The Mechanics of Gravity

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1. Abstract

A hypothesis is presented for the existence of an omni-present, omni-directional photon flux, to which matter is mostly transparent, as the foundation of time and space, causality, and from which equations of mass, energy and motion are derived.

Mass is measured when an object is accelerated in the flux and causes a momentary flux disturbance. An imbalanced flux will accelerate the same mass if it is free to move but apply a pressure force unto the same mass if it is restrained from accelerating. Inertial mass and gravitational mass are unified. $E=mc^2$ is found as not only a measure of mass, but also a measure of the flux.

It is shown that if a fraction of flux is absorbed into mass, a flux imbalance around mass exists, and this gives rise to the mechanics of gravity. Newton's equation is derived from first principles and found to be a general solution for 2-body problems. Gravitational constant G is found to be a function of flux-absorption and flux-mass-friction coefficients combined with a measure of local flux. G is not a universal constant. Apparent 'instant action at a distance' and 'curved space' is now understood through interpretations of this hypothesis.

This model is based on the original Fatio/Le Sage's shadow-gravity theories yet overcomes the numerous troubles that have plagued these theories.

1.1 Significance of the main findings

Inertial and gravitational mass is unified through an understanding of an omni-present, omni-directional photon flux.

A mechanistic understanding of gravitation arises, whereby gravity is a push-force resulting from mass absorbing a small faction of flux.

The conclusion that 'G' (universal gravitational constant) is not universal and is not a constant. 'G' is a measure of flux-strength, flux-absorption in mass and flux-coupling to mass.

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3. Introduction

Push-gravity has previously been proposed in many forms; most notably by the publication of Le Sage [1748], which was primarily based on the original idea (non-published) of Fatio [1690]. These, and other 'push-gravity' and 'flow-of-space' or 'shadow-gravity' theories have been met with vehement resistance and thoroughly valid objections by many great scientists[1-4,36-43]. With a new outlook on the theory, these objections are overcome and dealt with in this document.

Newtonian gravity [1687], with its 'Instant action at a distance' has been superseded by what is now our best current understanding of gravity, given by Einstein's General Relativity (GR) [1916][5], also described by Wheeler as: 'Space tells mass how to move, and mass tells spacetime how to curve'. Daniel Faccio's representation of 'space is sucked into earth' in his river model[6], or Einstein's own interpretation of 'earth is accelerating upward' both provide usable abstracts.

As Ethan Siegel states[7]:

What we perceived as gravity was simply the curvature of space, and the way that matter and energy responded to that curvature as they moved through spacetime. Matter and energy tell spacetime how to curve, and that curved space tells matter and energy how to move.

One can intuitively imagine how curved space could create a path for matter to move, but the above comments still do not explain the how of 'matter bends space'. It is agreed that all matter and energy add to the stress-energy tensor which describes the gravitational field via Einstein's field equations, but descriptively this is not much different from 'mass and energy creates gravity'. Yet the theory (GR) has been thoroughly tested and has proven that its accuracy is renowned[8].

A fully functional mechanistic explanation for the workings of gravity still does not exist. Even the above descriptions of GR do not provide the answer to 'how it works'.

3.1 Introducing the omni-present, omni-directional, photon flux

It is known that different frequencies of radiation interact differently with matter[9].

As frequencies get higher, the energies are higher, but the probability of interacting with matter becomes less as the cross-section gets smaller. Compare Infra-Red vs X-Rays. The first is mostly absorbed in a human body while for the other the body is mostly transparent. This document proposes a flux of even higher frequency where all matter is (almost) completely transparent to this flux.

> Masud Mansuripur describes a photon in a non-dispersive medium in[10]:
> *When the pulse first enters the dielectric slab, the positive force of its leading edge accelerates the slab. The acceleration continues until the trailing edge enters, at which point the net force returns to zero. If the mass of the slab is denoted by M – this could include the mass of the Earth, to which the slab is attached – its acquired momentum will be given by the integrated force over the pulse duration, namely, $MV = \frac{1}{4}\varepsilon_o(\varepsilon - 1)E_o^2 A\Delta T$. [This reduces to $MV = \frac{1}{2}(n^2 - 1)hf/nc$ for a single photon.] So long as the pulse stays within the slab this acquired momentum remains constant. However, as soon as the leading edge of the pulse exits through the slab's rear facet, the trailing edge begins to exert a braking force to slow down the slab's motion. By the time the trailing edge leaves the slab, the motion has come to a halt, and all the momentum initially acquired by the slab has returned to the light pulse.*

Postulate: The void of space, 'vacuum' contains an omni-directional photon flux. The flux is quantised in high energy photons which have a low probability to interact with mass, as compared to visible light that would have a high probability to interact with e.g., an electron in opaque matter. All ‘matter’ is transparent to the flux just as clear glass may be transparent to visible light photons. With matter being transparent to the flux, the flux is slowed in matter, and momentum is transferred for the duration of transit.

The omni-directional photon flux is not to be confused with the static aether theory of Lorentz[11], nor with the corpuscles of the push-gravity theory of Le Sage[1,2], although the latter provided much inspiration toward this hypothesis.

3.2 Neutrinos as an analogy to the ‘invisibility of matter’ to the flux

It is not suggested here-in that neutrinos are the source of the proposed omni-directional photon flux. However, some good analogies can be drawn from knowledge of, and experience with, neutrinos.

Neutrinos are continually being produced in the nuclear reactions of stars, like our own sun, and, to a lesser degree, from nuclear reactions here on earth[12].

Because neutrinos are highly un-interactive with the atom or even the nucleus, if one had an ‘eye’ that could ‘see’ neutrinos, it would make matter appear transparent to the neutrino, somewhat like one sees an image from visible light through clear glass. Such is the current understanding of neutrino behaviour that, from the sun alone, ‘65 billion neutrinos per second go through the nail of my thumb’[13].

The analogy here is that the proposal of an omni-directional photon flux, to which matter is mostly transparent, is not an entirely radical concept.

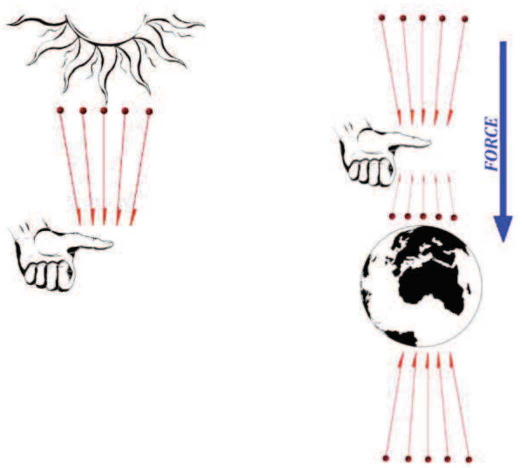

Figure 1: Analogy of neutrinos through a thumb to a photon flux that exerts a force downward on a thumb if the flux is imbalanced.

Thought experiment: Consider [Figure 1], the flux of ’65 billion neutrinos per second through a thumb’ and extend the consideration to not just from the sun, but say it is coming equally from all directions. Now replace the consideration of neutrinos with an the omni-directional photon flux, a flux to which mass is just as transparent, but which has a coupling with mass during transit. Visualise a pressure on one's thumb from all directions, which one might not feel as a force (on just a thumb) if it is equal from all directions. However, if another mass, such as the earth, should be close to one's thumb, it may absorb some incoming flux from the direction of 'other side of the earth', such that the balanced pressure on the thumb is disturbed. The thumb will experience a net pressure from the flux that pushes it toward the earth, and to a much lesser degree the earth will be pushed toward the thumb.

Here ends the flux analogy with neutrinos. The flux might not be 'seen' to come and go; but one can observe its interactions with matter.

4. Inertial mass as a measure of the flux

It is known that inertial mass can only be measured under a change in velocity. Relevant equations for force F=m*a or F=m*dv/dt. Momentum P=mv is useful if a change in velocity can be observed. However, gravitational mass exists in the field of a gravitation source and does not require a change in velocity. F = m*g may be applicable here.

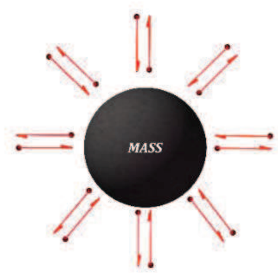

Figure 2: Mass is stable in a balanced omni-directional flux. If not disturbed by external forces, acceleration = 0. (a very small mass may not be stable in a quantised flux, and may appear to have random movements)

Consider [Figure 2]. Thought experiment: A composite mass is 'at rest' in an omni-directional photon flux, with 'at rest' understood as there being no imbalance in the flux from any direction, i.e. the flux is equal from all sides, and no net acceleration is imposed on the mass.

With the mass transparent to the omni-directional photon flux, the mass has stable (or no relative) motion.

From an observer in the same reference frame, for a small mass: Sum(E_{in}) ≈ Sum(E_{out}), where E_i are the energies of the photons.

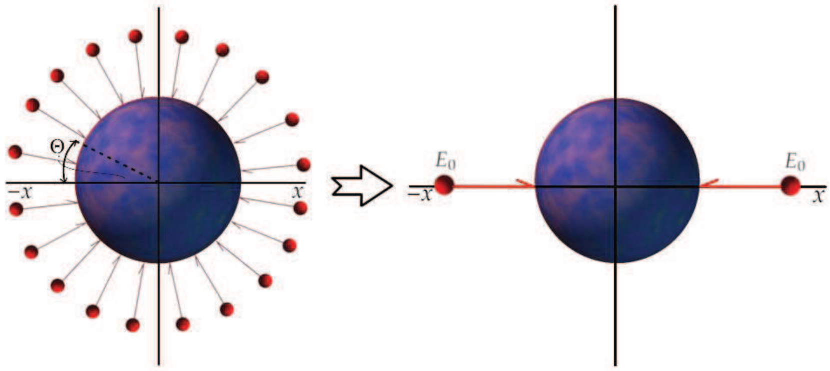

Figure 3: For this exercise, only the x-direction components of all inward photons are summed up, and then represented as +X and -X components.

Consider then, as shown in [Figure 3], only the effect in one dimension, at a point P, where the x-components of all photons contribute:

$$\overrightarrow{E_0} = \sum_i \overrightarrow{E_i} \cos\theta_i \qquad \text{Eq 1}$$

Since the sum of all photons in a balanced flux will equal to zero, the flux is presented as two single simultaneous photons approaching the mass, of equal energy but opposite direction on the +x and -x axes, so that the mass does not gain any momentum from these photons.

The energy vector of each initial photon, before entering the mass, can be represented as:

$$\overrightarrow{E_{01}} = h * f_0\, \hat{x} \qquad \text{Eq 2}$$

and

$$\overrightarrow{E_{02}} = -h * f_0\, \hat{x} \qquad \text{Eq 3}$$

A force F is now applied to the mass m, in direction x. The mass will experience a relativistic change in momentum:

$$\vec{F} = \gamma * m * \frac{dv}{dt}\hat{x} \qquad \text{Eq 4}$$

$$\gamma = \frac{1}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad \text{Eq 5}$$

For a mass accelerating from rest, after a single unit of time dt (dt=1), the velocity of the mass will be dv, in the +x direction.

At the instant of acceleration of the mass, the two photons $\pm E_0$ in the mass are transformed, so that they appear in the mass as shown in [Figure 4]:

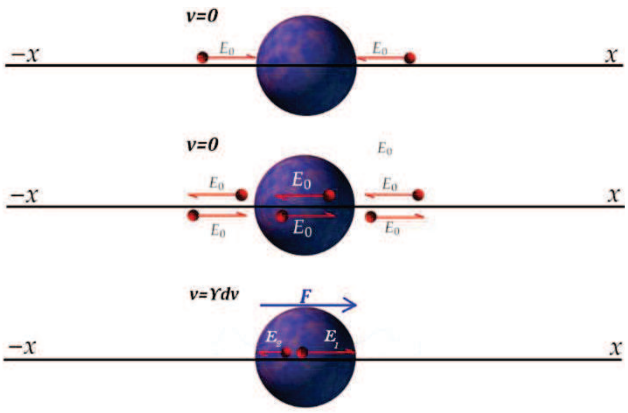

Figure 4: The flux photons in the mass are transformed when the mass is accelerated due to an external force. Top picture: the flux is shown around the mass as equal ± E_0. Mid picture: the mass is transparent to the flux and ± E_0 is also within the mass. Bottom picture: The mass is accelerated and the photons within are transformed to E_1 and E_2, blue-shifted and red-shifted respectively. (arrow lengths are not to scale, and represent vector strengths, not photon wavelengths)

From the relativistic Doppler equation[19,20], we get the energy of the transformed photons, shown in the bottom of [Figure 4] as E_1 and E_2:

$$|E_1| = h * f_0 * \sqrt{\frac{c+dv}{c-dv}} \qquad \text{Eq 6}$$

$$|E_2| = h * f_0 * \sqrt{\frac{c-dv}{c+dv}} \qquad \text{Eq 7}$$

$$\frac{|E_1| + |E_2|}{|E_0|} = \sqrt{\frac{c+dv}{c-dv}} + \sqrt{\frac{c-dv}{c+dv}} \qquad \text{Eq 8}$$

$$\frac{|E_1| + |E_2|}{|E_0|} = \frac{2}{\sqrt{1 - \frac{dv^2}{c^2}}} \qquad \text{Eq 9}$$

$$|E_1| + |E_2| = 2 * \gamma * |E_0| \qquad \text{Eq 10}$$

Change in energy can be calculated by comparing with the energy of the original photons:

$$|E_1| + |E_2| - 2 * |E_0| = 2 * |E_0| * (\gamma - 1) \qquad \text{Eq 11}$$

It is known that for a relativistic mass, the change in energy is the kinetic energy gained:

$$|E_k| = (\gamma - 1) * mc^2 \qquad \text{Eq 12}$$

By setting change in energy of the photons equal to kinetic energy of the mass, a well-known relationship is revealed:

$$2 * |E_0| = mc^2 \qquad \text{Eq 13}$$

(Note: $2*E_0 = mc^2$ in this document because the starting photons each had E_0 energy, which is not unrelated to Einstein's derivation[18] of $E = mc^2$, since Einstein's choice of starting energy of the emitted photons as E/2 each.)

In a different approach the resulting photons indicate the state of motion (dv) of the mass, where $|E_1+E_2|=|E_1|-|E_2|$ since the photons are in opposite direction:

$$|E_1| - |E_2| = \frac{2 * dv}{c} * \gamma * |E_0| \quad \text{Eq 14}$$

Consider for a particle in motion the momentum can be shown as:

$$P = \frac{|E|}{c} = \gamma * m * dv \quad \text{Eq 15}$$

By taking the momentum of the photons as $(|E_1|-|E_2|)/c$ of [Eq 14] and setting equal to P above, it reveals:

$$\gamma * m * dv = \frac{2 * dv}{c^2} * \gamma * |E_0| \quad \text{Eq 16}$$

And once again:

$$2 * |E_0| = mc^2 \quad \text{Eq 17}$$

A next approach takes the total energy of the transformed photons E_1 and E_2:

$$|E_1| + |E_2| = 2 * |E_0| * (\gamma - 1) + 2 * |E_0| \quad \text{Eq 18}$$

Then from [Eq 12] and [Eq 13] above,

$$|E_1| + |E_2| = |E_k| + mc^2 \quad \text{Eq 19}$$

Which is a well-known relationship.

A final approach confirms the relation $E^2 = (Pc)^2+(mc^2)^2$ in terms of the flux photon energies:

$$(2 * \gamma * |E_0|)^2 = \left(\frac{dv}{c} * (|E_1| + |E_2|)\right)^2 + \left(\frac{|E_1| + |E_2|}{\gamma}\right)^2 \quad \text{Eq 20}$$

4.1 Discussion of Inertial mass

The equations above reveal the relations of mass, kinetic energy, momentum, and total energy of a mass interacting with the photon flux:

Note: $E_1+E_2 > 2E_0$ because $\gamma > 1$ for all $v < c$ and is indicative of the energy absorbed by the mass during acceleration. $E_1 > E_0 > E_2$ is typical in Doppler results.

The premise of Einstein's $E=mc^2$ is that a photon inside an object of mass, adds to the mass of the object, equal to the energy of the photon. This is a well-established theory.

However, it has been argued in this section that the inertial mass of an object must ensue from photons in transit in the mass; an omni-directional photon flux to which all mass is transparent will reveal the mass of the object in any direction that it is accelerated. Inertial mass is apparent for the duration of acceleration (or change in velocity) in any direction.

During acceleration, the flux is perturbed, as in the E_1, E_2 argument above, in a direct ratio to the mass of the object.

E_0 represents the prime reference frame. Also, to be kept in mind is that E_0 is only a linear representation of an omni-directional flux. It should be noted that for a larger mass, it is not expected that E_0 would signify a greater energy for each photon, but as shown in [Figure 5], that a larger mass would contain more flux photons in transit, proportional to the volume and density of the mass.

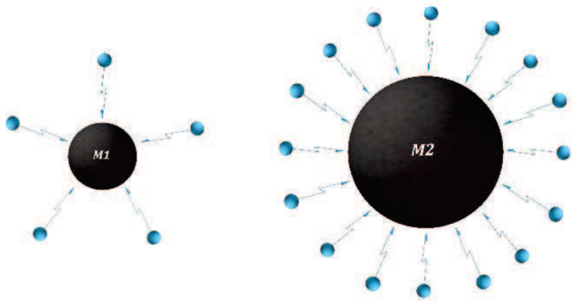

Figure 5: Small mass, fewer flux interactions; large mass, more flux interactions. Not 'bigger' flux for larger mass.

All particles with mass interact with (perturb during acceleration) the flux. It is from this interaction that its mass is defined. If it does not interact, it does not have mass, e.g. other photons. If it interacts only a little, it will have low mass, e.g. neutrino or electron.

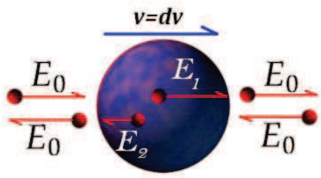

Figure 6: As seen from the viewpoint of an observer: Once the mass is no longer accelerating, the flux photons are not further perturbed. A mass in motion remains in motion unless another force enacts upon it. (Newton)

Once acceleration ends, and the mass is in constant motion, the energy of flux photons entering, and exiting, are changed due to the momentum and/or kinetic energy of the mass. No further energy is added, so an observer will continue to see the photons enter as E_0, transformed inside the mass as E_1 and E_2, and exit again as E_0. See [Figure 6]. Therefore, the flux does not resist constant motion, and no drag effect will ensue. {Newton's first law} The mass is now in a different reference frame in the flux, relative to an observer that did not accelerate, and from here-on they have a relativistic relationship. The moving mass has an unchanging momentum, relative to the observer, until disturbed again.

5. The inseparable G and M

In all direct references to 'G' in this document, the gravitation constant is implied.

NIST: G=7.674 30 x 10^{-11} m^3 kg^{-1} s^{-2}

Any other derivation from G would be shown in this document as e.g., G_m or G_M or G_1 or G_2 for any unit of mass, or e.g. G□ for earth. Any $G_?$ would thus imply a non-reference to G, and would have a different value and function than G.

The Gravitational constant G is prominent in both Newtonian and Einstein's General Relativity equations and presents a measure of the strength of gravitational interactions. See [Figure 7].

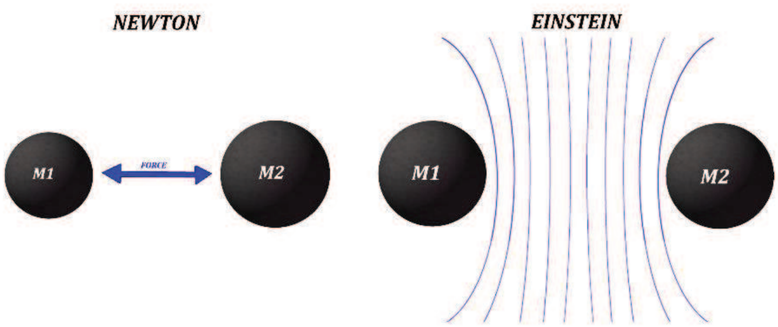

Figure 7: Comparing graphical representations of Newton's 'Action at a distance' to Einstein's 'Curved space'.

Newton:

$$F = \frac{G * M * m}{r^2} \qquad \textit{Eq 21}$$

, which explains the interaction of one mass with another across a distance 'r', but without a time component.

Einstein:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu} \qquad \textit{Eq 22}$$

, which formulates how mass bends space, and how space tells mass to move.

In gravitational calculations encountered above, the values of G (Newton's Gravitational Constant) and M (mass or energy of an object) are inseparable. In Newton's equation G*M is found, with M a measure of mass. In Einstein's equation $G*T_{\mu\nu}$ is present, with $T_{\mu\nu}$ a measure of mass or energy. Even in the equation for bending light dN = $4GMc^2r_p$, G*M is still inseparable. Orbital equations require G*M = v^2/r, or G*M=3*π*v/P^2=, and gravitational acceleration g = G*M/r^2. A few methods of measuring G manage to cancel out mass from the equation[15] (although such methods still need to include inertia), but generally these two values are found together as G*M and each equation relies on G being a constant.

5.1 Measurement and Units of G

Analysis of the SI units of G above, which can also be shown as ‘N*m^2/kg^2’, shows the units as required to balance Newton’s (and Einstein’s) equation and in Newton’s formula would result in a unit of force, measured in Newton. (1 N = 1 kg*m/s^2). The combination of units of G, directly reveals the inverse of what Newton’s equation does, in that mass (M*m) interacts over the square of distance (r^2) but is not otherwise descriptive as to its mechanics.

Acquiring an accurate and reliable measurement value of G has been problematic[33,35], compared to the accuracy obtained for other physics constants. A comprehensive review on the history of measurements of G, and difficulties encountered, is presented by C. Rothleitner and S. Schlamminger[17], and also by Junfei Wu et al[34].

6. Gravitational mass as a measure of the flux

Thought experiment: Consider again, the flux photons E_1 and E_2 emitted from the accelerated mass in the section [Eq 10] above. Mass is transparent to the flux photons, like glass is to visible light, so momentum is transferred while flux photons are within the mass.

When the force was applied externally, the inertial mass attained kinetic energy related to a change in photon energy, where the change in photon energy was equal to the attained kinetic energy of the mass, from [Eq 11]:

$$|E_1| + |E_2| - 2*|E_0| = 2*|E_0|*(\gamma - 1) \quad \textit{Eq 23}$$

Shown in [Figure 8], consider for a moment photons the initial photons E_1 and E_2 could be

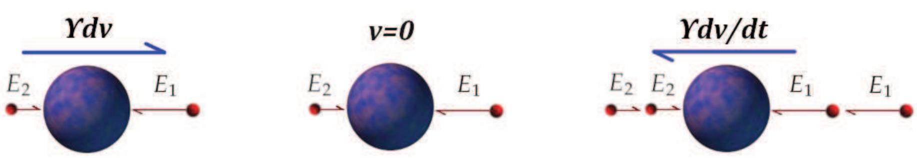

Figure 8: Reversing photons E_1 and E_2 will at first decelerate the mass, and if more photons arrive, accelerate in an opposite direction.

captured, and each reversed in direction. The resultant effect on the mass will be to negate the initial velocity (dv) and decelerate the mass back to rest. The equation [Eq 23] is thus reversed by applying the photons E_1 and E_2 back into the mass, for a time dt, to cancel the kinetic energy:

$$|E_1| + |E_2| - 2*|E_0|*(\gamma - 1) = 2*|E_0| \quad \textit{Eq 24}$$

Which leaves the mass at rest and the flux photons inside the mass (2 x E_0) restored. In effect E_1 and E_2 has applied the opposite force from the one that originally accelerated the mass [Eq 4] and brought it back to rest. The mass is restored to its original reference frame.

The mass is now stationary again in its original frame of reference. Let the exercise not stop here but apply another set of E_1 and E_2 photons to the mass. See [Figure 8], Where initially the 2 x E_0 photons represented a balanced flux, E_1 and E_2 now represent an imbalance in the flux, which would at first accelerate the mass to velocity dv (in the opposite direction). Now if E_1 and E_2 were to be a continuous stream of photons, in other words the mass is in an imbalanced flux, it would continue to accelerate the mass in the opposite direction. If the mass is restricted from being accelerated, a force is still applied to the mass.

$$\vec{F} = \gamma * m * \frac{dv}{dt} = \frac{2 * dv}{c^2 dt} * \gamma * |E_0| \qquad \text{Eq 25}$$

This is in accordance with the equivalence principle[21,22], where there is no difference between being accelerated by an external force and being in a gravitational field. See [Figure 9].

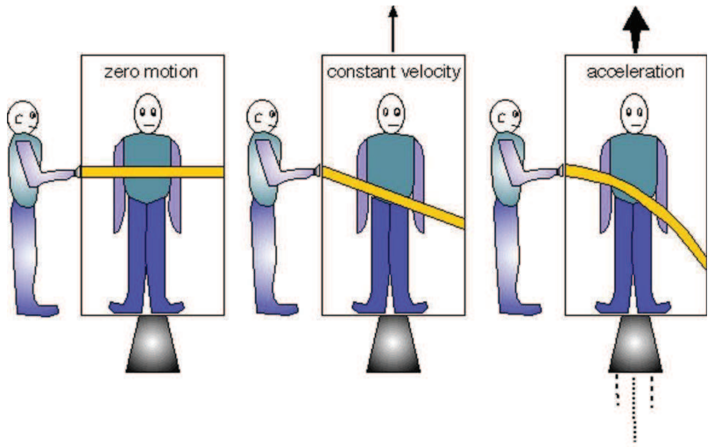

Figure 9: Visualisation of equivalence principle shows acceleration to be similar to being in a gravitational field. Picture credit: Ethan Siegel and Nick Strobel at www.astronomynotes.com

The result of E_1 and E_2 will be a net push force on the object, proportional to the mass and the strengths of E_1 and E_2. If the mass is unable to move, no acceleration ensues, such as would be the experience from the force from gravity.

6.1 Discussion of Gravitational Mass

Nothing new was delivered in the above section of Gravitational Mass. $E=mc^2$ is not a new scientific revelation. It has long been known that photons transfer momentum into mass by Einstein[18] and also by Abrahams and Minkowski[10]. If a photon transfers momentum to a mass[23], it is as if a force is applied when the photon enters the mass.

The author wanted the reader to not just visualise the effect of one photon on a mass, but the same effect (of momentum transfer and force enacted) as the result of 2 opposing but unequal magnitude photons. These 2 photons still represent the net photon flux in any single direction, and whereas 2*E_0 represented a balanced flux, E_1 and E_2 now represent an imbalanced flux which enacts an acceleration on a mass.

To describe the mechanics of gravity, what remains to be shown is that an object of mass could create such an imbalance in the omnidirectional photon flux. See [Figure 10].

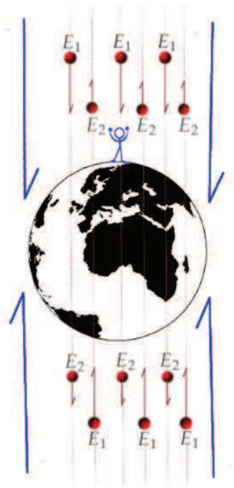

Figure 10: An imbalance in flux above the earth surface, with flux inward greater than a flux outward, results in a net flux inward and, will push a nearby mass down onto earth.

If it can be shown that flux(in) > flux(out) for an object of mass, such that E_1 (flux in) > E_2 (flux out), then a gravitational field has been formed around such mass. In this equivalent E_1 and E_2 of imbalanced flux, inertial mass and gravitational mass would be the same.

6.2 Gravity results from a flux imbalance around a mass

As a typical example of flux, calculating the force of the sun's radiation on earth reveals an equation that is proportional to the intensity of the solar radiation. An increased intensity (I) of flux (absorbed) from the sun would increase the force on the earth's surface[24].

$$F = I * \frac{A}{c} \qquad \textit{Eq 26}$$

With: F the force of the radiation on the surface

A the area where the radiation is absorbed

c the speed of light

If gravity were to originate from a flux, then the units of G in Nm^2/kg^2 may be expected to be flux-like, in that G should be an indication of the strength of the flux, and a higher flux would mean a higher G. The units of G do not immediately reveal such a reference.

Reconsider the units of G now represented as:

$$Units\ of\ G = \frac{m^2}{kg} * \frac{N}{kg} \qquad \text{Eq 27}$$

, where m^2/kg is a typical unit of a specific absorption coefficient, and N/kg is the unit of a force applied per mass (or the acceleration of a mass, if simplified), as would typically be applied to a friction coefficient. An absorption coefficient may be associated with a flux, and since G is used as a factor to calculate, among other things, force enacted upon mass, it is therefore arguable that G could be associated with a measure of flux, if absorption and friction can be shown as relevant.

From the solar flux equation [Eq 26], an increase in flux is associated with an increase in force. It must immediately be argued that the proposed omnidirectional photon flux of this paper is NOT coming from the sun and other stars, else earth would have felt a definite repulsion from the sun, not an attraction. Since gravity effects appear as a ‘pull’ and not a ‘push’, and flux provides a ‘push’ unto mass, a flux solution for gravity may rather be found by finding attraction as a ‘lack of flux’.

Space exists all around, thus flux must necessarily be omni-present and omni-directional. Gravity would be formed if there is somehow an imbalance created in the flux, as has been shown above [Eq 23] [Eq 25]. An imbalanced flux will result in acceleration (or gravitation) of mass. A balanced flux would imply zero acceleration of mass.

At this point in this discussion it is not yet intuitive to envision how a mass can enact a net inflow of flux. However, if an omni-directional flux exists, to which all mass is transparent, then, if some flux is absorbed in the mass, there will be less outgoing flux. The appearance is of a net ‘inflowing’ flux. The absorbed component of flux must necessarily be dispersed and cannot be ignored. However, it will be considered to not contribute against the gravitational effect but be dissipated as heat.

If it can thus be found that massive objects reduce outgoing flux, by ‘consuming’ incoming flux, hence creating an imbalance in the flux, a mechanistic description of gravity could begin to form. The measure of gravitational strength ‘G’ will then be (in part) a measure of the ‘flux absorption’ into objects of mass.

This document pursues this line of thought and firstly argues that G acts (in part) as an absorption coefficient of the flux.

6.3 Two body gravitational interaction

A standard Newton equation for gravitation is:

$$F = \frac{G * m_1 * m_2}{r^2}$$ *Eq 28*

Where it is assumed, G is a constant, and m_1 and m_2 represent the masses of the 2 bodies in the gravitational interaction. The distance between the centres of mass is r, and the force F enacts equally on both masses.

To calculate the acceleration of each mass in the interaction, the equation would be shown as:

$$F = m_1 * a_{m_1} = m_1 * (\frac{G * m_2}{r^2})$$ *Eq 29*

With an equal and opposing force toward the other mass, with its own acceleration:

$$F = m_2 * a_{m_2} = m_2 * (\frac{G * m_1}{r^2})$$ *Eq 30*

This has been tested to high precision[25, 26].

With the use of a torsion balance, and various other methods[27], the attraction of two masses is used to calculate 'G'. One mass is not sufficient to do such a test. At least two objects of mass are required. Measurement of G *must* be considered as a test of gravity between two masses.

It has already been discussed that gravity would be a result of absorption of flux into mass. For a gravitational effect to occur, two masses need to be in 'gravitational sight' of each other. The argument is immediately; if 'G' is in part a measure of absorption, which mass gets the 'G', when the interaction must require both masses to absorb flux, possibly in unequal measures due to unequal composistions? 'G' must be shared between the two masses in ratio to mass. This means for the 2 masses in the test for the value of G:

$$G = G_1 + G_2$$ Eq 31

Where G_i are (in part) the absorption vectors for each mass.

The use of G has until now not been found to be problematic because the combination M*G is always used in calculations. But whereas M*G may be calculated and used correctly, an error in G will result in an error in M.

For this flux gravity theory to bring new predictions though, the masses need their own absorption coefficients. See [Figure 11].

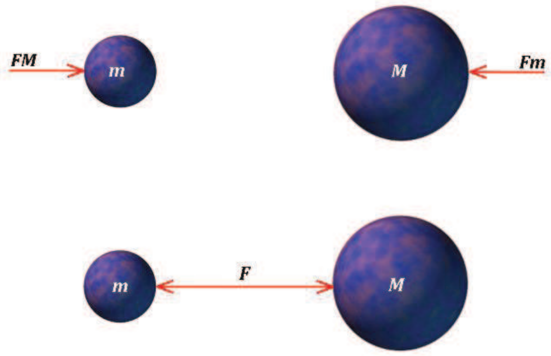

Figure 11: Mass m enacts a force unto mass M, and so also M unto m. It results in a perceived force that enacts on both masses equally. What is perceived as a 'pull force' between masses, is a result of a net push force on each mass.

Where each mass establishes an imbalanced flux field, (note: g_1, g_2 are not the total accelerations of the masses)

$$g_1 = \frac{(G_1 * m_1)}{r^2} \quad \text{Eq 32}$$

$$g_2 = \frac{(G_2 * m_2)}{r^2} \quad \text{Eq 33}$$

which can only be enacted by bringing another mass into measurable range, where each field acts unto the other mass, and the total force results from their combined flux imbalance fields.

Here, a note needs to be inserted to explain the apparent 'instant action at a distance' which ensues from Newton's equation. It has already been established that gravity moves at the speed of light[43], yet Newton's equation does not seem to rely on the speed of light. It is as if the mass 'knows' where the other mass is. Understanding the imbalance created by the absorption of flux takes the mysticism out of this effect. A mass can establish an imbalanced flux field before another mass might approach. When the other mass approaches, it seems as if there is an instant gravity between the masses. The masses are moving into each other's 'imbalance fields', *which is already there*, hence the instant action. (However, the scenario presented here, and Newton's equation, does not yet provide a solution for relativistic masses.)

From [Eq 32] and [Eq 33] Newton's equation could become:

$$F = F_1 + F_2 = \frac{(G_1 * m_1)}{r^2} * m_2 + \frac{(G_2 * m_2)}{r^2} * m_1 \quad \text{Eq 34}$$

$$\boxed{F = \frac{(G_1 + G_2) * m_1 * m_2}{r^2}} \quad \text{Eq 35}$$

, which is noticeably Newton's equations if $G_1 + G_2 \approx G$. Newton's equation is thus recognised to be a general solution for 2 bodies of similar composition only.

7. Calculation of Flux absorption

For an omnidirectional photon flux to result in a gravitational 'attraction', a portion of flux must be absorbed in a mass:

$$Flux_{out} = Flux_{in} - Flux_{absorbed} \quad \text{Eq 36}$$

Here flux is measured in units of 'number of photons/m^2/s', and no reflection or scattering is considered. Momentum transferred by absorbed flux (after absorption and re-emission) is considered as negligible.

It has been shown that the gravitational constant 'G' [Eq 27] may be associated with the absorption of flux. Here it will be shown that an imbalance in flux (due to absorption by mass) causes a net inward flux potential.

7.1 Flux absorption

It is known that absorption of x-rays[28,29,32] follows an exponential decay curve as shown in [Figure 12] and [Eq 37]:

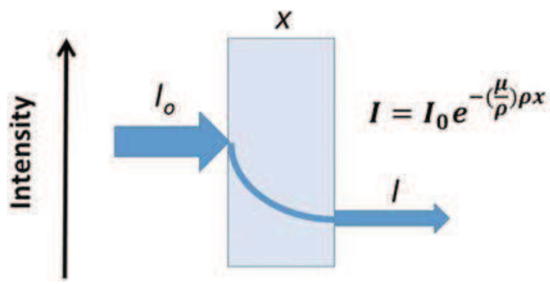

Figure 12: Typical X-Ray absorption curve over a distance x. Picture from: http://physicsopenlab.org/2018/01/20/x-ray-absorption/

$$I_{(x)} = I_{0x} * e^{[-(\frac{\mu}{\rho})\rho X]} \quad \text{Eq 37}$$

where ρ is the density of the element (g/cm^3), μ is the linear attenuation coefficient, and μ/ρ is the mass attenuation coefficient given in cm^2/g. Note that x-ray absorption is not influenced by the crystal structure of the pigment, but only by the number of atoms/cm^3 and the thickness of the pigment layer.[28]

From [Eq 37], absorbed flux into a mass equals:

$$I_{abs(x)} = I_{0x} - I_{(x)} \quad \text{Eq 38}$$

$$I_{abs(x)} = I_{0x}(1 - e^{[-(\frac{\mu}{\rho})\rho x]}) \quad \text{Eq 39}$$

, where ρ is the density of the element (kg/m^3), (μ/ρ) is the mass attenuation coefficient given in m^2/kg, I_0 and $I_{abs(x)}$ have units of 'number of photons/m^2/s'. Again, we consider only the x-components of flux, as was done in [Eq 1], so that for any point:

$$\overrightarrow{I_{0x}} = \sum_i \overrightarrow{I_{xi}} \cos\theta_{xi} \qquad \text{Eq 40}$$

[Eq 39] is seen to be the result of an integral of an exponential function with boundaries (0 – x); thus, equalling the total linear absorption of flux across a linear distance x, in one axis of x only. See [Figure 13].

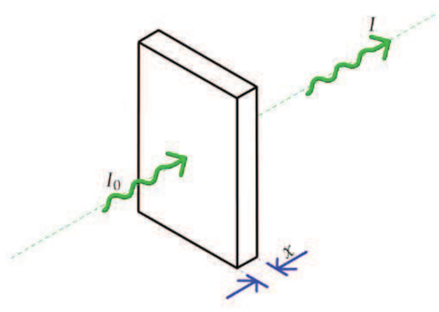

Figure 13: Representation of absorption of a unit of flux through a thickness of 'x'

Since $I_{abs(x)}$ is the absorption of photons per m^2 per second, absorption through a surface area (A), will be the absorption multiplied by area (A), resulting in the total absorption of flux into a cubic volume; through an area A=Y*Z, across distance x, resultant $I_{abs(vol)}$ has units of 'number of photons/s'. See [Figure 14].

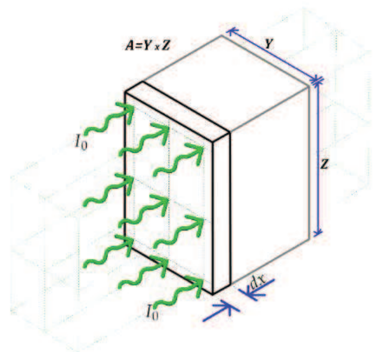

Figure 14: Representing absorption of a measure of flux across an area A, through a distance x

Absorbed flux for the volume can now be calculated:

$$I_{abs(vol_x)} = I_{0x}\left(1 - e^{\left[-\left(\frac{\mu}{\rho}\right)\rho X\right]}\right) * A$$ *Eq 41*

$$I_{abs(vol_x)} = Y * Z * I_{0x}\left(1 - e^{\left[-\left(\frac{\mu}{\rho}\right)\rho X\right]}\right)$$ *Eq 42*

A Taylor expansion for e^{-ax}

$$e^{[-(\frac{\mu}{\rho})\rho X]} = 1 - (\frac{\mu}{\rho})\rho X + \frac{(\frac{\mu}{\rho})^2\rho^2X^2}{2!} - \frac{(\frac{\mu}{\rho})^3\rho^3X^3}{3!} + \cdots$$ *Eq 43*

Which simplifies for small values of $(\frac{\mu}{\rho})\rho x$ to:

$$e^{[-(\frac{\mu}{\rho})\rho X]} = 1 - (\frac{\mu}{\rho})\rho X$$ *Eq 44*

Simplifying [Eq 42]:

$$I_{abs(vol_x)} = Y * Z * I_{0x}(1 - (1 - \mu\rho X))$$ *Eq 45*

$$I_{abs(vol_x)} = \rho * XYZ * \mu I_{0x}$$ *Eq 46*

, which XYZ equates to a volume of a cube, and ρ is density, hence ρ*XYZ=M.

Compare the above steps for e.g. a sphere, where area $A = \pi r^2$ and length x is the mean path for a photon through a sphere (x = 4r/3), then $4/3\pi r^3 * \rho = M$ for the sphere.

$$I_{abs(m_x)} = \mu I_{0x} * M$$ *Eq 47*

Here $I_{abs(m)}$ is in units of 'number of photons/s' (or vector components there-of) from any single direction.

From [Eq 47] it is seen that there is a net absorbed flux into the mass (per second). It is postulated that for any mass, total flux absorption, from all directions, is:

$$Flux_{abs(m)} = \mu * Flux_{in} * M$$ *Eq 48*

, however, it should be noted that a non-uniform, or non-symmetric, shape of mass e.g. a rod, will not have a uniform absorption.

Due to absorption of flux into the mass, an imbalance of flux (in vs out) is formed around a mass (M). This imbalance will be shown to be the cause of acceleration of other masses in the vicinity.

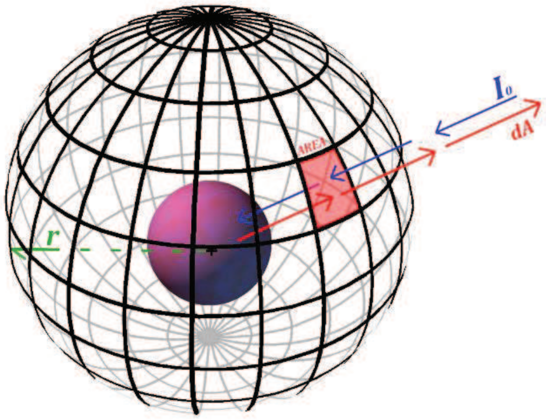

Figure 15: Gaussian sphere depicting measurement of flux at distance (r) through an area (A)

To predict the effect of this interaction over a distance, since the imbalanced flux is a vector field pointing in toward the (centre of) mass, invoking a Gaussian sphere, see [Figure 15], to measure the absorbed flux through an area (A) at a distance (r) from the centre of the mass:

$$\frac{Flux_{abs}(r)}{A} = \frac{\mu * Flux_{in}}{4\pi r^2} * M \quad \text{Eq 49}$$

, or

$$Flux_{abs}(r) = \frac{\mu * Flux_{in} * M}{4\pi r^2} * A \quad \text{Eq 50}$$

7.2 Flux interaction with mass (momentum transfer)

It has been shown in [Eq 48] that a fraction of the omni-directional flux is absorbed into a mass.

Should another mass (m) be in proximity of (M), (also contributing its own flux-imbalance through absorption), the imbalances in flux will interact on objects of mass (m) and mass (M) to accelerate toward each other, as already discussed in section: [Gravitational mass].

Danilatos[39] argues that gravitational attraction results from momentum transfer due to absorption within this imbalance. It is correct that an imbalanced flux, due to M, around m, will also result in an imbalanced flux absorption into m. This will in turn result in imbalanced momentum transfer unto m and appear to push m toward M. However, it is expected that this component will be negligibly small for the purpose of this document. If it were not small, this hypothesis would still suffer from the energy crisis of Le Sage. See argument in sections: [12.4 Energy of Absorbed flux], [8.2.7 Energy: Absorption; Thermodynamic problem;].

It is rather argued, as has been presented earlier in this document [Gravitational mass as a measure of the flux], that there is a direct momentum transfer from the net flux imbalance traversing through, and coupling with, the entire mass. To note here: The flux imbalance of one mass enacts a momentum transfer onto the other mass.

From [Eq 50] and [Figure 16], choosing spheres as interacting objects: Mass (M) creates an imbalanced flux around itself due to flux absorption. The mass (m) presents itself with a cross-section area ($A = \pi R^2$) through which the imbalanced flux (of M) will enact a push (toward M). [This covers one side of the interaction only]

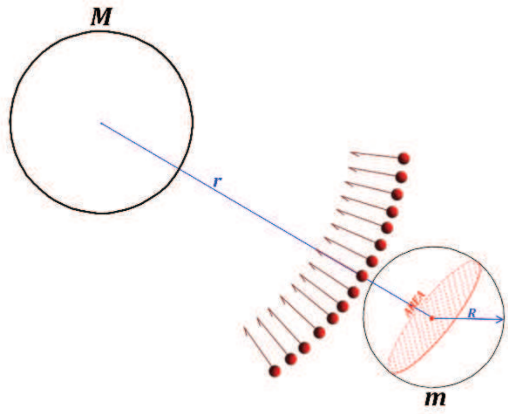

Figure 16: From the vantage point of mass M, mass m presents to it with a cross-section of surface area: $A = \pi R^2$

The mean free path of a photon through a sphere[30,31] is equal to:

$$L_{eff} = \frac{4R}{3} \qquad \text{Eq 51}$$

For this interaction of flux through the mean free path length, across area (A), a friction coefficient (f_z) of interaction is required, where the flux will enact an acceleration (push force) unto mass-density, in units of Nm^2s/kg or m^3/s. Since the flux I_0 is measured in (number of photons/m^2/s) the resultant units of $I_0 * f_z$ is in (N/kg).

From [Figure 16], a force is perceived to exist from one mass (M) to another (m) as the imbalanced flux, caused by (M), traverses through (m). Mass (m) has radius R_m, and density ρ_m:

$$F_m = Flux_{abs(M)}(r) * f_z * L_{eff(m)} * \rho_m = \frac{\mu * Flux_{in} * M}{4\pi r^2} * \pi R_m^2 * f_z * \frac{4R_m}{3} * \rho_m \qquad \text{Eq 52}$$

$$\frac{\mu * Flux_{in} * M}{4\pi r^2} * (\frac{4\pi R_m^3}{3} * \rho_m) * f_z = \frac{(\frac{\mu * Flux_{in}}{4\pi}) * M}{r^2} * m * f_z$$

There is thus no pull force acting between the masses. The imbalance in flux, caused by absorption into each mass, is enacting a friction push force directly toward the other mass, which may have been thus far perceived as a 'pulling force' from the other mass.

The perceived force from mass M unto mass m, measured in Newton (N) is thus:

$$F_m = \frac{Flux_{abs(M)}(r) * f_z * m}{Area} = \frac{(\frac{\mu * Flux_{in} * f_z}{4\pi})) * M)}{r^2} * m \quad \text{Eq 53}$$

, while, assuming a uniform (balanced) local surrounding flux, the mass m also exerts a force unto mass M:

$$F_M = \frac{Flux_{abs(m)}(r) * f_z * M}{Area} = \frac{(\frac{\mu * Flux_{in} * f_z}{4\pi})) * m)}{r^2} * M \quad \text{Eq 54}$$

Since the masses will be accelerating toward each other, the perceived total force is the sum of the forces between two masses M and m, which causes the total acceleration toward each other. From [Eq 35]:

$$F = \frac{(\frac{\mu * Flux_{in} * f_z}{4\pi})) * M * m)}{r^2} + \frac{(\frac{\mu * Flux_{in} * f_z}{4\pi})) * m * M)}{r^2} \quad \text{Eq 55}$$

$$F = \frac{((\frac{\mu * Flux_{in} * f_z}{2\pi}) * M * m)}{r^2} \quad \text{Eq 56}$$

, or shown as the familiar Newton's equation:

$$F = \frac{G * M * m}{r^2} \quad \text{Eq 57}$$

, revealing gravity because of flux absorption, flux intensity, and a friction interaction between photons and mass, and G as a non-constant function of the local flux:

$$G = \frac{\mu * Flux_{in} * f_z}{2\pi} = 6.67 * 10^{-11}(\frac{m^2}{kg} * \frac{N}{kg}) \quad \text{Eq 58}$$

Now it becomes evident that Newton's equation is a 2-body approximation for 'low' values of G*M, since the term $e^{-\mu\rho x}$ from [Eq 42] does not reappear in the equations above but remains simplified. It also needs to be pointed out that this flux absorption model is based on 'standard' molecular masses, that μ likely varies for different materials, and might vary greatly for 'degenerate' masses e.g. neutron stars or black holes. Necessarily, variations in local flux ($Flux_{in}$), or imbalances in local flux, must cause variations in perceived gravity, as discussed in the example under section [12.1 The flux and gravity in a spiral galaxy disc].

8. The Fatio/Le Sage shadow gravity theory

Several valid problems have been identified in Fatio/Le Sage type push-gravity theories (Also known as Le Sage's Shadow Theory)[1-4,36-43].

In the references above, several of the authors attempt a revision of Le Sage, with some successful corrections thereof, however not holistic. To date these theories have still not been widely accepted. From[43]:

> *Although it is not regarded as a viable theory within the mainstream scientific community, there are occasional attempts to re-habilitate the theory outside the mainstream, including those of Radzievskii and Kagalnikova (1960), Shneiderov (1961), Buonomano and Engels (1976), Adamut (1982), Jaakkola (1996), Tom Van Flandern (1999), and Edwards (2007)*

A great number of these 'problems' stem from at least some misunderstanding of the original push-gravity theories. As 'shadow-gravity', it is sometimes incorrectly understood that gravity must have a 'light-speed or better' connection between objects of mass and that attraction only ensues when a mutual 'shadow' has been established between masses. Defining this connection has been troublesome and has led to many failed attempts at push-gravity.

Almost every gravitational theory currently suffers from the 'speed of gravity' problem (GR excluded). As an example of this, if a photon, a 'graviton', left the sun toward earth for purposes of attracting the earth when it arrives, the orbital speed of the earth would move it out of the photon's path in the ~8 minutes it takes the photon to get there, and the photon will find nothing there to attract. Add to that it must not only be intuitive to interact at the correct location, but also then return to the sun to effect upon it a full 'graviton exchange'. To correct this idea, to thus 'connect' sun and earth, a successful graviton leaving from the sun would need to know the velocity vector of the earth, which is absurd. It was erroneously thought the only way to overcome this problem, was to assign speeds to gravity much greater than the speed of light.

This document no longer suffers from Le Sage's problems. The problem statements below will not be extensively elaborated in this section; please refer to the references for exceptional reviews of Le Sage and the problems associated therewith.

8.1 Problems with Fatio/Le Sage theories:

Some of the problems encountered by Fatio and Le Sage have by now been overcome by advances in science, but many have remained unsolved. The issues below are now solved and clarified, either in currently established science, or in this preceding document.

8.2.1 Porosity of matter

Problem: Leibniz criticized Fatio's theory for demanding empty space between the particles:

Solution: At the time of the writings of Fatio and Le Sage, little was known about the atom and electron, as is known today. This problem can be discounted since atoms are now known to be largely ‘empty space’. Furthermore, the premise of this document is that matter is transparent to the omnidirectional flux, like glass is to visible light, and the absorption of flux scales with density. Empty space, although present in ‘normal atoms’, is no longer a requirement for this hypothesis.

8.2.2 Superluminal speeds of particles

Problem: Corpuscles had to be severely small as to not have a large cross-section. To compensate, and still transfer sufficient momentum, particle velocities had to be raised to greater than the speed of light.

Solution: In this document the speed of light is the speed of the flux, and the flux interacts with mass through a friction coefficient. The ‘sizes’ of the flux photons are irrelevant for this hypothesis.

8.2.3 Surface area, or volume, not mass

Problem: Flux interaction will interact on a volume, and it is known that gravity is mass dependent, not volume or surface dependent.

Solution: This document has shown that flux travel through an area, also needs to account for travel at a normal to the area, through the entire mass, which ends in a calculation of volume. Account for density ρ into equations, to convert a volume to mass. It is intuitive that a higher density will receive more interaction with any flux.

8.2.4 Gravitational shielding

Problem: If a mass absorbs flux, it will shield the next mass of some flux, and gravity will be lower on the next mass, and the next mass, and so on.

Solution: Gravitational shielding was perceived to be a big problem for the Fatio/Le Sage theory. However, an understanding of the mechanism of gravity now brings evidence that shielding is real, as flux will be absorbed and reduced through multiple masses, or very large masses. It can be observed in e.g. non-uniform gravity in spiral galaxy disks, and in ocean tides on earth. Shielding is not a problem, but a support of this hypothesis.

8.2.5 Speed and Range of gravity, Instant action at a distance, Aberration

Problem: Due to the finite speed of gravity, an object should be attracted to its historic location, at a distance d=ct. LaPlace calculated that the speed of gravity must be ‘at least a hundred millions of times greater than that of light'. Even today it is not understood how Newton's equations know 'where the mass is', and how a mass can instantly be attracted over a great distance. It defies the rules of causality and can thus far only be explained by letting the interaction exceed the speed of light.

Solution: With this omnidirectional flux theory, mass absorbs flux and creates an imbalance in flux-in vs flux-out, all around every mass. An imbalance travels outward at the speed of light and is no longer dependent on its originating mass. When another mass meets the imbalance, the imbalance is already there. An action ensues between them, creating an impression of instant action at a distance. Although not done here-in, this hypothesis can be extended to apply to relativistic gravity.

8.2.6 Drag

Problem: Gravity through absorption seems to work fine until bodies start moving, then flux particles will 'pile up' on the leading face of a mass and cause noticeable drag. Since a drag is not observed in orbiting bodies, this was considered a 'death-blow' to the corpuscle theories.

Solution: In this theory of photon flux, momentum is transferred from photon to mass, but retrieved after transit through the transparent mass. In a balanced flux, even if the mass has 'velocity', there is no net transfer of momentum to or from the flux, and thus there is no net drag effect.

8.2.7 Energy: Absorption; Thermodynamic problem;

Problem: Given the superluminal speeds of particles mentioned above, most Fatio/Le Sage variations would result in 'blowing up the earth' due to scales of absorbed energy.

Solution: This hypothesis agrees that absorbed photons would ultimately generate heat. However, the heat scales to mass sizes, and, for a chosen value of μ, are found to be well within bounds of known energy limits of e.g., planets. It is shown that (most of the) internal heat of each Jovian planet is due to flux absorption, and at least a fraction of the energy from the sun is due to flux absorption.

8.2.8 Massive bodies absorb flux, Growing earth

Problem: Omnidirectional flux of corpuscles gets absorbed to create the shadow effect. Where do the corpuscles go? Fatio and Le Sages corpuscles needed to be absorbed, or somehow discreetly discarded. Some theories suggested a 'growing earth' from these accumulated particles, for which no evidence exists.

Solution: This seems to have been defined as a problem, but it is indeed a part of the solution. Massive bodies do absorb some flux, thereby creating a surrounding flux imbalance.

Apart from the fraction of flux that is absorbed, clearly defined in this document, all flux photons would transit a mass with their original energy intact. Flux in transit, if not balanced, will result in acceleration of the mass.

8.2.9 Coupling to energy

Problem: The question is, 'how does push-gravity attract a photon toward a mass?'

Solution: This problem arises from labelling gravity as an 'attractive' force, when it is a result of 'push' force. It can be argued that the 'gradient of the flux' is what is understood as Einstein's 'curved space'. Solutions may be borrowed from electromagnetic flux-theory in support here-of. It brings with it the solutions to bending of light and red-blue gravitational shifting of frequencies.

8.2.10 Particles exit with reduced velocity

Problems: Corpuscles that are not absorbed may have some interaction with the mass and will eventually lose velocity, thereby no longer contributing to 'the flux'.

Solution: A flux photon arrives at 'c' and leaves at 'c' unless it is absorbed. Inside the mass it traverses at 'v=c/n'. A flux-photon, in a balanced flux, that has not been absorbed, does not lose its energy. A flux-photon that partakes in accelerating a mass loses energy, while the mass gains energy.

8.2.11 Particles would collide with, and attract each other,

Problem: No matter how small, corpuscles must bounce against each other. An omni-directional flux of particles that does not annihilate itself is hard to fathom.

Solution: Photons are bosons and the above does not apply.

8.2.12 Special relativity (SR)

Problem: To maintain a shadow, corpuscles must travel at greater than the speed of light.

Solution: The speed of light is a universal limit. This document has shown the local flux to be the limiter, and any relative movement in a balanced flux immediately becomes relativistic. This document is SR compliant, but general solutions have only been offered for low-velocity scenarios. However, since flux theories are greatly understood in e.g electromagnetism, expanding this solution to relativistic cases is just a next task to be taken, and not seen as an insurmountable problem.

8.2.13 Ultramundane particles, Cosmic radiation, Omnidirectional flux

Problem: Fatio/Le Sage proposed a new 'ultramundane corpuscle' as an omnidirectional flux, with origin outside of the universe. Even though Newton was exploring the particle behaviour of light, little was known of the 'photon' as a particle. Fatio and Le Sage required particles with mass (corpuscles) to transfer momentum unto mass.

Solution: A photon flux overcomes this problem since the photon will only transfer momentum while in transit through a transparent medium, then reclaim its momentum at exit, unless it is wholly or partially absorbed during transit.

The problem of the flux origin has not been overcome. The (apparently infinite) source of the flux has not been established. There is much to do, and finding the source of the flux is one of many tasks at hand. 'Not knowing' the origin of the flux does not diminish this hypothesis.

9. Conclusion

Through interaction with the omnidirectional flux, mass is measured. If a mass is accelerated in a balanced flux, its mass arises as a function of the strength of the local flux. If a mass exists in an imbalanced flux, it is accelerated by the flux, and its mass is revealed as a function of the strength of the local flux. Inertial and gravitational mass is unified.

It has been argued above that gravity ensues from of a 'lack of' outgoing flux from a mass. A fraction of flux is absorbed in all mass, which results in a surrounding flux imbalance. In a balanced flux a mass remains at rest (or at constant velocity), but it will accelerate in an imbalanced flux. If the imbalance was created by absorption into a mass, gravity ensues. From the omni-directional flux a mechanistic understanding of gravitation thus arises, which leads to a conclusion that 'G' (universal gravitational constant) is not universal and is not a constant.

This study reveals that, from the premise of an omnidirectional flux, concepts emerge of distance and time, mass, and the subsequent workings of gravity. It can be envisaged that a gradient in flux represent Einstein's 'curved space', as the source of gravity when 2 objects (or more) of mass approach. The same gradient can also be envisaged to bend a passing light signal and red-shift or blue-shift outgoing or incoming photons, and that time must pass slower in a weaker or imbalanced flux. The above omnidirectional flux concept not only adheres to Special Relativity but strongly supports it, and brings a new understanding of its workings.

Through our further understanding of the workings there-of, pursuit of this model will inevitably lead to a quantum solution for General Relativity, with G as a measure of local flux, and hopefully also assist to solve the immediate Dark Matter dilemma.

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12. Addendum

12.1 The flux and gravity in a spiral galaxy disc

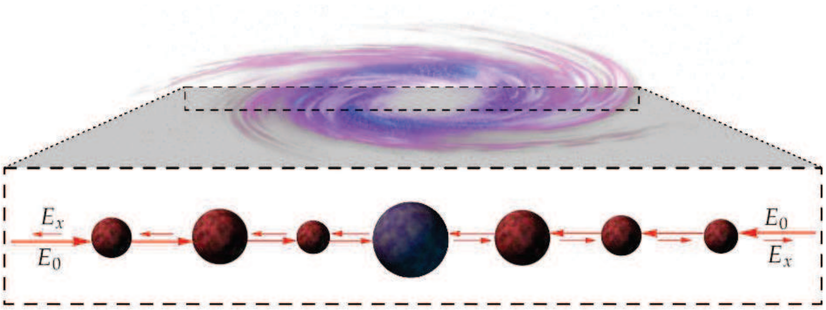


Figure 17: Representation of flux absorption in a spiral galaxy disk, viewed side-on, shows diminishing flux from each side until out the other side.

Consider only the flux in the plane of the disk. [Figure 17] and [Figure 18] show exaggerated flux absorption curves ($I_0e^{-\mu x}$) into the plane of the disk of a spiral galaxy – edge on. For purposes of illustration the absorption into a central black hole is not distinguished from 'standard' absorption. Curve y_3 is the difference between the curves and represents the local flux imbalance in the disk at a distance from the centre.

From the preceding document it is evident that G is directly proportional to the strength of the local flux. A non-constant value for G in a galaxy disk is thus predicted. The results below show a stronger incoming flux strength, and a weaker outgoing flux strength, and thus a larger flux imbalance, toward the outer edges of a galaxy disk, which causes increased inward gravitation on the systems in the outer areas of the disk. This may create an impression that there is additional mass (Dark Matter) in the system to cause this increased gravitation.

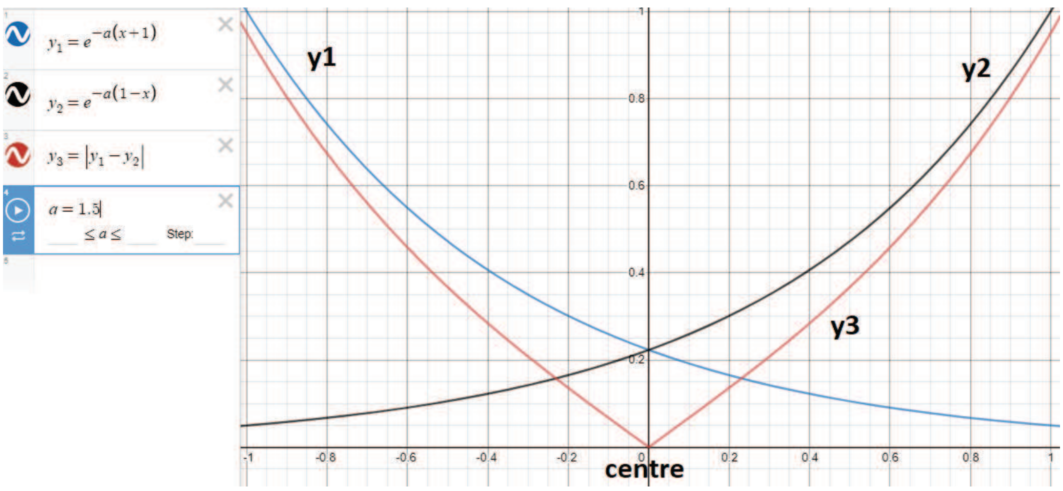


Figure 18: Depiction (merely a representation, exaggerated, not to scale) of absorption into the plane of a galaxy disk (y_1=flux left and y_2=flux right). y_3=|y1-y2| shows increased flux imbalance toward outer regions of the disk. y_3 is an exaggerated representation of varying G across the galactic disk, with a minimum (but not zero) in the centre.

12.2 Proposed Clock Experiment

An experiment is proposed to validate the existence of the omni-directional photon flux.

It is known from GR[5] that clocks are slowed in a gravitational field. A clock moved away from a large mass will speed up, and a clock brought closer to a large mass will slow down[44]. The conclusion from GR is that increased gravity slows the clock.

This hypothesis argues that it is absorption of flux into a mass, causing a flux imbalance around the mass, which reduces flux around (through) the clock and causes it to slow down.

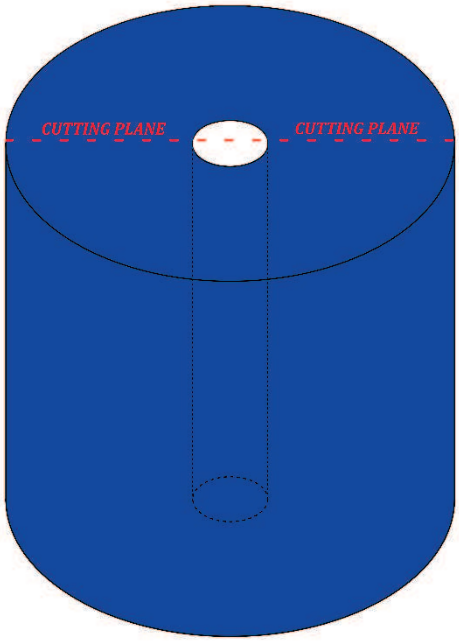
If clocks are 'ticked' by the flux, reduced flux close to a massive object will reduce a clock's speed. The purpose of this experiment is to determine if clock speeds are influenced by local flux density, or merely by the measure of gravity.

12.2.1 Equipment:

A clock
A large pool, above-ground
A waterproof container or channel secured in the centre of the pool
Liquid to fill the pool

12.2.2 Procedure

While the pool is empty of liquid, place the clock – in the centre – at the bottom of the pool and take a reference of the clock speed. See [Figure 19]



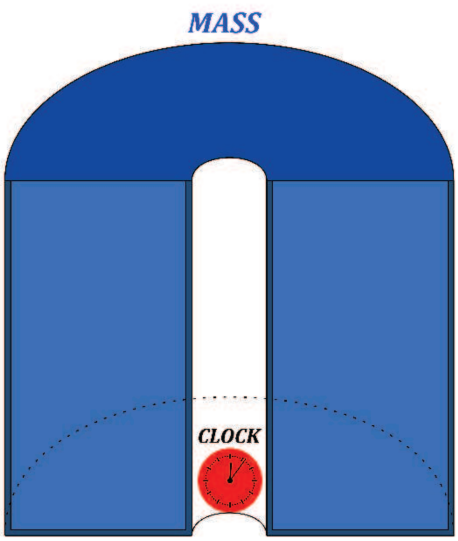


Figure 19: A clock is placed at the bottom of a pool

The clock is placed in a watertight enclosure so that the clock itself is not submerged, thus buoyancy has no direct effect on the clock. The enclosure or channel is secured so that it is not affected by buoyancy.

Fill the pool with liquid, and measure clock speed while the pool is filling, until full.

12.2.3 Discussion of expectations

The clock will be slowed by the earth's gravity but measuring this effect is not important for this experiment. If the clock is not moved (relative to the earth) during the experiment, this effect will remain constant during the experiment, and not influence the result.

With the clock in the centre of the pool, no (sideways) gravity is added except from the net mass of water being symmetric above the clock. From the clock's perspective, the mass of the water is opposing earth's gravity and the clock will feel less gravity from the earth.

Note: The mass of water above the clock should be subtracted from the mass of the earth during the experiment since the water is taken from earth. Due to gravity falling off over $1/r^2$, this effect may be negligible and can be ignored because the distance to earth centre is magnitudes higher than the distance to the (centre of mass) water in the pool.

1. GR[5] predicts that a mass (water in pool) above the clock will reduce the gravity unto the clock, and the clock's speed will ***increase*** as the pool fills up.
2. Flux theory predicts that the water mass above the clock absorbs additional flux around the clock, and the clock speed will ***decrease*** as the pool fills up.

See graph in [Figure 20] for opposing expectations:

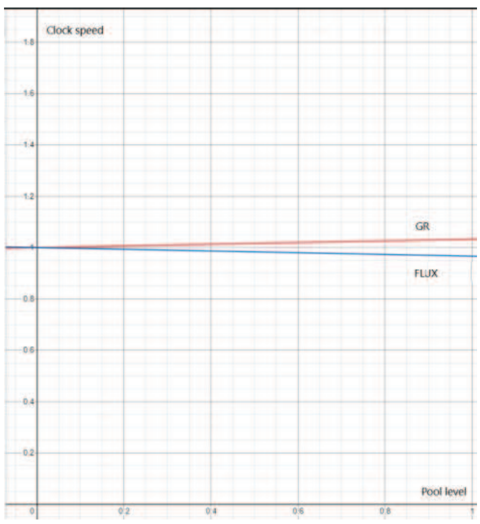


Figure 20: Expectation of clock speed variation; GR predicts a clock speed increase; Flux theory predicts a clock speed decrease.

Conclusion: If the clock in the bottom of the pool slows down more, it is due to increased flux absorption in the surrounding mass.

By extension of this experiment, a clock that is lowered into e.g. a vertical borehole shaft into the earth, will, according to GR, increase clock-speed up until it reaches the centre of the earth where g=0, and there the clock speed must equal maximal clock-speed in a remote vacuum. In opposition, this hypothesis predicts that the clock will have a lower speed at the centre of a large mass.

12.3 Time and Space

In a quote from Lee Smolin on Scientific American[14]:

> *Initially there is no space—just a network of individual elementary events, together with the relations expressing which of these were the direct causes of which other events. The notion of the flow of events collectively giving rise to a smooth description in terms of the geometry of a spacetime must emerge—and the most important aspect of this is locality. The notion of distance must emerge, and in such a way that those events that are close to each other are, on average, correspondingly more likely to have influenced each other. Getting this right is the holy grail of quantum gravity theorists.*

For the omnidirectional flux, ‘c’, the speed of light, is fundamental as the velocity of the flux in vacuum, which in SI units is measured in metres per second. It is the speed at which messages are directly conveyed from an event to an observer. The flux is thus the agent of causality. Without the flux, the universe is static, and if no information goes from A to B; no event ‘happens’ at A or B. Distance and time cannot be perceived unless information is transferred from A to B, in a certain time t.

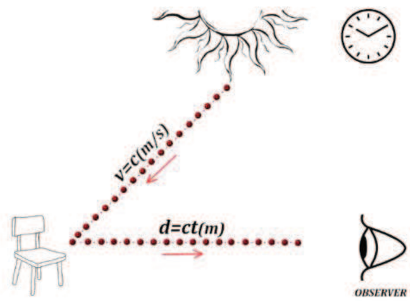


Figure 21: Flux is measured at the speed of light, and from it emerges time and distance. Choose one as a base, and the other can be calculated.

Consider [Figure 21]. With an omnidirectional photon flux travelling inward & outward at ‘c’ everywhere, TIME and SPACE are emergent. A base must be set for one, to calculate the other. Distance vector D in 3D Euclidian space is defined as D=cT, where time (T) is a scalar choice of measure. Even here one observer may differ from another, but this has already been well addressed in Einstein’s Special Relativity[18].

In an omnidirectional photon flux the clocks of atoms are driven by the flux. The highest clock time may be achieved in open space, away from gravitational sources. In a strong gravitational field, the flux is imbalanced in at least 1 direction (toward the local gravity source), and the atom’s clock is slowed down.

12.4 Energy of Absorbed flux

From [Eq 48]

$$Flux_{abs} = \mu * Flux_{in} * M \qquad \text{Eq 59}$$

$Flux_{abs}$ (number of photons/s) and $Flux_{in}$ (number of photons/m^2/s) represent 'numbers of flux photons'. In a previous section [Inertial mass as a measure of the flux] the sum of all photons with an x-component was combined to be represented by two photons with energy E_0. Thus, for energy purposes, it is taken that $Flux_{in} = 2$, (I_0 = count of 2 photons/m^2/s) which each has an energy of E_0/s (J/s).

It has also been shown that acceleration in the flux reveals the relation $2E_0 = mc^2$, whereas $2E_0 = E_{0x}$ is the sum of energies of all +x and -x components of flux into the mass. The total flux energy would be the components of y and z as well:

$$E_{total} = E_{0x} + E_{0y} + E_{0z} \qquad \text{Eq 60}$$

For a balanced flux the x,y,z components would likely be equal in magnitude, and the total energy is then:

$$E_{total} = 3E_{0x} = 6E_0 \qquad \text{Eq 61}$$

From [Eq 13], the total energy absorbed is then:

$$E_{total} = 3 * Mc^2 \qquad \text{Eq 62}$$

From [Eq 13] and [Eq 59], the absorbed energy per area is:

$$\frac{E_{abs}}{A} = \frac{\mu * E_{total} * M}{4\pi R^2} \qquad \text{Eq 63}$$

, where the total absorption area A is also the total surface area of the sphere $4\pi R^2$, thus:

$$\boxed{E_{abs} = 3\mu M^2 c^2 \ (W)} \qquad \text{Eq 64}$$

Absorbed energy is expected to emerge as heat.

12.4.1 Energy calculations for Jovian planetary heat, and an estimate of μ.

(Note: Speculative) Below is a comparison [Table 1] where all internal heat of earth and Jovian planetary bodies is taken crudely as being totally resultant of flux absorption from [Eq 64]. This is however not in line with current understanding of the origin of planetary internal heating and needs to be reviewed. [Table 1] is presented as an expected order of magnitude for μ.

$E_{abs} = 3\mu M^2 c^2\ (W)$			
Name	Mass (kg)	Energy Outflow (W)	μ = 1/3*E_{abs}/M^2/c^2 (m^2/kg)
Earth	6.0E24	4.4E13	4.5E-54
Jupiter	1.9E27	4.0E17	4.1E-55
Saturn	5.7E26	2.0E17	2.3E-54
Neptune	1.0E26	3.0E15	1.1E-54

Table 1: Energy outflows of Jovian planets are used to determine an upper boundary on μ

(source of energy data:
https://www.tcd.ie/Physics/people/Peter.Gallagher/lectures/PY4A03/pdfs/PY4A03_lecture10n11_ineriors.ppt.pdf)