Problems with Flowing Space Gravity Theory

Glen W. Deen, B.S.E.E
820 Baxter Drive, Plano, Texas, 75025
e-mail: glen.deen@gte.net

Any of the seven problems with flowing space gravity theory (FSGT) discussed in this paper could threaten the validity of the theory. They are (1) the space fountain problem, (2) whether space flow is skewed by orbital motion, (3) the entrained ether problem, (4) the non-uniform density problem, (5) the ether structure problem, (6) the space flow direction reversal problem, and (7) the mutual attraction problem.

The author postulates that ordinary atomic nuclei absorb space by bursting quantum foam bubbles upon contact with their surfaces, and that dark matter (DM) expels space. The nucleus absorption postulate leads to the prediction that all atomic nuclei have similar radii = 6 ±2 femtometers, and the nuclear densities of the elements in each row of the periodic table are related by an empirical quadratic formula that is unique to that row.

The author suggests that the ether pressure inside atomic nuclei may be much lower than the external ether pressure. If true, then the excess of external over internal ether pressure may supply the force that opposes the Coulomb repulsion between protons and holds atomic nuclei together.

The author believes that space fountains have dipole magnetic fields, entrained ether globes, and radial space flow. Space drains do not necessarily have any of those things. He believes that Population I stars (including the Sun), the planets Mercury, Earth, Jupiter and active comets are space fountains, and Population II stars, planets Venus and Mars, the Moon, and dormant comets are space drains.

1. Introduction

Flowing-space gravity theory (FSGT) is a generally unpopular alternative to Einstein's General Relativity Theory (GRT). Two prominent proponents of FSGT are Reginald T. Cahill [1] and T.D. Martin [2]. Actually Martin became agnostic about flowing space gravity after a Cavendish-type hollow shell experiment he performed failed to provide the evidence he was looking for. In a recent email he wrote:

> To my mind, the hollow shell experiment pretty well eliminates the possibility that "flowing space" has anything to do with the flowing and absorption of any sort of "stuff" (quantum foam being absorbed by nuclei, for example).

That last parenthetical phrase is a reference to my suggestion that I describe in Section 4. Nevertheless, FSGT has one attractive feature that few gravity theories have. It is the only theory of gravity I know of (other than electromagnetic gravity theories) that provides a somewhat plausible explanation for the actual cause of gravity and how it works. GRT does not explain how matter "warps" space.

In this paper, the word "space" refers to the underlying physical substratum (ether), not to the mathematical Euclidian volume that fills the Cartesian coordinate system by which distances and motions are measured. Modern physicists tend to call it the quantum foam. The quanta of space are static and compressible in GRT (matter "warps" space), and they are dynamic and incompressible in FSGT (matter "absorbs" space).

I postulate that atomic nuclei absorb space by bursting quantum foam bubbles upon contact, and this process causes a spherically symmetric radial inflow of space into a motionless, uniformitarian, spherical, space-draining planet to occur at the escape velocity at its surface and also inside the planet.

Section 2 applies FSGT principles to the conventional model of the Earth's interior. Section 3 discusses space fountains and space drains and how to distinguish one from the other. Section 4 discusses space absorption. Section 5 explains how nuclear densities and nuclear radii can be deduced from applying Eq. (8) to atomic nuclei. Section 6 identifies and discusses seven problems with FSGT. Section 7 presents our conclusions.

1.1. Uniformitarianism

> The uniformitarianism assumption is that the same natural laws and processes that operate in the universe now, have always operated in the universe in the past and apply everywhere in the universe [3].

This paper presents a uniformitarian model of the Earth because it is simpler than a catastrophic model. Space fountains may require massive, compact dark-matter (DM) cores (this is one of the seven problems), but space drains do not. The absence of such an exotic core makes uniformitarian space drains relatively easy to study. Such studies are useful because a valid FSGT should apply to both uniformitarian and catastrophic space fountains and drains.

1.2. Catastrophism

This speculative section is an aside. It does not apply to the uniformitarian model. It will be the topic of a future paper.

> Catastrophism is the idea that Earth has been affected in the past by sudden, short-lived, violent events, possibly worldwide in scope [4].

Catastrophists believe that the mass extinctions we see in the fossil record were caused by global catastrophes. My catastrophic model is incomplete and not ready for publication. But I expect my model will lead to the conclusion that the most likely cause of all such global catastrophes is the sudden reversal of the space flow direction. Asteroid impacts may play important roles, but I expect they will be seen to be side effects of space flow reversals.

I believe that all gravitating space bodies eventually reverse the direction of their space flows, and such reversals often release tremendous amounts of energy. The most energetic examples are gamma ray bursts and supernovae, according to my theory. At least one comet has experienced such catastrophes in recent times. Comet Holmes displayed the most energetic comet explosion ever observed on October 23, 2007 [5].

I speculate that the principal continuous source of all thermal energy in the universe is neutron beta decay. Explosions result when large clouds of neutrons are suddenly released by ultra-high-density cores during a space flow reversal event because the neutrons will all decay within a few minutes of each other.

I believe that these compact cores have temperatures of absolute zero, and they are enclosed by shells of solid and liquid hydrogen. Explosive lifting power is produced when the neutron decay fireball suddenly boils these hydrogen shells. The neutron fireball triggers thermonuclear hydrogen fusion in supernovae.

2. Density, Enclosed Mass, Escape Velocity, and Acceleration of Gravity for the PREM

Before we discuss the details of FSGT, it will be instructive to examine the physical parameters listed in this section heading that can be found in the standard model for the Earth's interior. The Preliminary Reference Earth Model (PREM—a non-rotating spherical model of the Earth's interior) [6] specifies a radial density profile that ranges from 13.09 g/cm^3 at the center to 1.02 g/cm^3 in the ocean (Fig. 1).

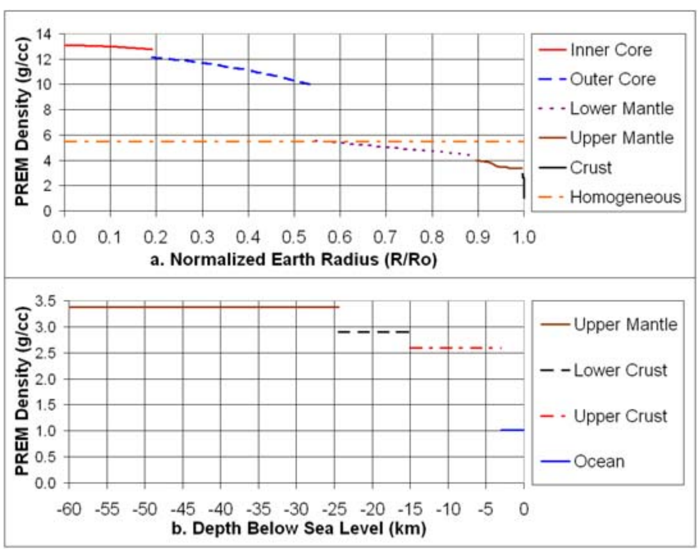

Fig. 1a. PREM density (g/cm^3) at normalized radius R/R_0 for inner & outer core, lower & upper mantle, and crust; **b.** PREM density at depth (km) below sea level for the upper part of the upper mantle, lower and upper crust, and ocean.

In Figs. 1 and 2, R_0 is the Earth's radius. Fig. 1a plots the density (g/cm^3) of the mass in a thin spherical shell located at a reference radius R/R_0. The PREM divides the Earth into five concentric zones or spherical shells. The crust shell is actually divided into three parts—lower crust, upper crust, and ocean, see Fig. 1b—for a total of seven shells altogether. The radial density profile is discontinuous at the boundaries between adjacent shells in Figs. 1a and 1b.

Fig. 1b plots the same information for the upper 60 km of the world that is enlarged for clarity. The PREM world is spherical, does not rotate, has no continents, and it is completely covered with an ocean that is 3 km deep. The horizontal dash-dot homogeneous density line in Fig. 1a is the average Earth density of 5.513 g/cm^3.

The lower crust, upper crust, and ocean shells in Fig. 1b have constant densities of 2.90, 2.60, and 1.02 g/cm^3, respectively. All the other shell densities are given in [6] as third-order polynomial functions of the normalized radius. So, the mass inside some reference radius can be obtained by integrating those density polynomials times the differential volume.

In Fig. 2, M_0 is the Earth's mass, M/M_0 is the normalized mass inside radius R, and $\langle\rho\rangle = M/\left(\frac{4}{3}\pi R^3\right)$ is the average mass density inside radius R.

The mass inside some reference radius matters because the escape velocity at that radius is the same as if all the mass inside that sphere were lumped as a point mass at the center.

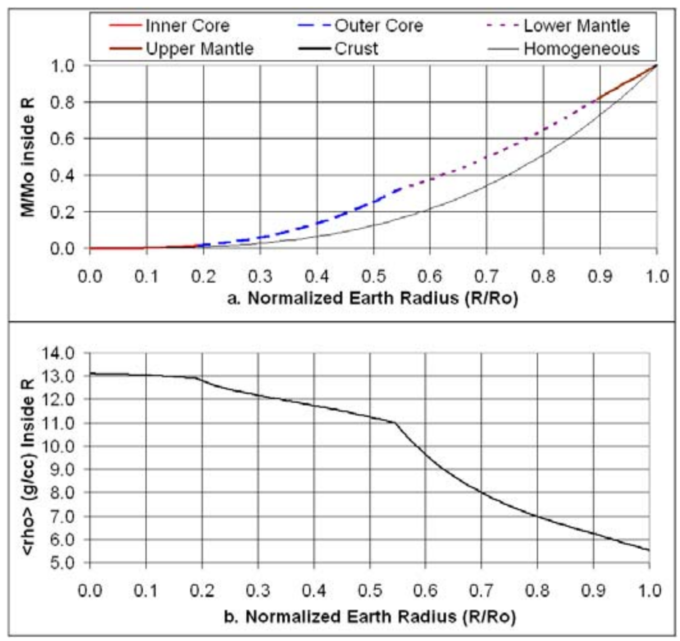

Fig. 2a. Normalized PREM mass (M/M_0) inside radius R; **b.** Average PREM density inside radius R.

Given the density $\rho(r)$ as a function of the radius from the polynomials specified in [6], the next step is to integrate the interior mass M_R from the center to some reference radius and compute the interior average density $\langle\rho_R\rangle$ inside R.

$$M_R = 4\pi\int_0^R \rho r^2 dr; \qquad \langle\rho_R\rangle = \frac{M_R}{\frac{4}{3}\pi R^3}. \tag{1}$$

Fig. 2a plots the enclosed normalized PREM mass (as a fraction of the total mass) inside a reference radius R versus the reference radius as a fraction of the total radius. Fig. 2b plots the average density (g/cm^3) inside the reference radius. These values are for a hypothetical uniformitarian, motionless, space-draining non-rotating spherical model of the Earth.

The escape velocity as a function of the radius R can be computed with either of two formulas that I call Eq. (2)a and (2)b.

$$v_R = \sqrt{\frac{2GM_R}{R}}; \qquad v_R = R\sqrt{\tfrac{8}{3}\pi G\langle\rho_R\rangle} \tag{2}$$

where v_R is the escape velocity at radius R, G is Newton's constant of gravitation, M_R is the enclosed mass inside radius R, and $\langle\rho_R\rangle = M_R/\left(\tfrac{4}{3}\pi R^3\right)$ is the average mass density inside radius R. Eq. (2)a is the familiar escape velocity formula, and Eq. (2)b is a formula that I derived that uses the planet's density instead of its mass. It shows that if the density should be uniform (constant at all radii), then the escape velocity is proportional to the radius in a uniformitarian, motionless, spherical, space-draining planet.

The acceleration of gravity is always inward regardless of the space flow direction. (I am talking about a test particle in the gravitational field of an isolated planet. These equations do not apply between two planets or other gravitating bodies.) This fact can be proved by equating the kinetic energy of a test particle that is moving up or down at the escape velocity to its potential energy.

$$\tfrac{1}{2}mv^2 = gmr \tag{3}$$

where m is the mass of the test particle, v is the escape velocity, g is the inward acceleration of gravity, and r is the radial distance from the center of the planet or star to the test mass. The factor m cancels out, and solving for g we have:

$$g = \frac{v^2}{2r} \tag{4}$$

If you know the escape velocity at any given radius, you can use Eq.(4) to compute the acceleration of gravity at that radius.

Fig. 3 plots the PREM escape velocity and acceleration of gravity as functions of the normalized radius, R/R_0. It also plots the escape velocity and acceleration of gravity for the homogeneous uniform density case (dashed lines). Notice that both homogeneous functions are straight lines. You can see from Eq. (2)b that escape velocity is proportional to the radius if ρ is a constant. If we substitute that formula into Eq. (4), we get:

$$g = \tfrac{4}{3}\pi G\langle\rho\rangle R, \tag{5}$$

and if ρ is constant, then g is also proportional to the radius.

2.1. Total Mass and Polar Moment of Inertia Constraints

Using conventional Newtonian gravity theory, I confirmed that the PREM not only satisfies the constraint for Earth's total mass but also for its polar axis moment of inertia, both of which are determined independently from astronomical observations. The PREM mass of the Earth is 5.97318×10^{24} kg, compared to the official NASA value of 5.97219×10^{24} kg [7], an error of only +0.0165%. The PREM value for Earth's normalized moment of inertia is C/MR^2 = 0.33080. This compares favorably with the astronomical calculation of C/MR^2 = 0.3307007 [8]. That calculation is based upon the observed precession and nutation of the Earth's equator which arise from the solar, lunar, and planetary torques on the oblate Earth. Satisfying the moment of inertia constraint is significant. Williams [8] surely knew in 1994 about the 1981 PREM data, but he didn't refer to it in his paper.

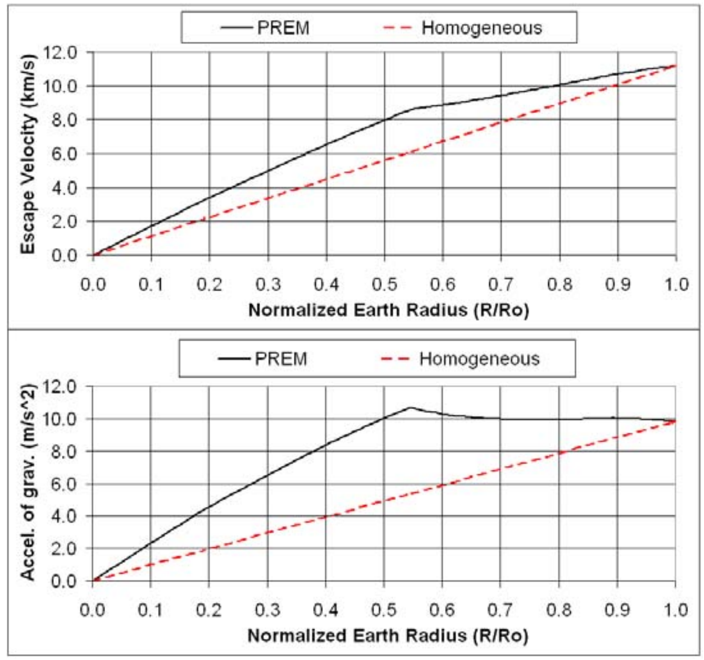

Fig. 3. PREM escape velocity and acceleration of gravity.

3. Space Flow—Fountains and Drains

If spatial flows exist, and they are the causes of gravity, then there must be sources and/or sinks of space flow in the universe—space fountains and/or space drains—otherwise space wouldn't flow. Furthermore, unless space fountains balance out against space drains, the universe would expand if there is an excess of fountains or contract if there is an excess of drains. GRT claims that the universe is expanding, and if so, it would mean there is an excess of fountains over drains. Since I believe this apparent expansion of the universe is an optical illusion [9], I believe space fountains should balance out space drains.

My version of FSGT is evolving. I presently believe that ordinary atomic nuclei absorb space (see Section 4), and DM neutrons expel space because I'm saying that DM neutrons are the WIMP form of dark matter, and I postulate that DM expels space [10].

Dark-matter neutrons are not antineutrons. They are right-handed neutrons. I think the conventional theory says that an antineutron would annihilate a neutron. Dark matter is mirror matter, and mirror matter does not interact with ordinary matter except by the force of gravity. Free (unbound) neutrons are unstable in positive time, but I suggest that they are stable in negative time. Conversely, DM neutrons are unstable in negative time, but they are stable in positive time [11].

Space Body	Space Fountains	Space Drains
Galaxies	spirals, irregulars	ellipticals, lenticulars
Clusters	"voids" = black dwarfs	globular clusters
Stars	Population I	Population II
Planets	have magnetic fields	no magnetic field
Moons	have magnetic fields	no magnetic field
Comets	active	dormant
Asteroids	have magnetic fields	no magnetic field

Table 1. Space bodies classified as space fountains or drains.

A space body listed in Table 1 is a net space fountain if its core has such a powerful space outflow rate that it is able to not only satisfy the substantial space absorption demands of the shells of ordinary matter that enclose it but also to expel the excess space flow into interplanetary space in all directions at the escape velocity. A formula for the space flow demand rate per unit of mass ((m^3/sec)/kg) is given by Eq.(8) in Section 4. We will see in Section 6.1 that the innermost core of a space fountain must be a DM, ultra-dense compact object.

Assuming DM neutrons are stable, we can imagine that a core comprised of a substantial concentration of DM neutrons packed at the nuclear density could have enough space-blowing power to satisfy the requirement mentioned in the preceding paragraph. I am skeptical about dark energy because I think the apparent expansion of the universe is an optical illusion. But I believe that there is about 6.5 times as much dark matter as ordinary matter in the universe. Much of this may be in the form of WIMPs (DM neutrons, I'm saying) that swarm throughout galactic space like gas particles. I understand that DM neutrons are mirror-matter particles that interact with ordinary matter only via the force of gravity. Consequently we can easily imagine that they could fall through the ordinary matter shells of stars and planets without interacting with their atomic nuclei, as easily as neutrinos do, and pool in their cores.

I believe that space fountains have dipole magnetic fields, entrained ether globes (see Section 6.3), radial space flow, and vertical plumb bobs. I believe that space drains do not necessarily have any of those things. I believe that Population I stars (including the Sun), the planets Mercury, Earth, Jupiter and active comets are space fountains, and Population II stars, planets Venus and Mars, the Moon, and dormant comets are space drains.

3.1. Nucleosynthesis and Magnetic Fields

There is an important property that space fountains must have besides the generation and maintenance of an entrained ether globe. There must be a continuous and powerful neutron flux that sprays radially outward in all directions from the DM, compact-object core into the interior of the star or planet. These neutrons are emitted by the DM core at the escape velocity which is extremely high (0.861% *c*, for the Earth—see Section 6.1), but they slow down quickly because the effective mass falls fast with radius (Fig. 6). Their main purpose is to be the agents of continuous creation in situ by means of nucleosynthesis in the mantle and crust. Those neutrons that are not captured by atomic nuclei will experience beta decay inside or outside the planet or star.

In the Sun, beta decay in the coronosphere (visible during a total eclipse) would explain the million-degree temperature of the solar corona. And the protons and electrons that are liberated by beta decay would explain the constituents of the solar wind.

When neutrons decay in Earth's stratosphere, the electrons are more easily scattered by the thin air, and the protons keep moving upward to form the ionosphere. Earth's thermosphere temperature can rise up to 1,500 °C (2,730 °F). I suspect that the rotation of this proton cloud generates Earth's magnetic field.

The conventional theory for the generation of Earth's magnetic field invokes the electrical conductivity of a liquid iron outer core. My space fountain model has a liquid hydrogen outer core. The outer core must be a liquid because it reflects transverse seismic waves, and its viscosity is known to be extremely low. The reason why the temperature of the DM core is absolute zero is beyond the scope of this paper. Hydrogen is the logical element for the inner and outer cores because the emitted neutrons move too fast near the DM core to become captured by the proton nuclei, so nucleosynthesis is impossible in the inner and outer cores. At low pressure, liquid hydrogen is an insulator, but the pressure surrounding the DM core is high enough to metalize the liquid hydrogen, making it a good conductor.

The uniformitarian reason why space-drain planets have no magnetic fields is that they have no DM cores. The escape velocity and the acceleration of gravity at the center are zero.

So, if my theory is correct, stars, planets, moons, comets, and asteroids that have magnetic fields are all space fountains, and those without magnetic fields are space drains. I believe that Venus, Mars, and the Moon are space drains since they have no dipole magnetic fields.

If my version of FSGT is true, then the Michelson-Morley experiment, which "fails" on Earth, would succeed on Mars, Venus, and the Moon because they have no entrained ether globes.

3.2. Population I and Population II Stars

Population I stars are recognized by the high abundance of "metals"—elements more massive than helium—in their line spectra. My version of FSGT claims that these metals are continuously created within Population I stars because their DM cores expel free neutrons at the escape velocity along with their space outflow, and a substantial fraction of these neutrons are captured by atomic nuclei, thereby raising their atomic numbers via beta decay. The beta decay events release thermal energy in the form of X-rays, and that—not nuclear fusion—is the source of all stellar thermal energy, according to my theory. Most solar system bodies and <u>all active comets</u> have been observed to produce X-rays [12]. X-rays from Venus, Mars, and the Moon probably result from incoming cosmic ray collisions, not beta decay.

Population II stars are recognized by the low abundance of metals in their line spectra. Since Population II stars have no magnetic fields, they are bombarded with cosmic rays, causing atomic nuclei near the surface of the star to emit neutrons. Nuclei with too many protons are unstable, and the remedy is for a nuclear proton to capture an orbital electron and become a neutron, thereby reducing that atom's atomic number. This is inverse beta decay, and it absorbs thermal energy.

A substantial fraction of the emitted neutrons ride downward with the space inflow, and the DM core captures them, storing them up for the next space fountain cycle. The neutrons that don't get captured will decay and release thermal energy. But the inverse beta decay absorbs more heat than the beta decay releases because some of those emitted neutrons are captured by the DM core before they can decay. The evidence for this net heat loss is that Population II stars are generally cooler than Population I stars. My theory is that Population II stars shine only from the residual heat that was acquired during the previous Population I cycle, and their temperatures fall until they reverse their space flow. White dwarf stars will continue cooling and eventually become black dwarf stars. This idea goes against conventional theory which claims that radiation is the only cooling mechanism for white dwarf stars.

4. Space Absorption

Space quanta can be visualized as being the tiny bubbles that comprise the quantum foam. We can imagine that an atomic nucleus might "absorb" space by popping all the space bubbles that come in contact with its surface even if we have no idea as to what these extremely tiny bubbles are made of. As soon as one layer of quantum bubbles contacting the surface of a nucleus pops, the next layer is squeezed into contact with it by ether pressure to take its place. This continual popping, layer by layer, of quantum foam bubbles is the cause of the space inflow.

Section 5 computes the radius and the nuclear density of every atomic nucleus in the periodic table simply by assuming that only atomic nuclei absorb space.

We postulate that the space absorbed by a space-draining planet at its surface from its surrounding interplanetary environment ($Q \equiv$ unit volume of space absorbed per unit time) in a given time interval is exactly equal to the space absorbed by all the atomic nuclei inside the planet in that same time interval.

Since we postulate that space flows at the escape velocity, the radial bulk space flow rate through the surface into a space-draining planet is obtained by simply multiplying the planet's surface area times the escape velocity at the surface.

$$Q \equiv dV/dt = 4\pi R^2 v_R , \tag{6}$$

where Q is the inward radial space flow rate through the spherical surface with radius R, V is the volume of the planet, and v_R is the escape velocity at the surface. Since all this inflowing space at the surface is being absorbed by atomic nuclei inside the planet, we may reasonably divide this bulk space flow rate at the surface by the planet's total mass to obtain an average space absorption rate per unit mass inside the planet. We can substitute Eq. (2)b for v_R.

$$\frac{Q}{M} = \frac{4\pi R^2 v_R}{\frac{4}{3}\pi R^3 \langle\rho\rangle} = \frac{4\pi R^2 \left(R\sqrt{\frac{8}{3}\pi G\langle\rho\rangle} \right)}{\frac{4}{3}\pi R^3 \langle\rho\rangle}. \tag{7}$$

After simplification we obtain Eq. (8)

$$\frac{Q}{M} = \sqrt{\frac{24\pi G}{\langle\rho\rangle}}, \tag{8}$$

where Q is the average space absorption rate in units of volume per unit of time inside the planet, M is the total mass, G is Newton's gravitation constant, and $\langle\rho\rangle = M/V$ is the planet's average mass density. If MKS units are used, multiply this result by 1,000,000 to convert cubic meters to cubic centimeters. Earth's average mass density is 5.513 g/cm^3, and its average space absorption rate is 0.9554 (cm^3/s)/kg, according to Eq. (8).

Eq. (8) can also be used to obtain the space absorption per unit mass for a thin spherical shell where Q, M, and $\langle\rho\rangle$ apply to the shell.

For the special (unrealistic but mathematically convenient) case of a homogeneous space-draining planet (made of one single chemical element) that is small enough to ignore self compression so that the density is also homogeneous, Eq. (8) would apply to every kilogram of matter in the planet. In fact, it would apply to every individual atomic nucleus in the planet.

Element	Mass Density ρ (kg/m^3)	Q/M ((cc/s)/kg) = sqrt(24Gπ/ρ)*1E6
Lithium 7	534	3.069815
Ice	1,000	2.243276
Magnesium 24	1,740	1.700623
Aluminum 27	2,699	1.365467
Titanium 48	4,507	1.056669
Iron 56	7,870	0.799642
Lead 208	11,360	0.665570
Gold 197	19,320	0.510363

Table 2. Space absorption rate per unit mass for a hypothetical homogeneous planet vs. its density at 20°C. Units are (cm^3/s)/kg.

Table 2 illustrates this relationship for seven atomic elements plus the water ice molecule. The densities of the seven elements are given for a temperature of 20°C.

4.1. The "Windshield" Effect Absorbs Space Efficiently

Eq. (8) states that the average space absorption per unit time per unit mass is inversely proportional to the square root of the average mass density. We conclude from Table 2 that lithium absorbs space 6 times faster than gold per kilogram because gold is 36 times denser than lithium. This fact rules out the possibility that each nucleon absorbs its pro-rata share of space. The lithium atom has 7 nucleons, and gold has 197. Gold has 28 times as many nucleons as lithium, yet gold only absorbs $1/6$ as much space per unit time as lithium. Lithium's nucleons seem to be $6 \times 28 =$ 168 times more efficient as space absorbers than gold's nucleons. Surely a nucleon's properties cannot be a function of which nucleus contains it. We conclude that nucleons are not the principal absorbers of space.

Instead, we will see that the effective parameters that determine the space absorption rate are the escape velocity at the nucleus site (just outside the nucleus) and the cross-sectional "capture" area of the nucleus. Also, we will learn in Section 5.2 that all atomic nuclei are about the same size. The lithium nucleus has a radius of 5.35 fm, and the gold nucleus has a radius of 4.90 fm (see Fig. 4). This implies that most if not all of the lithium nucleons may be at the surface of its nucleus, whereas most of the gold nucleons are hidden deep inside its nucleus, and shielded from the space flow.

Except at or near the center of a space-draining planet, I suggest that atomic nuclei absorb space quanta like windshields collect bugs. An isolated unbound neutron may absorb space in all directions, and small volumes of matter very near the center of a space-draining planet might do so as well. But the escape velocity in a homogeneous space-draining planet is proportional to the distance from the center, and we needn't go very far from the center to find that space is flowing in a laminar fashion in the radial direction—not omnidirectionally. The interior nucleons and the downwind surface nucleons are apparently not exposed to the bulk space flow outside the nucleus, and their only role is to absorb whatever space "fluid" might leak into the nuclear interior through an imperfect membrane at the surface.

Physical space apparently "evaporates" upon contact with the nuclear "windshield". Any space "fluid" that manages to leak into the nuclear interior is subject to being "absorbed" as it comes in contact with interior nucleons that are shielded from the outside ether flow. If so, the ether pressure inside every nucleus may be extremely low, and the force that holds nuclei together against the repulsive Coulomb forces of protons may be the excess of the external ether pressure over the internal ether pressure.

5. Teasing Nuclear Density from Space Flow

When the uniform mass density condition is imposed upon to a hypothetical space-draining planet comprised of only one element, we can compute the nuclear density of that element. Given the average space absorption rate Q/M (cm³/sec/kg) for a particular isotope from Eq. (8) or Table 2, we can compute the average space absorption rate for each nucleus, since we know its mass.

$$Q_n = m_n\left(\frac{Q}{M}\right) = A \times m_u\left(\frac{Q}{M}\right) \tag{9}$$

where Q_n is the average space absorption rate of a single nucleus, m_n is the mass of that nucleus, Q/M is the average space absorption rate per unit mass for the isotope from Eq. (8) or Table 2, A is the atomic mass number of the particular isotope (u), and $m_u = 1.660538782 \times 10^{-27}$ kg.

5.1. Weighted Average Escape Velocity

The escape velocity of a uniform-density spherical space-draining planet varies linearly with the radius from zero at the center—see Eq. (2)b. It turns out that the weighted average escape velocity for all the atoms in such a planet is exactly $\frac{3}{4}$ of the escape velocity at the planet's surface, as given by Eq. (10):

$$\langle v \rangle = \tfrac{3}{4} v_0 = \tfrac{3}{4}\sqrt{\frac{2GM}{R_0}} = \tfrac{3}{4} R_0 \sqrt{\tfrac{8}{3}\pi G \rho}, \tag{10}$$

where the 0 subscripts refer to surface values and M is the total mass of the planet. For a homogeneous planet, the density is the same throughout the entire volume. But this formula also works for a heterogeneous planet and/or one having a variable radial density profile if you use the average density $\langle \rho \rangle = M/V$, where M and V are the total mass and total volume of the planet.

5.2. Nuclear Capture Area, Radius, and Density

If you know the average space absorption rate for each nucleus Q_n from Eq. (9), and you know the average escape velocity for all nuclei $\langle v \rangle$ from Eq. (10), then you can compute the average capture area of all the nuclei:

$$A_n = \frac{Q_n}{\langle v \rangle}, \tag{11}$$

where A_n is the average cross-sectional capture area of the nucleus. This is true because we postulate that the nucleus acts like an open mouth that "swallows" the laminar space flow as it flows into its maw at the escape velocity. Given the circular cross-sectional area of that maw, we can compute the nuclear radius, r_n, and density, ρ_n.

$$r_n = \sqrt{\frac{A_n}{\pi}}; \qquad \rho_n = \frac{m_n}{\frac{4}{3}\pi r_n^3}. \tag{12}$$

Fig. 4 plots the nuclear radii for all the elements in the periodic table versus their atomic number, using the formulas in this section for a one-meter radius sphere that is filled with each element at its liquid density at its melting point temperature [13]. This density is not available for every element. So, for the following atomic numbers I used the density at 20 °C: Z = 6, 15, 41, 43, 53, 61, 84, 87-91, 93, and 95-99. You may recognize carbon Z = 6, phosphorus Z = 15, and iodine Z = 53 in that list—they don't exist in the liquid state.

It is very interesting that Fig. 4 shows that all the alkali metals but lithium have nuclear radii that are much higher than normal (up to 3 times the average): helium (not lithium) (Z = 2) = 7.64 fm, sodium (Z = 11) = 7.24 fm, potassium (Z = 19) = 9.99 fm, rubidium (Z = 37) = 11.13 fm, cesium (Z = 55) = 12.35 fm, and francium (Z = 87) = 15.88 fm.

The solid line in Fig. 4 is an empirical formula for the nuclear radius as a function of the atomic mass number, A.

$$R_n = r_0 A^{1/3}, \tag{13}$$

where $r_0 = 1.25 \pm 0.2$ femtometers [14].

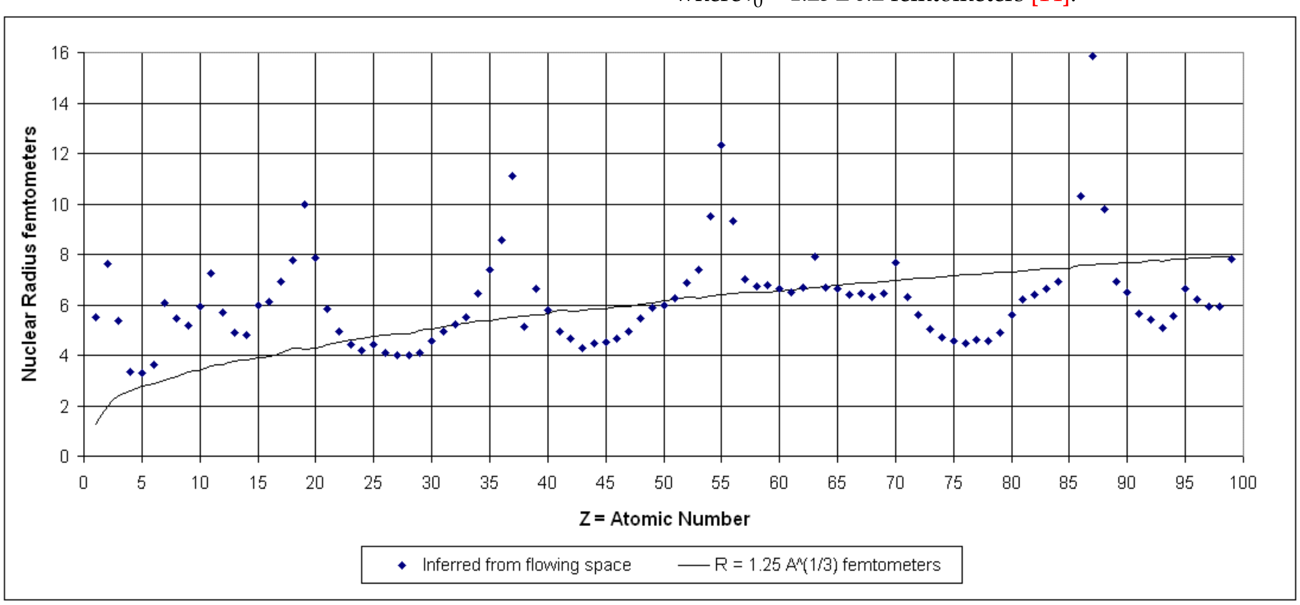

Fig. 4. Nuclear radius by atomic number as inferred from flowing space gravity theory. Average radius = 6.1903 femtometers.

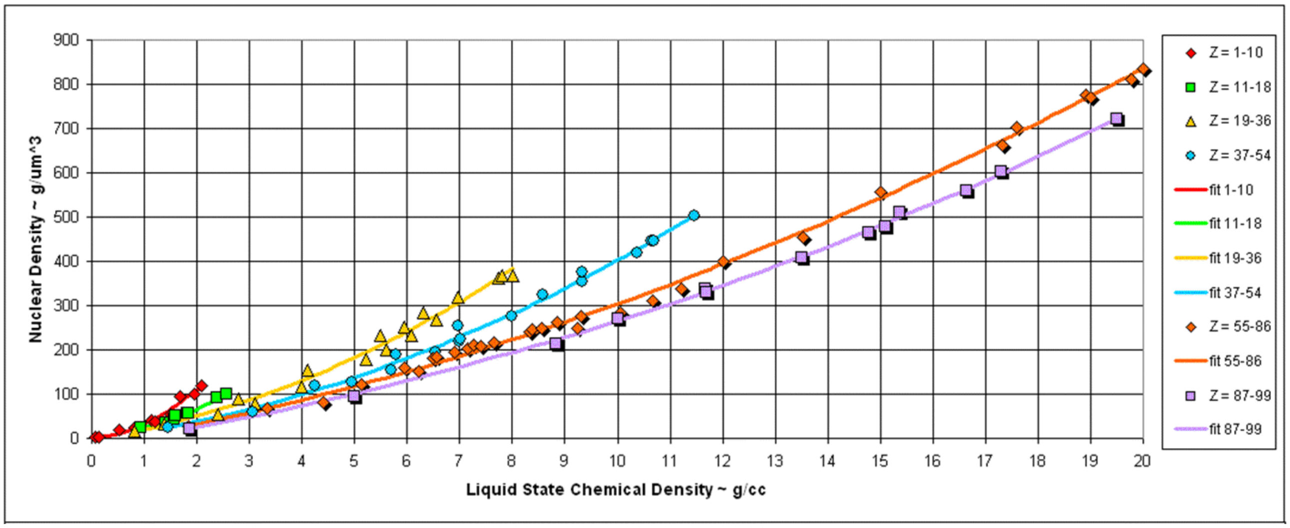

Fig. 5. Nuclear density (grams/micrometer³) of elements inferred from flowing space gravity theory as a function of chemical density (g/cm³) in the liquid state at the melting point.

Fig. 5 plots the nuclear densities of the elements versus their liquid-state atomic (molecular for some gasses) densities. Imagine how this graph would look if I had not organized the elements according to their horizontal rows in the periodic table. There would have been a lot of scattering. But when you group them as I have, you get six different curves because there are six horizontal rows in the table. And each row has only a minimal amount of scatter about a best-fit quadratic equation. The rows are: Z = 1-10, Z = 11-18, Z = 19-36, Z = 37-54, Z = 55-86, and Z = 87-99. This unexpected alignment indicates that there is an empirical relationship between an element's nuclear density and its atomic density that is unique for each row in the periodic table.

6. Problems with Flowing Space Theory

This section identifies seven problems with FSGT, but it does not offer any solutions—only some suggestions. Some of these problems are potential threats to the validity of the theory.

6.1. The Space Fountain Problem

We saw in Fig. 3 that the PREM space drain model shows that the escape velocity decreases with depth below the surface, moving from right to left in the chart, and it drops to zero at the center. This can be understood by dividing a spherically symmetric planet into a large number of thin concentric layers, like an onion. Each layer has a characteristic density defined by Fig. 1. From that, compute the layer's mass and use Eq. (8) to compute the layer's space absorption rate. Starting at the planet's surface, you know the escape velocity at the surface from Eq. (2)a, and the total space flow into the planet is just the surface area times that escape velocity. Since space is flowing downward, the space flow rate through the bottom surface of the layer will be the space flow rate into the top surface minus the space absorbed by the layer. So the radial space flow is less at the inner surface than it is at the outer surface of the layer because the space is flowing downward, and each layer absorbs its share of space. If you keep doing this, layer by layer, you will find that when you reach the center of the planet, the radial space flow is zero. The escape velocity at any given radius is just the radial space flow at that radius divided by the area of a sphere with that radius. So increasing the depth (reducing the radius) means reducing the escape velocity. By the time you reach the center, the escape velocity and the acceleration of gravity have become zero (Fig 3).

But if you use the PREM radial density profile in a space fountain model, space is flowing upward, and this means that since each layer is absorbing space, the radial space flow must be *greater* at the inner surface than it is at the outer surface of each layer. This means that increasing the depth means increasing the escape velocity way beyond what it was at the surface, and by the time you reach the center, the escape velocity would have become *infinite*. This would require an infinite mass at the center.

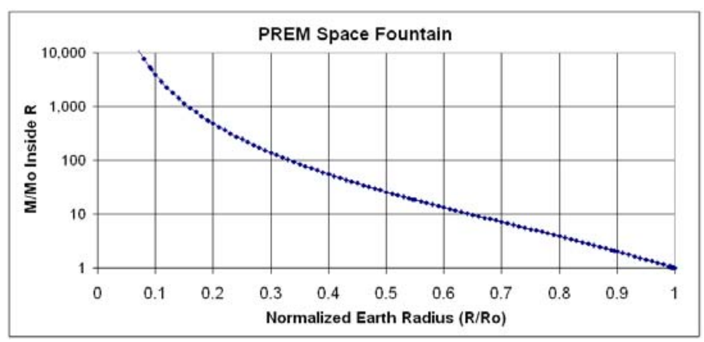

Fig. 6. Normalized PREM Mass inside R for a Space Fountain

Fig. 6 is a semi-logarithmic plot of the normalized PREM mass inside R versus R/R_0 that is required for a space fountain. Compare this curve to Fig. 2a for a space drain. I suspect that if I had plotted Fig. 2a on a semi-logarithmic chart the two curves might be mirror images of each other about the horizontal line $M = M_0$. In the space drain case, the mass inside a given radius is just the sum of all of the atomic masses inside that spherical radius. Clearly that is not the case for the space fountain case, because the radial density profiles in both are identical.

I didn't go all the way to the center because by the time you reach a radius of 54.75 km (0.00859 Earth radii) with the PREM density profile for a space fountain model, the escape velocity would have been the speed of light, and the mass inside that radius would be 18.5 solar masses. Clearly, that would have been a black hole.

This is a **big** problem. It leads to the possibility that the core is some sort of exotic ultra-high-density matter such as we might expect to find in a white dwarf star or a neutron star. Astronomers call them "compact objects". In fact, a DM core would be quite exotic, I should think, especially if it were a mixture of neutrons and DM neutrons packed at the nuclear density. I call such a mixture *neutronium*. Neutronium is a made-up name used by science fiction writers that has been abandoned by conventional physics [15].

Geophysicists have recently discovered an "innermost" core that has a radius of about 590 km, and I think that it may be Earth's neutronium core [16].

That is 48.3% as big as the solid inner core in the PREM model, and it is 0.0926 Earth radii. At this radius, the space-fountain PREM model requires a core having 4,926 Earth masses (0.0148 solar masses), and the escape velocity is 0.861% of the speed of light. I plan to explain how a core having a radius of 590 km could plausibly have 4,926 Earth masses in a future paper. That explanation is beyond the scope of this paper.

6.2. Must Space Flow be Radial?

Radial space flow is easy for a space fountain planet because its outflow originates at the center of the planet, and it is what produces the planet's entrained ether globe.

There are two ways for a space-drain planet to have a radial space flow. The first way would be for the planet to be motionless, but that would only satisfy geocentrists who prefer the Ptolemaic system to the Copernican system. The second way would be to surround the space-drain planet with a reservoir of entrained ether. But that is problematic without a mechanism for replenishing the reservoir for the following reason.

Applying Eq. (8) to the Earth, we use the fact that Earth's average density is 5.513 g/cm^3. The average space absorption rate of Earth is 0.95537 (cm^3/s)/kg. That doesn't sound like much, but in one year Earth would completely drain a spherical volume of space having a radius of 55.0 Earth radii. The Moon's average orbit radius is about 60 Earth radii.

6.3. The Entrained Ether Problem

The very existence of the luminiferous ether is vigorously debated by some open-minded physicists, although mainstream physics curricula teach that such an ether was ruled out by the "negative" outcome of the Michelson-Morley experiment [17].

Dayton C. Miller suggested on page 239 of his seminal 1933 paper [18] that his results could be accounted for by postulating that the Earth is inside an entrained ether globe that translates with it around the Sun in its orbit. Light waves in laboratory interferometers and radio waves propagating to Earth from orbiting GPS satellites are both generated inside Earth's entrained ether globe, if it has one. These wave experiments indicate that either (1) Earth is motionless in space or else (2) it moves around the Sun and drags an entrained ether globe with it that is large enough to enclose the GPS satellite orbits.

Annual aberration of starlight [19], on the other hand, is accurately accounted for by a math model of an orbiting telescope that moves through parallel streams of starlight photons that are beamed directly at the Sun like an umbrella moves through falling raindrops. Starlight appears to be photon streams that behave as if Earth has no entrained ether.

We know that GPS radio signals are not aberrated by Earth's orbital velocity, but they are aberrated by Earth's diurnal rotation about its axis. We know this because the system corrects the signal timings for this effect, which obviously varies with latitude, being strongest at the equator. If physical space (ether) exists, then it is evidently entrained like a big reservoir (globe) surrounding the Earth. The GPS satellite orbits are within that globe, and the globe translates with the Earth in its heliocentric orbital motion, but it does not rotate with the Earth on its axis.

6.4. The Non-uniform Density Problem

The problem that is introduced by a realistic radial density profile is that the space absorption rate per unit mass of any given material is not easy to predict because it depends not only upon the material's own density but also upon the density of the material underneath it, which is usually denser because planet density generally increases with depth.

Greater density implies a higher escape velocity (see Eq. (2)), and this means that in general the escape velocity at any given depth in a planet having a radial density gradient will be greater than it would have been if the local density at that depth were everywhere the same underneath. This means that the space absorption rate per unit mass given in Table 2 is the minimum possible absorption rate. Call it the intrinsic absorption rate.

Table 3 shows how the space absorption rate of a given crust depends strongly upon the density of the planet under the crust.

					Crust thickness z =	1	meter						
Hypothetical Planet material composition	Uniform mass density (kg/m^3)	Radius earth radii	Surface escape velocity (km/s)	Mass in earth masses	Crust density-> / a. Surface gravity g's	ρ (kg/m^3) 534	ρ (kg/m^3) 1,000	ρ (kg/m^3) 1,740	ρ (kg/m^3) 2,699	ρ (kg/m^3) 4,507	ρ (kg/m^3) 7,870	ρ (kg/m^3) 11,360	ρ (kg/m^3) 19,320
						Space absorption rate (cc/s)/kg of this crust resting on planet surface R = 1 earth radius							
						Lithium 7	Ice	Magnesium	Aluminum	Titanium 48	Iron 56	Lead 208	Gold 197
Lithium 7	534	1.0000	3.481	0.09685	0.21090	3.06981	2.35455	2.00596	1.83859	1.71677	1.63905	1.60706	1.57733
Ice	1,000	1.0000	4.764	0.18138	0.32042	3.22208	2.24328	1.76626	1.53721	1.37050	1.26416	1.22037	1.17969
Magnesium	1,740	1.0000	6.284	0.31559	0.46354	3.62099	2.32985	1.70062	1.39849	1.17859	1.03831	0.98055	0.92689
Aluminum	2,699	1.0000	7.827	0.48953	0.62114	4.13348	2.52543	1.74176	1.36547	1.09159	0.91688	0.84494	0.77811
Titanium 48	4,507	1.0000	10.114	0.81746	0.87427	4.98752	2.90954	1.89684	1.41059	1.05667	0.83090	0.73795	0.65159
Iron 56	7,870	1.0000	13.365	1.42742	1.26775	6.29231	3.54641	2.20821	1.56566	1.09798	0.79964	0.67681	0.56269
Lead 208	11,360	1.0000	16.057	2.06042	1.61921	7.41225	4.11322	2.50545	1.73347	1.17158	0.81315	0.66557	0.52846
Gold 197	19,320	1.0000	20.940	3.50417	2.30705	9.48759	5.18529	3.08858	2.08182	1.34906	0.88162	0.68917	0.51036

Table 3. Space absorption rates per unit mass for eight **1-meter thick crusts** resting on planets with uniform densities.

For example, Table 2 and Table 3 show that a solid lithium world would absorb space at the rate of 3.07 cm^3/sec/kg, yet Table 3 shows that a lithium crust resting on a solid gold world would absorb space at the rate of 9.49 cm^3/sec/kg (of lithium).

On the other hand, a solid gold world would absorb space at the rate of 0.510 cm^3/sec/kg, while a gold crust resting on a solid lithium world would absorb space at the rate of 1.577 cm^3/sec/kg (of gold).

We find that:

1. A lithium crust will absorb space 9.4876/3.0698 = 3.0906 times faster on a gold world than on lithium world, and a gold crust will absorb space 1.5773/0.5104 = 3.0906 times faster on a lithium world than on a gold world.
2. An ice crust will absorb space 4.1132/2.2433 = 1.8335 times faster on a lead world than on an ice world, and a lead crust will absorb space 1.2204/0.6656 = 1.8335 times faster on an ice world than on a lead world.
3. A magnesium crust will absorb space 2.2082/1.7006 = 1.2985 times faster on an iron world than on a magnesium world, and an iron crust will absorb space 1.0383/0.7996 = 1.2985 times faster on a magnesium world than on an iron world.
4. An aluminum crust will absorb space 1.4106/1.3655 = 1.0330 times faster on a titanium world than on an aluminum world, and a titanium crust will absorb space 1.0916/1.0567 = 1.0330 times faster on an aluminum world than on a titanium world.

This pattern may be a clue that might lead to a rule, but I have not yet discovered the rule. Another clue is the dependence of the space flow rate per unit mass upon the escape velocity. Eq. (14) gives the space flow rate per unit mass of the crust as a function of the escape velocities at the upper and lower surfaces of the crust.

$$\frac{Q}{M} = \frac{v_2 r_2^2 - v_1 r_1^2}{r_1 r_2 \left(r_2 - r_1\right) \rho_2} \tag{14}$$

where v_1 is the escape velocity at the lower surface of the crust at radius r_1, v_2 is the escape velocity at the upper surface of the crust at radius r_2, and ρ_2 is the density of the crust.

The escape velocity at the lower surface of the crust is the same as the escape velocity at the outer surface of the hypothetical planet under the crust.

$$v_1 = r_1 \sqrt{\tfrac{8}{3} \pi G \rho_1}, \tag{15}$$

where ρ_1 is the average density of the underworld. This is the same formula as Eq. (2)b.

The escape velocity at the upper surface of the crust is given by:

$$v_2 = v_1 \sqrt{\frac{r_1}{r_2} + \frac{3\rho_2 \left(r_2 - r_1\right)}{\rho_1 r_1}} \tag{16}$$

The crust thickness $\left(r_2 - r_1\right)$ is a factor in the denominator of Eq. (14) and in the numerator of the second term under the radical of Eq.(16).

6.5. Ether Structure and Mechanism Problems

Boldyreva and Sotina describe the physical vacuum (ether) as having properties similar to the superfluid He-3 [20]. Other authors claim the ether must be a solid since liquids cannot propagate transverse waves, and light is classically a transverse wave. But that begs the question: how can a solid flow like a liquid? One possible answer might be that the ether might behave like a solid (or a gel) for high-frequency vibrations, such as light waves, but otherwise like a liquid—like quicksand.

In a private communication, Nina Sotina pointed out that there are fluids in which transverse waves can exist. These fluids have intrinsic degrees of freedom [21]. Examples include magnetic liquids, superfluid He-3, and some others. However, she thinks that light is not a simple transverse wave. It is like a soliton in a superfluid.

6.6. The Space Flow Reversal Problem

The sixth problem does not apply to the uniformitarian model presented in this paper. That model says that space fountains have always been and will always be space fountains, and likewise for space drains. I do not endorse the uniformitarian model, but I offer it for the reader's consideration. My catastrophic model, which is not ready for publication, claims that supernovae and gamma-ray bursts are the results of space flow reversals. Earth's historic space flow reversals may have caused the mass extinctions seen in the fossil record. The unprecedented October 23, 2007 explosion of Comet Holmes may have been caused by a reversal of the comet's space flow from inward to outward.

Not all space flow reversals are catastrophes. I have reason to believe that classical Cepheid variable stars reverse their space flow directions every few days. The prototype δ Cephei has a 5-day period. As it expands (spectral blueshift) for 1.5 days, it is a space fountain, and as it contracts (spectral redshift) for 3.5 days, it is a space drain. These space flow reversals can occur quickly because they occur within the core, which is physically quite small. To be convincing, FSGT needs explain the pulsating star phenomenon more plausibly than the conventional theory. Why are the pulsations not damped?

6.7. The Mutual Attraction Problem

It is easy to see how two space drains can attract each other. It follows that two space fountains must repel each other. Yet the Sun and the Earth are space fountains, and we know they attract each other.

Newtonian gravity formulas need to be generalized slightly. Two space bodies are not attracted towards each other; they are both attracted towards their mutual center of mass. In the case of two space drains, the center of mass is between them, so there is no difference. But in the case of two space fountains, the center of mass is at infinity. Each body is attracted in the opposite direction from the other body. The result is that the force between them is zero because the distance in the denominator of the force equation is infinity.

So, how do the Sun and the Earth attract each other? Every gravitating space body has a "twin" of the opposite polarity that is concentric with it in space but displaced in time. Each body is phase locked with its twin, core to core, by gravity. The time displacement is no problem because gravity propagates instantaneously. The Sun's twin could be Groombridge 1830, the nearest Population II star. This theory can be confirmed or disproved because all of the solar system planets' twins must orbit the solar twin star. The search for extra-solar planets includes this star, and the distance to it is only 29.9 light-years [22]. So, Earth's twin and the Sun's twin attract each other (1 AU from each other) because they are both space drains, and Earth and the Sun just go along for the ride because they are phase locked with their twins. If the Sun's absolute velocity is 370 km/s (CMB anisotropy dipole velocity), then the time displacement between the Sun and its twin is 24,346 years.

7. Conclusion

There is a way to determine if Venus, Mars, and the Moon are space drains. The Sun is a space fountain, and it should generate ether steams and proton streams that flow to Venus, Mars, and the Moon. If Earth is a space fountain, it should do likewise. These would be the Earth winds that are analogous to the solar wind. I suggest that an attempt should be made to observe proton flows between Earth and Venus, between Earth and Mars, and between Earth and the Moon. An attempt should be made to observe the direction of the flows. The Moon should receive proton flows from the Sun and the Earth. Earth proton flows to the Moon should be observed at First and Last Quarters to distinguish them from solar proton flows.

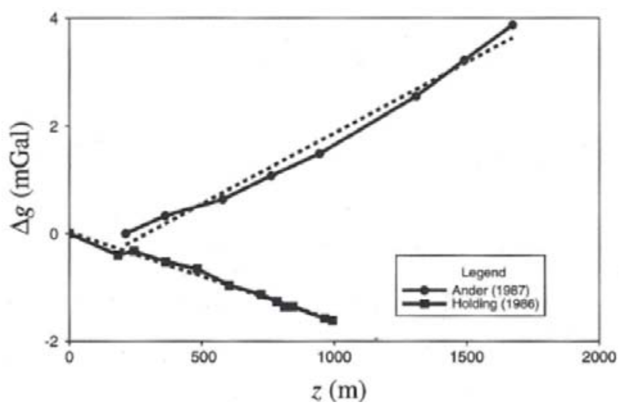

Fig. 7. Measured anomalous gravity residuals versus depth for a mine shaft (falling curve) and a Greenland ice cap borehole (rising curve)

FSGT predicts that the acceleration of gravity as a function of depth in a borehole should be different in a rocky mine shaft than in the Greenland ice cap. A study should be made to see if FSGT can account for the measured anomalous gravity residuals for the experiments of Ander [23] (Greenland ice cap) and Holding [24] (Australian mine shaft) as shown in Fig. 7.

I suspect that the streamers visible in the solar corona during total eclipses may be illuminated by neutron beta decay events. The streamer illumination reveals the structure of discrete ether flows from the Sun to discrete space drains. To prove this, a study should be made in which the position angles of every streamer are recorded for many solar eclipses. These position angles should be compared with the position angles of the great-circle projections of radius vectors to all the planets to see if any of them match up on a consistent basis. The planet radius vector great circles will all be very near the ecliptic plane, but some planet streamers ought to be fatter and others thinner, and they should be recognizable as to whether they are east or west of the Sun at each particular eclipse.

References

[1] Reginald T. Cahill, "Gravity as Quantum Foam In-flow" (2003), http://arxiv.org/PS_cache/physics/pdf/0307/0307003v1.pdf.

[2] Tom Martin, "General Relativity and Spatial Flows: I. Absolute Relativistic Dynamics" (2000), http://arxiv.org/ftp/gr-qc/papers/0006/0006029.pdf.

[3] http://en.wikipedia.org/wiki/Uniformitarianism

[4] http://en.wikipedia.org/wiki/Catastrophism

[5] William T. Reach, et al, "Explosion of Comet Holmes", *American Astronomical Society, DPS meeting* 41, 23.01 (2009), http://adsabs.harvard.edu/abs/2009DPS....41.2301R.

[6] Adam M. Dziewonski, Don L. Anderson, "Preliminary reference Earth model", *Physics of the Earth and Planetary Interiors* **25**: 297-356 (Elsevier Scientific Publishing Co., Amsterdam, 1981).

[7] NASA, "Solar System Explorartion", http://solarsystem.nasa.gov/planets/profile.cfm?Object=Earth&Display=Facts.

[8] James G. Williams, "Contributions to the Earth's Obliquity Rate, Precession, and Nutation", *The Astronomical Journal* **108:** 711-724 (Aug 1994).

[9] Glen W. Deen, "A Cosmic Lens May Explain the Hubble Flow", 14th Natural Philosophy Alliance Conference, Storrs, CT (2007).

[10] http://en.wikipedia.org/wiki/Weakly_interacting_massive_particles

[11] R. Foot, "A CoGeNT confirmation of the DAMA signal", *Physics Letters B* **692** (2): 65-69 (23 Aug 2010) http://www.sciencedirect.com/science/article/pii/S0370269310008488.

[12] Anil Bhardwaj, et al, "X-rays from solar system objects", *Planetary and Space Science* **55**: 1135–1189 (2007).

[13] David R. Lide, Ed., **CRC Handbook of Chemistry and Physics**, 84th Ed., p. 4-137-140 (2003-4).

[14] http://en.wikipedia.org/wiki/Atomic_nucleus

[15] http://en.wikipedia.org/wiki/Neutronium

[16] http://www.sciencedaily.com/releases/2008/03/080310131507.htm

[17] http://en.wikipedia.org/wiki/Michelson-Morley_experiment

[18] Dayton C. Miller, "The Ether-Drift Experiment and the Determination of the Absolute Motion of the Earth", *Reviews of Modern Physics*, **5**: 203-242 (1933), http://www.anti-relativity.com/ Miller1933.pdf.

[19] http://en.wikipedia.org/wiki/Aberration_of_light

[20] L. B. Boldyreva & N. B. Sotina, "Superfluid Vacuum with Intrinsic Degrees of Freedom", *Physics Essays* **5**: 510 (1992).

[21] http://en.wikipedia.org/wiki/Spin_(physics)

[22] http://en.wikipedia.org/wiki/Groombridge_1830

[23] Mark E. Ander, et al, "Test of Newton's inverse-square law in the Greenland ice cap," *Phys. Rev. Lett.* **62**: 985-988 (1989).

[24] S. C. Holding, F. D. Stacey, & G. J. Tuck, "Gravity in mines—An investigation of Newton's law" *Phys. Rev. D* **33**: 3487-3494 (1986).