Newtonian vs. ‘LeSagian’ Gravitation in Our Solar System

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Classical Newtonian gravitation is considered to be an attractive force, although the mechanism by which this is manifested remains unknown. Speculation includes graviton particles, space-time warping, etc. LeSagian gravitation is considered to be a pushing force, the net result of which appears to be attractive. It coincides with, but does not necessarily depend on, various aether theories where the universe is filled with moving ‘particles’ capable of exerting forces on whatever they contact. ‘Pushing’ gravity occurs when two objects ‘shadow’ each other by blocking the flow of these particles so as to create an area where the density of the particles is less than that ‘outside’ the shadow. The higher density outside the shadow impinges on a greater surface area than the lower density within the shadow, resulting in a net pushing force which appears to be an attraction between the two bodies toward one another (gravity). This paper examines how the results for ‘pushing’ gravity between the sun and a planet compare to those for ‘pulling’ gravity, as per Newton.

1. Introduction

Since first proposed by Fatio in in 1690 before the Royal Society in London, and submitted poetically in 1731 to the Paris Academy of Science, the concept of gravity as a pushing force has existed (and been roundly discredited by mainstream physicists). Popularized and allegedly enhanced by LeSage in 1748 (and equally dismissed as Fatio’s), this theory involves ‘shadowing’ of omnidirectional gravity particles that impinge on all matter so as to make gravity appear as an attractive phenomenon (Figure 1). [1]

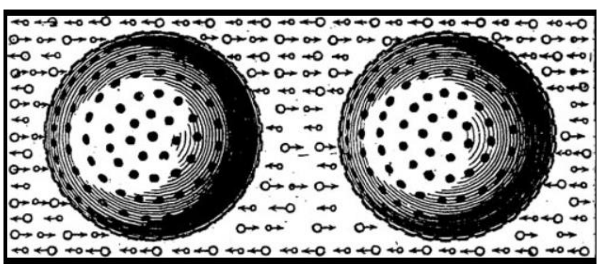


FIGURE 1. LeSage’s Original Illustration

Despite its repeated rejection, this theory has survived and even been revived by dissident physicists as mainstream physicists continue to struggle with an explanation for gravity and search for the elusive ‘gravity waves’ or ‘gravitons’ implied by their theories. Of especial note is the recent book by de Hilster of the Gravity Group of the John Chappell Natural Philosophy Society (formerly the Natural Philosophy Alliance). [2]

This paper examines the theory of pushing gravity on the scale of our solar system, comparing results for the ‘LeSagian’ theory against those resulting from Newton’s Law.

2. Gravity on a Solar System Scale

Classical Newtonian gravitation is considered to be an attractive force, although the mechanism by which this is manifested remains unknown. Speculation includes graviton particles, space-time warping, etc. LeSagian gravitation is considered to be a pushing force, the net result of which appears to be attractive. It coincides with, but not necessarily depends on, various aether theories where the universe is filled with moving ‘particles’ capable of exerting forces on whatever they contact. Gravity occurs when two objects (spheres, for convenience, which will be modeled in two dimensions as circles) ‘shadow’ each other by blocking the flow of these particles so as to create a trapezoidal area (truncated conic volume in three dimensions) where the density of the particles is less than that ‘outside’ the shadow. The higher density outside the shadow impinges on a greater surface area than the lower density within the shadow, resulting in a net pushing force which appears to be an attraction between the two bodies toward one another (gravity). Figure 2 illustrates this with the sun and a planet.

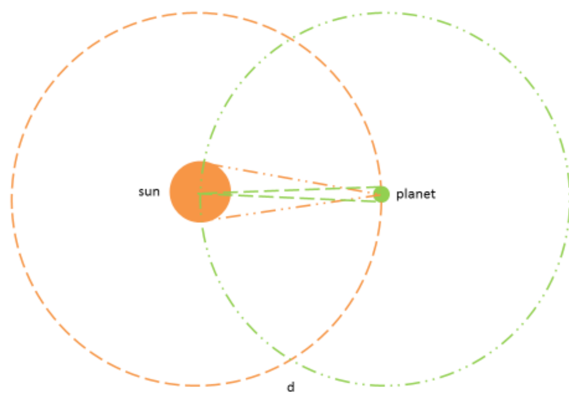


FIGURE 2. Schematic Showing LeSagian ‘Shadowing’ between the Sun and a Planet

The sun, idealized as a circle (sphere) is impinged upon over a circle (sphere) with radius equal to its distance from the planet by these particles from all directions (orange [dotted] circle), resulting in normal forces radially inward over its entire surface, except for the green (dashed-dotted) pie-shaped area where it is shadowed by the planet. Similarly, the planet, also idealized as a circle (sphere) is impinged upon over an equally-sized circle (sphere) of the same radius from all directions, resulting in normal forces radially inward over its entire surface (green [dashed-dotted] circle) except for the orange (dashed) pie-shaped area where it is shadowed by the sun. Clearly, the fraction of the circle surrounding the planet that is shadowed by the sun exceeds that of the sun shadowed by the planet. As a result, the planet will be pushed closer to the sun than the sun will be to the planet, but due to the planet’s orbital motion, the sun and planet do not collide. Rather, the planet and sun rotate about their mutual barycenter, essentially the center of the sun.

<u>TABLE 1</u>. Calculation for Newtonian Gravitational Force for the Nine Planets

ORB	RADIUS (km)	MASS (kg)	DENSITY (kg/km^3)	DISTANCE (km)	PERIOD (s)	SPEED (km/s)	ACCELERATION (km/s^2)	NEWTON (nt)
SUN	6.957E+05	1.989E+30	1.408E+12				2.740E-01	
MERCURY	2.440E+03	3.301E+23	5.427E+12	5.791E+07	7.594E+06	4.736E+01	3.700E-03	1.307E+19
VENUS	6.052E+03	4.868E+24	5.243E+12	1.082E+08	1.940E+07	3.502E+01	8.870E-03	5.520E+19
EARTH	6.371E+03	5.972E+24	5.514E+12	1.496E+08	3.154E+07	2.978E+01	9.807E-03	***3.542E+19***
MARS	3.390E+03	6.417E+23	3.934E+12	2.280E+08	5.932E+07	2.408E+01	3.711E-03	1.639E+18
JUPITER	6.991E+04	1.899E+27	1.326E+12	7.784E+08	3.740E+08	1.307E+01	2.479E-02	4.161E+20
SATURN	5.823E+04	5.684E+26	6.870E+11	1.429E+09	9.291E+08	9.690E+00	1.044E-02	3.693E+19
URANUS	2.536E+04	8.681E+25	1.270E+12	2.875E+09	2.650E+09	6.800E+00	8.690E-03	1.394E+18
NEPTUNE	2.462E+04	1.024E+26	1.638E+12	4.504E+09	5.197E+09	5.430E+00	1.115E-02	6.699E+17
PLUTO	1.187E+03	1.303E+22	1.860E+12	5.915E+09	7.821E+09	4.670E+00	6.200E-04	4.943E+13

<u>TABLE 2</u>. Calculation for LeSagian Gravitational Force for the Nine Planets

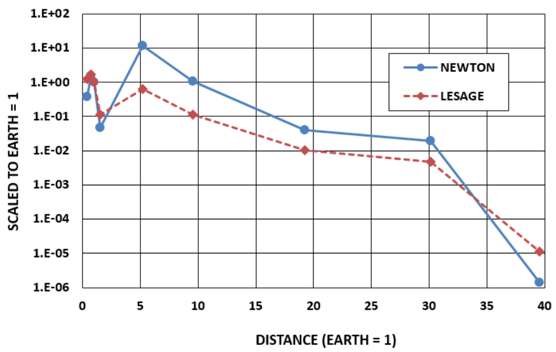
ORB	SUN SHADOW (km^2)	SHADOW FRACTION (s-p)	ORB SHADOW (km^2)	SHADOW FRACTION (p-s)	EXP(-MU*R) (MU[E]=1)	LESAGE
SUN					7.767E-13	
MERCURY	4.043E+13	1.341E-05	1.413E+11	3.837E-03	6.860E-01	1.616E-08
VENUS	7.593E+13	1.780E-05	6.548E+11	2.064E-03	4.053E-01	2.186E-08
EARTH	1.050E+14	1.356E-05	9.531E+11	1.494E-03	3.679E-01	***1.280E-08***
MARS	1.594E+14	4.733E-06	7.729E+11	9.760E-04	6.841E-01	1.459E-09
JUPITER	5.959E+14	2.859E-05	5.442E+13	3.131E-04	7.145E-02	8.312E-09
SATURN	1.078E+15	1.297E-05	8.324E+13	1.679E-04	3.202E-01	1.480E-09
URANUS	2.073E+15	2.807E-06	7.292E+13	7.982E-05	3.998E-01	1.345E-10
NEPTUNE	3.245E+15	1.740E-06	1.109E+14	5.090E-05	3.173E-01	6.046E-11
PLUTO	4.122E+15	6.388E-08	7.021E+12	3.750E-05	9.391E-01	1.459E-13

The Newtonian gravitational attraction between the sun and planet is readily calculated as $F = {GMm}/{d^2}$, where 'G' = gravitational constant (6.67E-20 km^3/kg-s), 'M' = mass of sun (1.99E+30 kg), 'm' = mass of planet (kg) and 'd' = distance between sun and planet (km). For our solar system, the Newtonian gravitational force between the sun and each planet (retaining Pluto) is shown in Table 1 (column 'Newton') along with other planetary properties, including the orbital period, orbital speed and gravitational acceleration at the surface.

Returning to Figure 2, define 'R' as the radius of the sun (6.98E+5 km) and 'r' as the radius of the planet (km). Given that d >> R (at a minimum, nearly two orders of magnitude for Mercury) > r (at a minimum, an additional order of magnitude for Jupiter), the approximate areas of the 'shadows' cast by the sun on the planet and the planet on the sun are, respectively, $A_{s-p} = (R + r)d$ and $A_{p-s} = rd$. The areas (volumes) of the circles (spheres) around the sun and planet with radius equal to the sun-planet distance are each $A_c = \pi d^2$, yielding the following fractions of 'shadowed' area (volume), respectively, $f_{s-p} = {A_{s-p}}/{A_c} = {(R + r)}/{\pi d}$ and $f_{p-s} = {A_{p-s}}/{A_c} = {r}/{\pi d}$.

Additionally, LeSagian gravitation assumes that some fraction of the particles interact within the volume of the spheres as they pass through, generating the pushing force. This can be characterized using the typical exponential function for attenuation, where the fraction of particles that 'survive' the passage through a distance 'x' is $e^{-\mu x}$ (longer distance means more attenuation and greater push). The attenuation coefficient 'μ' is unknown, but a reasonable assumption is that it is proportional to the density 'ρ' of the sphere (denser sphere means more attenuation and greater push). Limiting the analysis to relative comparisons, for each sphere assume $\mu \propto {\rho}/{\rho_e}$, where '$\rho_e$' is earth's density (5.51E+12 kg/km^3). Again working with relative comparisons, the distance through each sphere scaled to that through the earth will be ${r}/{r_e}$, where 'r_e' is earth's radius (6370 km), such that this ratio will be 1 for earth. Now, the LeSagian gravitational force acting on each planet will be proportional as follows, $L \propto (f_{s-p}[1 - e^{\frac{-\rho_s R}{\rho_e r_e}}])(f_{p-s}[1 - e^{\frac{-\rho_p r_p}{\rho_e r_e}}])$, where subscripts 's' = sun and 'p' = planet. The pairs of terms inside each set of '( )' represent the fractional area shadowed by the opposing sphere times the fraction of particles that interact with the affected sphere. The results from these calculations for each planet are shown in Table 2 as the last column 'LeSage.'

A quite interesting behavior results if the Newtonian gravity 'F' (last column in Table 1) and LeSagian gravity 'L' (last column in Table 2) are scaled relative to their respective values for earth (***bold italics***) and plotted against their distances from the sun (Figure 3). While there is a noticeable difference in the scaled values (up to roughly an order of magnitude, especially from Jupiter onward), the pattern is remarkably similar for the nine planets. Newtonian gravity depends directly on the product of the two masses and inversely on the square of the distance. LeSagian gravity depends on the product of some function of the two densities (exponential attenuation governed by the coefficient 'μ,' proportional to the density, has been assumed) and the product of the 'shadowed' area, which are direct functions of distance.

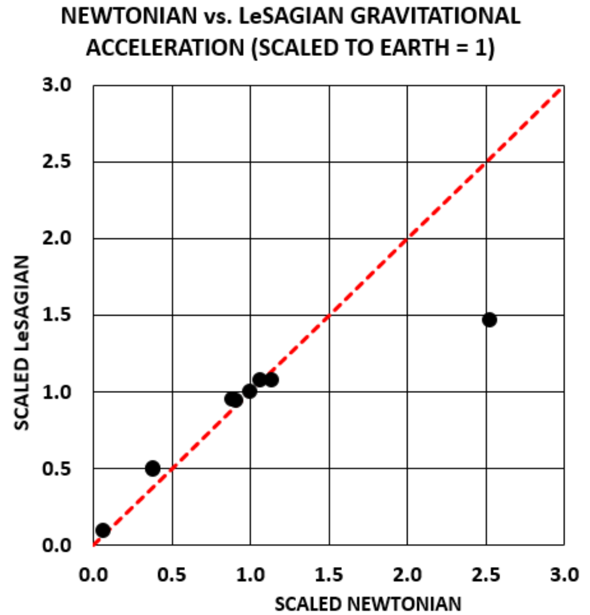


<u>FIGURE 3</u>. Newtonian vs. LeSagian Gravitational Force vs. Distance for the Nine Planets

3. Gravitational Acceleration at Each Planetary Surface

Another phenomenon worth examining from the Newtonian vs. LeSagian gravitational viewpoint is the gravitational acceleration at the surface of each planet. For each planet, assume a 1-kg mass is sitting on the surface (a loosely defined term for the gas giants). As should be evident from Figure 2, if the sun is now replaced by a planet, the planet by the 1-kg mass sitting on the surface, and the distance 'd' by the planet's radius 'r,' effectively half the circle of radius 'r' will constitute the area shadowed by the planet relative to the 1-kg mass. This will be true for any of the planets, so the fractional area that is shadowed (0.5) is the same for all and need not be considered further for relative comparisons. This leaves as variables the planet's radius and density 'ρ' (which is still assumed to affect the attenuation coefficient 'μ').

Ignoring any attenuation by the 1-kg mass, the LeSagian gravitational acceleration is proportional as follows, $\frac{dv}{dt} \propto 1 - e^{\frac{-\rho r}{\rho_e r_e}}$. Calculating this for each planet and then scaling to earth's LeSagian value yields Figure 4, which compares the scaled Newtonian and LeSagian gravitational accelerations. Except for Jupiter, where the scaled Newtonian gravitational acceleration (2.5) is about 2/3 higher than its LeSagian counterpart (1.5), the gravitational accelerations when scaled show very good agreement (follow the 45-degree slope).



<u>FIGURE 4</u>. Newtonian vs. LeSagian Gravitational Acceleration for the Nine Planets

4. Conclusion

The relatively good agreement between Newtonian and LeSagian gravitation exhibited in Figures 3 and 4 for our solar system are positive results for the 'pushing' gravity theory. While Newton's Law does not attempt to explain how gravity works, it obviously provides an excellent model for the effects of gravity. Any theory purporting to 'explain' the mechanism of gravitation must at least align calculationally with the results from Newton, especially within our solar system upon which much of his original theory was based and where it has been repeatedly verified.

5. References

1. *https://en.wikipedia.org/wiki/LeSage%627s_theory_of_gravitation*
2. de Hilster, R., <u>Gravity is not Free – Pushing Gravity Beyond the Apple</u>, John Chappell Natural Philosophy Society, Caledonia, MI (2016).