cdot \rho_{space} = 9.1 \cdot 10^{11} \cdot Pa \cdot s$$ ...Dynamic viscosity of the ether

Where:

$R_{out} = 175.57 \cdot Gly$ Outside radius of matter universe =The bounary layer thickness (Eq. 4.10)

$R_{pivot} = 6.21 \cdot 10^{8}\, km$ The radius of the Pivot (Eq. 4.11)

$\Omega(R_{pivot}) = 5.31 \cdot 10^{-17}\, rad/\sec$ Angular velocity of the fluid relative to the Pivot surface (Eq. 4.12)

$\rho_{space} = 10^{-29} \cdot kg/\mathrm{m}^3$ Density of space (given by others)

Note:

The high value of the dynamic viscosity of ether seems to be wrong because the dynamic viscosity of a very viscous fluid Bitumen is substantially smaller than this result. It is to be noted that Delplace using other methods, based on general relativity, also calculated a very high viscosity of the ether. [**2**]

I claim that there is another way to calculate the dynamic viscosity of the ether. This is the dynamic viscosity on the surface of the Pivot. The result of solving Stokes flow of a rotating sphere gives the torque τ on the surface of the Pivot:

$$\tau = 8 \cdot \pi \cdot \mu_{space} \cdot R_{pivot}^{\ 3} \cdot \Omega_{pivot}$$ ....where μ_{space} is the dynamic viscosity of the space.

On the other hand, $J_{pivot} = \tau \cdot \frac{2 \cdot \pi}{\Omega_{pivot}}$ where the dragged space on the Pivot surface is spinning at Ω_{pivot}. Therefore, the dynamic viscosity of space μ_{space} on the surface of the Pivot can be calculated by:

$$\mu_{space} = \frac{J_{pivot}}{16 \cdot \pi^2 \cdot R_{pivot}^{\ 3}} = 2.72 \cdot 10^{49} \cdot Pa \cdot s$$

I claim that the dynamic viscosity Delplace and I found is the average dynamic viscosity of ether. However, the ether viscosity varies substantially in the matter universe. The high viscosity of the ether on the surface of the Pivot means that the ether adheres strongly to the surface of the Pivot. The viscosity must vary sharply as a function of distance from the Pivot, such that in the visible universe (defined from the range 122.9Gly to 175.6Gly as shown in Fig. 4) the viscosity is reduced to a minimal value and eventually the average viscosity in the universe is 9.1*10^11 Pa*s.

It is also feasible that other parameters, such as the density of ether in the matter universe are changed considerably. One must also take into account the change in gravity force from ~10^20 m/sec^2 on the surface of the Pivot to the minute gravity force found in the visible universe.

Therefore, computational fluid dynamics (CFD) simulation must be used to analyze the Pivot universe.

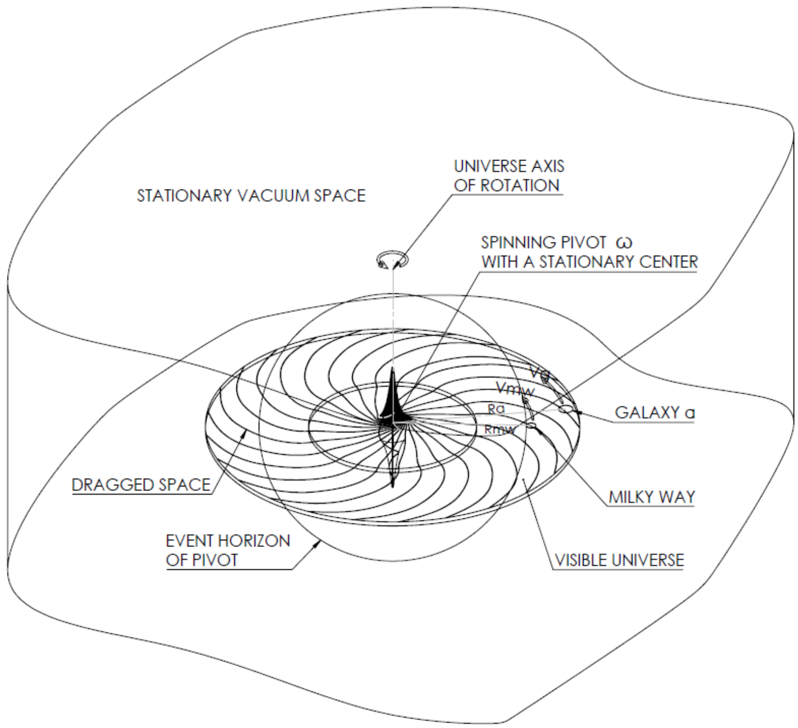

Fig. 3 – The Pivot universe according to general relativity. **[1]**

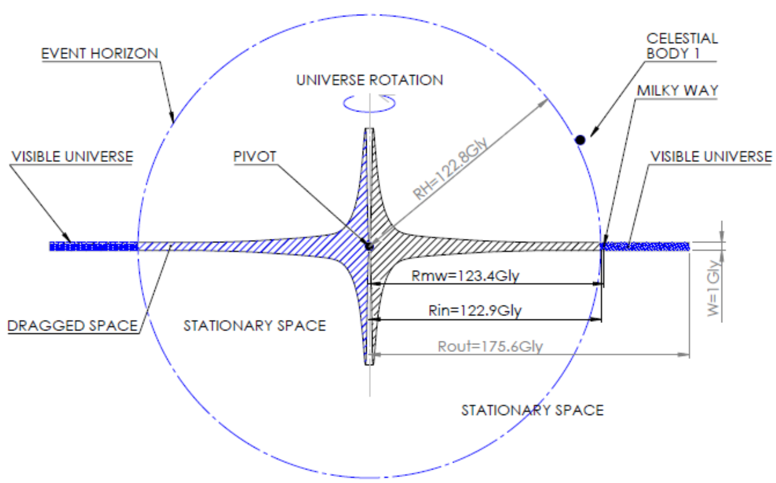

Fig. 4 – Cross section of the Pivot universe shown in Fig. 3

Subatomic regime

As the ether is identical on all scales, and it was found above that at the cosmological scale the flow has a very low Reynolds number, then a high Reynolds number describes turbulent flow that is suitable for the atomic scale.

A recent idea described by David Tong is the connection between turbulent flow and the chaotic behavior of quarks. [**4**]

The left figure is the description of quantum fluctuating in vacuum space and the right is turbulent in a fluid. 3D visualization of quantum fluctuations is given in [**5**]. The volume of the box is 2.4 by 2.4 by 3.6 fm, big enough to hold a couple of protons.

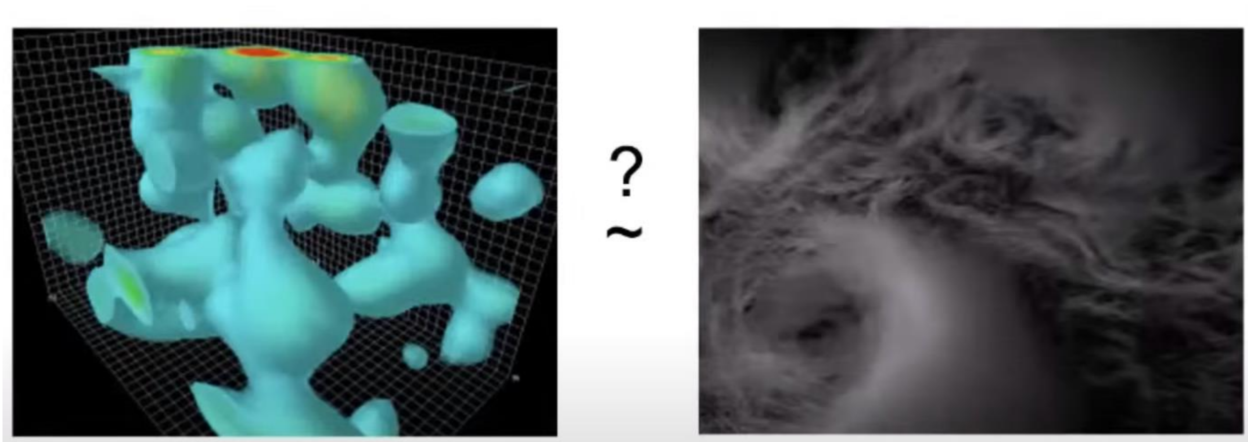

Fig. 3 – Resemblance of quarks (left side) and turbulence (right side)

Why do celestial bodies spin?

It is observed that all celestial bodies spin in the same direction. What is the reason for that? Fluid dynamics can explain this. The reader is referred to an experiment of Stokes flow that is shown in NSF (start time: 3:38 min) [**6**]. Relating to the Pivot universe, the origin of all the celestial body's spin can be explained. Bodies orbiting the Pivot are dragged by the viscous space and simultaneously spin around their axis in the opposite direction to the Pivot spin.

Summary

The goal of this paper is to explain qualitatively how the entire universe can be described by fluid dynamics. It shows the similarity between the general relativity solution and fluid dynamics. In both cases, the system is described by a rotating sphere that drags a viscous fluid around it. It can also explain the chaotic (or turbulent flow) in the atomic scale.

A quantitively fluid dynamics solution (CFD) is needed for this problem. For solving CFD one has to define viscosity, density, pressure, and gravity forces in the matter universe. Using general relativity is simpler as shown in [**1**].

References

[**1**] Arieh Sher, [Does Newton's ether exist?]()

[**2**] Franck Delplace, Liquid spacetime (Aether) viscosity

[**3**] Dominik Beck Fluid dynamics | Creeping flow around rotating sphere for low Reynold number

[**4**] David Tong On Quarks and Turbulence by David Tong - YouTube

[**5**] Dereck Leinweber Quantum Fluctuations - Quantum fluctuation - Wikipedia

[6] G.I. Taylor NSF "Low Reynolds number flow" https://www.youtube.com/watch?v=QcBpDVzBPMk

[**7**] Arieh Sher The Structure of the Pivot Universe