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Lagrangian Examination on the Speed of Gravity and Newtons Laws ©

(*Gravity as an Energy/Force Field Faster than Light)*

Abstract

This revised paper is due to research leading to new data and requiring changes to the previously published GSJ paper 9692, 11 Sep., 2023, that proposes that the speed of the Force of Gravity is a variable, not 'c' and not fixed at light speed. The result gives stronger confirmation to the claim of Tom Van Flandern, PhD in Celestial Mechanics that the velocity of Gravity is orders of magnitude higher than 'c.' Newton's Gravity Law gives Lagrangian mechanics an additional degree of freedom because it defines additional Stationary Action. That additional Action is the force/energy to ***provide the constant acceleration*** of an object in a gravitational field generated by a Gravitational Mass regardless of that object's Inertial Mass. Newton's second Law on force and acceleration, $F = ma$, and his Law $F = GMm/r^2$ on the force of gravity are examined from a new perspective to find that the speed of this force is ten orders of magnitude higher than light speed. Points of change are shown in red.

Lagrangian Mechanics

This approach is used in advanced physics to provide for the derivation of Newton's 2nd Law of Force via the examination of the Kinetic and Potential energies. It is well established that Kinetic Energy, KE, T, minus Potential Energy, PE, V, is the Lagrangian version of $F_a = m_2a$.[1] This acceleration force has been shown to be equivalent to the gravitational force given by Newton's equation $F_G = Gm_1m_2/ r^2$ as Einstein had found the Equivalence Principle, that the Gravitational Mass, GM can be considered equal to the Inertial Mass, IM.[2] Setting F_a and F_G equal and solving for the acceleration, a, gives the correct acceleration value, $9.8 m/sec^2$ found experimentally for the Mass of the Earth with the IM, m_2, canceling out of the equation. The mass of the object does not influence its acceleration.

The Lagrangian, L, is equal to kinetic energy (T) minus potential energy (V).

$$KE - PE = T - V = \frac{1}{2} m_2 v^2{}_1 - m_2 gh.$$

Physics applies the Euler-Lagrange equation to show the object follows the Stationary Action path which is what is consistently observed.

Newton's Law of Gravity

It is proposed here that this stationary action, for the kinetic and potential energy, is due to participation in the energy of Space and thus, Newton's gravity equation Gm_1m_2/ r^2 can also be included with the Lagrangian as an energy source.

It is a contributing constraint under Universe direction.

Then, KE - PE = Gravitational Force

$$T - V = F_G = Gm_1m_2/ r^2 \quad (1)$$

The Gravitational Mass is m_1, the mass of Earth. The Inertial Mass is m_2. G is the mysterious gravitational constant.

The left side of the equation defines energies, and the right side of the equation defines a force. T and V are the result of the energy provided, and work done defined by Space, the Gravitational Mass, and the Inertial Mass in Newton's equation. The right side can be changed since work 'W' is a Force 'F' through a Distance 'D.' D would be the radial distance 'r' between the GM and the IM.

$$T - V = (Gm_1m_2/ r^2)*\mathbf{r} \quad (2)$$

And since the distance is rate x time ($D = r = v_2\ t$)

Giving energy factors to both sides.

$$F_a = m_2 a*\mathbf{r} = \frac{1}{2} m_2 v^2{}_1 - m_2 gh = F_G = Gm_1m_2/ v_2 t \quad (3)$$

The IM 'm_2' cancels out.

$$a*r = \frac{1}{2} v^2{}_1 - gh = Gm_1/ v_2 t \quad (4)$$

Note, v_1 is the velocity of the IM and v_2 is the speed of the energy force, Gravity, defined by Newton's equation. Working now with F_a and F_G as energy.

Using the KE and PE energy factors instead of the Newton force equation $F_a = m_2a$, as in equation 3

$$\tfrac{1}{2} m_2v^2_1 - m_2gh = Gm_1m_2/ v_2 t$$

Gives $$v_2 t = Gm_1/(\tfrac{1}{2} v^2_1 - gh) \qquad (5)$$

$$v_2 = Gm_1/t(\tfrac{1}{2} v^2_1 - gh) \quad (m^3/kg\text{-}sec^2)kg/[(m^2/sec^2)-(m/sec^2)(m)]$$

Given:
- g = (0.0027 m/sec^2 the Moon acceleration towards Earth in orbit.)[4]
- G = 6.67408×10^{-11} m^3/kgsec^2
- m_1 = 5.97220×10^{24} kg (mass of Earth)
- h = distance between GM and IM 384,400 km Earth to Moon[5] (Avg.)
- v_1 = velocity of the IM (m/sec) Moon Velocity[6] 1.022 km/sec (mean)
- t = t_0 (time) For instantaneous time Δt, choose 100 Pico seconds.

Substituting, finds $\mathbf{v_2 = 7.73 \times 10^{18}}$ **m/sec**

An approximate speed for the gravity force from Newton's equation.

Faster Than Light

It has been proposed by this author in previous papers published in the GSJ that gravity is the response of Space to the detection of any acceleration at any scale. Thus, any acceleration would be expected to trigger an extremely fast response, so assuming a time for Δt, one hundred Pico seconds, gives the revised calculated value above for $\mathbf{v_2}$ which is in line with the order of magnitude estimated by Van Flandern.

The estimate found by Van Flandern[3] would suggest that the response of Space to acceleration is almost instantaneous and in agreement with Newton.

Tom Van Flandern, PhD in Celestial Mechanics, NASA astronomer, in his work/research[3] in orbital and astrodynamics had estimated the speed of the force of gravity to be

at least $2 \times 10^{10} \times c$; at least 6×10^{18}m/sec.

Self-Adjusting Energy/Force Field

A time, t = 0, r = 0, or v_1 =0, $\mathbf{v_2}$ would be indeterminate. The initial condition is when the force of gravity emerges via the response of Space at t_0 to any acceleration and the Inertial Reference Frame (IRF) changes to an accelerated frame.

The velocity of the Inertial Mass (v_1) increasing over time with constant acceleration would reduce v_2. This would appear to be an insignificant change, but it also suggests that this force can respond to any change to maintain that constraint required by Universe.

This would also provide a varying value for v_2 with changing v_1 and h values. It says the speed of the Gravity force changes over time, self-adjusting as needed, as the position and velocity of the Inertial Mass are changing over time.

The interaction of gravity through an unknown quantum energy field maintains constant acceleration on an inertial mass, regardless of its mass, in a gravitational field.

Universe and Gravity are about energy, not geometry and time. Geometry is the consequence of that energy dance over time. This constant acceleration is the Universe's constraint, a Stationary Action that minimizes energy.

Summary Comments

It seemed reasonable to equate the Lagrangian (L – V) to Newton's Gravity Law as (L – V) is equivalent to F = ma and this 2nd Law of Newton is routinely equated to the gravity law to calculate the acceleration. Applying a needed adjustment factor to the forces also seemed to be an acceptable step permitting a calculation for the speed of gravity in Newton's modified equations.

It shows that there is a critical connection between these kinetic and potential energy factors and the mysterious energy of Space under the control by Universe to apply the constraint to maintain order and minimize energy.

It would be interesting to see what might be revealed if that detailed mathematical analysis with the differential Euler-Lagrangian equation could be applied to celestial mechanics from this different perspective that considers the force of gravity to be a real component of the energy of Space and not locked up in a Space-Time continuum that turns it all into an illusion.

References

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