Plausibility of Shaw's "Aether Concept of Gravity"

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Shaw has proposed an aether explanation for gravity, publishing several papers over the current decade (see *http://www.duncanshaw.ca/*). These have evolved into his "Aether Concept of Gravity," by which inflowing aether into cosmic bodies produces an accelerating "ram force" that manifests as the "attractive" gravitational force without the need to postulate "action at a distance." While examination of the full theory is beyond the scope of this paper, it is feasible to examine three of the key aspects which lend themselves to modeling in the form of mathematical constructs. While no attempt is made to explain the physics behind Shaw's theory, an investigation into its plausibility, at least from a mathematical perspective, is undertaken and appears to support at least this level of plausibility.

1. Introduction

In "Aether Concept of Gravity," Shaw has proposed a model where gravity is a pushing, not pulling (attractive) force. He chooses the simple analogy of a vacuum cleaner which, by creating lower air pressure inside, causes air from the outside, at higher pressure, to push itself "inward" toward the artificially lowered pressure region. Rather than "sucking in air," a vacuum cleaner allows air to "push itself inward." Shaw's gravity concept postulates "that the inflow is caused by the pressure of 'aether' in cosmic bodies being lower that the pressure of aether in space. Pressure in cosmic bodies is lowered by the emission of aether from cosmic bodies. The resulting pressure differential causes aether in space to flow toward the partial vacuum – much like the emission of air from a household vacuum cleaner creates a partial vacuum into which surrounding air flows. Pressure in cosmic bodies is also lowered by the acceleration of inflowing aether from space to the relatively narrow targets of cosmic bodies. This is an application of Bernoulli's principle pursuant to which the pressure of a fluid that is flowing in a narrowing channel reduces as the speed of fluid accelerates." [1]

With all this aether flowing into a cosmic body, Shaw must address whether there is an outflow to maintain equilibrium and prevent runaway heating of the body. "Outflow is essential because: (1) it replenishes the supply of aether in space required for continuous inflow; and (2) it provides a mechanism to dissipate into space the heat that is transferred to cosmic bodies by the ram force of inflowing aether … [H]eat generated by the ram force of inflow causes inflowing condensed aether to vaporize or evaporate into its gaseous state and flow back into space by way of diffusion and convection. When gaseous aether is back in space, it condenses into droplets of liquid aether … [T]hey gradually come into contact with other aether cells and with droplets of condensed aether … [T]he supply of condensed aether in space is replenished." [1]

There are three concepts that lend themselves to constructing mathematical models within Shaw's theory: (1) Accelerating rate of radial inflow of aether as it approaches a cosmic body (assumed spherical for convenience); (2) Creation of a pressure differential between inflowing and outflowing aether at the surface of the cosmic body, such that the inflow pressure is greater and represents "attractive" gravity; and (3) Dependence of inflow vs. outflow pressure differential on mass of the cosmic body, such that two bodies of equal size and shape experience different "gravities" depending upon their masses (densities). The following proposes a mathematical construct for each of these. These are purely mathematical exercises, not intending to address the physics that may be involved in the phenomena, in an attempt to at least gauge whether the concepts are plausible.

2. Radially Accelerating Aether Inflow

Shaw envisions this inward flow of aether to be dominated by the most massive member of our solar system, namely the Sun, as illustrated in Figure 1, overwhelming that of any planet except in the immediate vicinity of the planet. Envisioning this in three dimensions, where the Sun and planets are essentially spheres, the rate of aether "inflowing" from an infinitesimal shell of radius "d," where d = distance from planet center to Sun center, and thickness "Δd" over a time increment "Δt" is $4\pi d^2\, {\Delta d}/{\Delta t}$, i.e., $4\pi d^2 v$, where $v = {\Delta d}/{\Delta t}$ can be viewed as the radially inward velocity of the aether at planetary distance d. If we define the rate of aether inflow (velocity) at the Sun's surface to be 1 and the inflow rates at the planet and Sun, since aether is not building up anywhere in the

Solar System, we obtain $4\pi R^2(1) = 4\pi d^2 v(1) \rightarrow v = (R/d)^2$, where "R" = radius of the Sun. Since $R \ll d$, the velocity of inflowing aether at the planet will be much less than that at the Sun, decreasing as one proceeds outward from the Sun.

The force of gravity generated by this inflowing aether results from the momentum imparted on the planet by the dominant inflowing aether due to the Sun, which is proportional to the amount of aether "mass" impinging on the cross-sectional area perpendicular to the radially inward flow toward the Sun. If the planet has radius "r", the mass is proportional to πr^2. Thus, the gravitational push inward due to the inflowing aether on the planet of radius "r" at distance "d" from the Sun is proportional to $vr^2 = (rR/d)^2$, dropping the constant terms since we will be dealing with ratios among the planets.

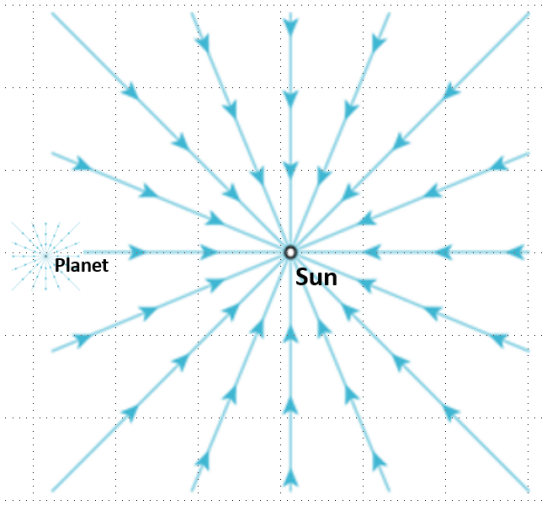

Figure 1. Approximate Reproduction of Shaw's Figure for Inflowing Aether [2]

The "impact" effect of the aether particles likely will differ significantly when impinging on a "solid" surface, such as Earth's, vs. a "gaseous" one, such as Jupiter's. Therefore, one might consider comparing the effects between the "solid" (denser) four inner planets and the four "gas giants" (less dense) to be somewhat of an "apples" to "oranges" comparison. To try to compensate somewhat for this possibility, consider treating the four gas giants as "solid" planets with a density equal to the average of those for the four inner planets (ρ_{av} = 5.030E+12 kg/km^3) and equivalent radii (r_{eq}) based on their respective masses (m), i.e., $m = \frac{4}{3}\pi\rho_{av}r_{eq}^3 = \frac{4}{3}\pi\rho r^3 \rightarrow r_{eq} = r(\rho/\rho_{av})^{1/3}$, where "ρ" and "r" are the planet's actual density and radius. This results in the equivalent radii and densities shown in Table 1 for the four gas giants.

When scaled to the Sun's gravitational force on Earth equal to unity, the ratios for each planet of the aether vs. Newton gravitational forces calculated in Table 1 are shown in Figure 2. As can be seen, except for, at most, roughly an order of magnitude difference for the gas giants and Pluto, the agreement is quite good, especially with respect to the trend.

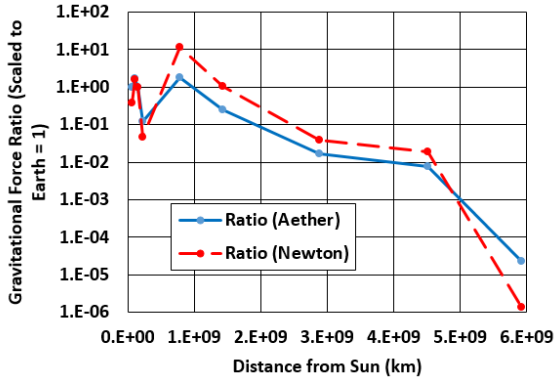

Figure 2. Ratios of Aether vs. Newton Gravitational Forces on the Planets (Scaled to Earth = 1) vs. Orbital Distance

3. Aether Pressure Differential

Shaw's inflowing, condensed aether can be viewed as an aether "capsule," shown as a tetrahedral package of four aether particles, each a sphere of unit radius, inflowing into a sphere in Figure 3. The tetrahedron represents the simplest three-dimensionally symmetric array of equal-sized spheres. As the aether capsule flows "into" a large spherical body, it displaces four individual aether particles in a "straight" line. This is analogous to Shaw's concept of the ram force of inflow causing the inflowing capsule to vaporize or evaporate into its constituent particles. The inflowing aether tetrahedron has an equivalent spherical volume of $4\frac{4\pi}{3}(1)^3 = 16.76$, which corresponds to a sphere of equivalent radius = $(\frac{16.76}{4\pi/3})^{1/3} = 1.587$ (relative to unit particle radius), shown in dashed red in Figure 3. The volume of the four "expelled" aether particles is assumed to correspond to a cylinder of equivalent length = $\frac{16.76}{\pi(1)^2} =$ 5.333 that proceeds outward in a straight line, the average distance being half the length, or 2.667.

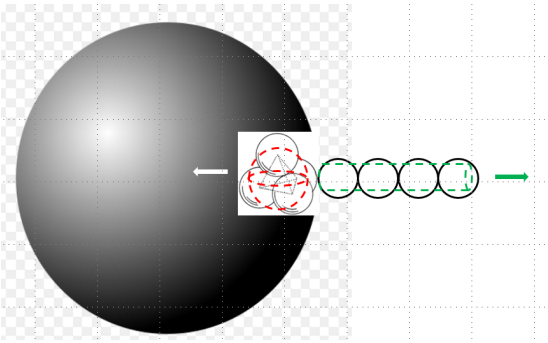

Figure 3. Mathematical Construct for Shaw's Inflowing and Outflowing Aether [3,4]

Because the inflowing aether is in the form of a tetrahedral capsule, with equivalent spherical radius = 1.587, its "depth" of penetration is less than the equivalent average distance traveled by the expelled individual aether particles, 2.667. Radially, this corresponds to the expelled particles traveling at $\frac{2.667}{1.587} = 1.680$ times the speed of the inflowing capsule. By Bernoulli's equation (ignoring gravity), a positive pressure differential results between the inflowing and expelling aether, derived as follows:

$$P_{in} + \frac{\rho {v_{in}}^2}{2} = P_{out} + \frac{\rho {v_{out}}^2}{2} \rightarrow P_{in} - P_{out} = \frac{\rho}{2}({v_{out}}^2 - {v_{in}}^2) > 0, \; since \; v_{out} > v_{in}.$$

Given neither the density of aether nor the inflow or outflow radial speed is known, one can only make some very crude estimates of what this pressure differential might be. To accomplish this, the following very subjective assumptions are made.

(1) As per Reference [5], "[i]n all phases, the interstellar medium [ISM] is extremely tenuous by terrestrial standards. In cool, dense regions of the ISM, matter is primarily in molecular form, and reaches number densities of 10^6 molecules per cm^3 ... In hot, diffuse regions of the ISM, matter is primarily ionized, and the density may be as low as 10^{-4} ions per cm^3." The geometric mean of this range of ~10 orders of magnitude would be ~10/cm^3. Assuming this to consist of individual hydrogen atoms (separated protons [1.67×10^{-27} kg mass] and electrons [9.11×10^{-31} kg mass] in equal numbers if ionized), the ISM density would be approximately

$$(10)(1.67x10^{-27}kg + 9.11x10^{-31}kg) \Big/ (1\ cm^3)(\frac{0.01m}{cm})^3 \approx 1.67x10^{-20}\frac{kg}{m^3}.$$

(2) Shaw assumes "… that the spacecraft [returning from the moon] are being carried by aether that is flowing toward the Earth … [I]t follows that the speeds of the spacecraft en route to the Earth should be essentially the same as the velocities of the inflowing aether. Thus, for example, the velocity of the aether at the point where the vehicles reach the Earth's atmosphere must be about 11 km/s [… where they start to encounter the braking effect of the Earth's atmosphere …]. One may conclude that the speeds of aether flowing toward and into the Earth are no more than tiny fractions of the speed of light … One can speculate, however, that inflow speeds at or near a black hole might be at or beyond the speed of light." [6] Shaw's estimate exceeds by more than an order of magnitude the maximum terminal velocity quoted for skydiving, 1342 km/h, or 0.373 km/s, "… held by Felix Baumgartner who jumped from a height of 128,100 feet (39,000 m) …, though he achieved this velocity at high altitude, where extremely thin air presents less drag force." [7] Let us use Shaw's estimate of 11 km/s as the speed of aether flowing into the Earth at it approaches its surface.

Returning to Bernoulli's equation with these very crudely assumed values, the pressure differential between inflowing and outflowing aether (at least for the Earth) becomes (assuming that v_{in} = 11000 m/s and $v_{out} = 1.68v_{in}$):

$$P_{in} - P_{out} = \frac{1.67x10^{-20}\frac{kg}{m^3}}{2}(1.68^2 - 1)(11000\frac{m}{s})^2 = 1.68x10^{-16}\frac{nt}{m^2} = 1.68x10^{-21}bar.$$

Table 2. Surface Pressures of the Planets and the Sun [8]

Surface Pressure of the Planets and the Sun

Name	Surface Pressure (bar)
Saturn	>>1000
Uranus	>>1000
Neptune	>>1000
Venus	92
Earth	1.014
Jupiter	0.2 - 2
Mars	$4 - 8.7 \times 10^{-3}$
Sun	8.68×10^{-4}
Pluto	3×10^{-6}
Mercury	10×10^{-15}
Moon	3×10^{-15}

Source: NASA

With respect to Table 2, this is roughly one-millionth the atmospheric pressure on the Moon. If we use light speed (3.00×10^8 m/s) as the radial speed of aether, the pressure differential rises to 4.57×10^{-17} bar,

still below the Moon's atmospheric pressure. However, if we use the maximum estimate for ISM density (~10^6/cm^3), the estimates for pressure differential rise to 1.68x10^{-16} bar (for Shaw's "aether speed" of 11 km/s) and 4.57x10^{-12} bar (for "light-speed" aether), now at least comparable to the lowest atmospheric pressures within our solar system. Still, it is apparent that the differential pressure between inflowing and outflowing aether is miniscule, but apparently positive enough to produce the "attractive" gravitational force.

4. Effect of Mass

So far, mathematical constructs have been created to address (1) the increase in aether's radial inflow speed with the inverse of distance squared and (2) the pressure differential between inflowing and outflowing aether at a "planet's" surface to account for "attractive" gravity. What remains is to consider two equally-sized "planets" with different masses (densities), such that the more massive experiences the greater surface gravity. How does the inflowing aether "know" that, given the exact same geometry and distance, it must inflow faster for the more massive planet, thereby generating a greater pressure differential and, as a result, greater gravity? While I cannot answer "how," I propose yet another mathematical construct for visualization (Figure 4).

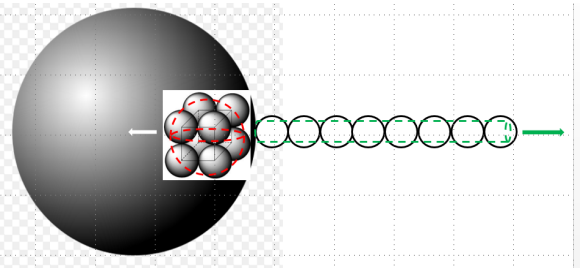

Figure 4. Mathematical Construct for Effect of Greater Mass [3,9]

Assume that, as a result of the greater mass, a "larger" aether "capsule" (shown now as a cubic package of eight aether particles, each a sphere of unit radius) flows "into" the planet, now displacing eight individual aether particles in a "straight" line. The inflowing aether cube has a volume of $8\frac{4\pi}{3}(1)^3 = 33.51$, which corresponds to a sphere of equivalent radius = $(\frac{33.51}{4\pi/3})^{1/3} = 2.000$ (relative to unit particle radius), shown in dashed red. The volume of eight "expelled" aether particles is assumed to correspond to a cylinder of equivalent length = $\frac{33.51}{\pi(1)^2} = 10.667$ that proceeds outward in a straight line, the average distance being half the length, or 5.333. Radially, this corresponds to the expelled particles traveling at $\frac{5.333}{2.000} = 2.667$ times the speed of the inflowing capsule, 1.587 times higher than previously.

Returning to Bernoulli's equation with the previously assumed values, the pressure differential between inflowing and outflowing aether (at least for the Earth) now becomes (assuming that v_{in} = 11000 m/s and now $v_{out} = 2.67v_{in}$):

$$P_{in} - P_{out} = \frac{1.67x10^{-20}\frac{kg}{m^3}}{2}(2.67^2 - 1)(11000\frac{m}{s})^2 = 5.63x10^{-16}\frac{nt}{m^2} = 5.63x10^{-21}bar.$$

If we use light speed (3.00x10^8 m/s) as the radial speed of aether, and the maximum estimate for ISM density (~10^6/cm^3), the estimate for pressure differential rises to 1.53x10^{-6} bar, comparable to Pluto's atmospheric pressure (see Table 2).

The numerical results really do not matter. What is key is that, via another mathematical construct, Shaw's Aether Concept of Gravity remains plausible, now accounting for the third effect, the dependence of aether inflow speed and pressure differential between inflow and outflow, and therefore gravity, on mass.

5. Conclusion

While no definitive conclusion regarding Shaw's Aether Concept of Gravity can be drawn from this examination, it is evident that at least mathematical constructs can be developed for three key aspects, such that Shaw's theory is plausible. That has been the only goal here, and further investigation into the physics involved hopefully will lead to greater insight into the potential validity of this theory.

Acknowledgment

The author wishes to acknowledge personal communications with Duncan Shaw throughout the development of this paper and expresses his gratitude for his support of this effort. This does not imply his agreement with any of my speculations, which are offered only as one out of what may be many possible and different mathematical models for Shaw's theory.

References

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Table 1. Gravitational Forces on Planets due to Aether vs. Newton (with Equivalent Radii for Gas Giants)

ORB	EQ. RADIUS (km)	MASS (kg)	DENSITY (kg/km^3)	DISTANCE (km)	VELOCITY	AETHER		NEWTON	
						Force	Ratio	Force (nt)	Ratio
SUN	6.957E+05	1.989E+30	1.408E+12	6.957E+05	1.000E+00	8.592E+02	9.789E-01	1.307E+19	3.689E-01
MERCURY	2.440E+03	3.301E+23	5.427E+12	5.791E+07	1.443E-04	1.514E+03	1.725E+00	5.520E+19	1.558E+00
VENUS	6.052E+03	4.868E+24	5.243E+12	1.082E+08	4.134E-05	8.778E+02	1.000E+00	3.542E+19	1.000E+00
EARTH	6.371E+03	5.972E+24	5.514E+12	1.496E+08	2.163E-05	1.070E+02	1.219E-01	1.639E+18	4.626E-02
MARS	3.390E+03	6.417E+23	3.934E+12	2.280E+08	9.311E-06	1.605E+03	1.829E+00	4.161E+20	1.175E+01
JUPITER	4.483E+04	1.899E+27	5.030E+12	7.784E+08	7.989E-07	2.130E+02	2.427E-01	3.693E+19	1.042E+00
SATURN	2.999E+04	5.684E+26		1.429E+09	2.369E-07	1.504E+01	1.714E-02	1.394E+18	3.935E-02
URANUS	1.603E+04	8.681E+25		2.875E+09	5.854E-08	6.844E+00	7.797E-03	6.699E+17	1.891E-02
NEPTUNE	1.694E+04	1.024E+26		4.504E+09	2.385E-08	1.949E-02	2.220E-05	4.943E+13	1.396E-06
PLUTO	1.187E+03	1.303E+22	1.860E+12	5.915E+09	1.383E-08				