Vacuum Refraction Theory of Gravity

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The gravity field does not supply the force or energy that accelerates a massive object. The force and energy originate in the accelerated object, which auto-propels toward the gravity centre. The auto-propulsive action is instructed by an anisotropic space-physical condition in Euclidean space, which is experimentally verifiable as an incremented refraction index of vacuum space around a massive object.

Introduction

Classical gravity theory is highly accurate, yet its methodology has given rise to many misconceptions in modern theory.

An accelerating force must also be the supplier of the energy of acceleration. The gravity field does not supply energy. It is therefore inconceivable that it exerts force. The theory says that the energy of gravitational acceleration comes from the potential energy associated with the position of the mass object upon which the gravity force acts. Where is the potential energy and in what form is it stored? Is it hidden in the object or in the position of the object in space?

Classical scientists invented 'potential energy' because theory was not yet advanced enough to find a concrete substitute. But ever since astronomy established that stars burn up their own mass through gravitational contraction and nuclear fusion, the concept of potential energy is ready for the dustbin. Scientists continue to use the concept, thereby introducing and maintaining many misconceptions associated with rest mass, potential energy and the classical concepts of the gravitational and electric fields.

A gravitationally accelerated object exteriorizes part of its rest mass by converting it into kinetic energy. This conclusions eliminates the need for the force-action of gravity fields and leads to the notion of self-propulsion of gravitationally accelerated objects. Self-propulsion is immediately plausible when: (a) the gravity field is seen as a gradient of the refraction index of vacuum space, and (b) mass particles are seen as self-confined auto-orbiting photons. The photon in the particle interior reacts to the index gradient and seeks to climb up toward a higher refraction region.

Nuclear experiments have shown that all mass particles constitute self-confined electromagnetic energy. The spin and gyro magnetic moment of every elementary particle prove that there is an orbiting process of electromagnetic energy at work inside every particle. These conclusions, properly understood, remove all speculation of action-at-a-distance associated with gravity fields and electric fields.

We will show that the gravity field is a manifestation of the gradient of the gravitationally induced refraction index increment

$$(n-1)=\frac{2GM}{c^2r}$$

around stellar objects. This increment is added onto the cosmic base level unity refraction produced by Universal mass. The increment is proportional to the Newtonian gravity potential energy as follows:

$$E_{pot}=\left(-0.5mc^2\right)\cdot(n-1)=-\frac{GMm}{r}$$

$$F=\frac{dE_{pot}}{dr}=\left(-0.5mc^2\right)\cdot\left(\frac{dn}{dr}\right)=\frac{GMm}{r^2}$$

The gravitationally incremented vacuum space refraction

$$n=1+\frac{2GM}{c^2r}$$

around M induces the self-confined photons in the mass particles of object m located at a distance r from M to exert radiative pressure toward M. This radiative pressure is proportional to the gradient dn/dr multiplied by the mass m, *i.e.*

$$P_{1\to 2}=-\frac{2GM}{c^2r^2}m$$

multiplied by a proportionality constant. Conversely, mass M exerts a radiative pressure toward m

$$P_{2\to 1}=-\frac{2Gm}{c^2r^2}M$$

times the same proportionality constant. Thus M and m attract each other equally.

The mass m is not moving relative to its own increment of the vacuum space refraction, and it cannot experience any force/effect that is significant for the immediate interaction between M and m.

The effective mass of an object remains invariant during non-dissipative gravitation. In other words, the kinetic energy, which results from gravitational acceleration (exteriorization of rest mass-energy) represents exactly the gravitational rest mass decrease, and matter as mass-energy is kept in one piece. The invariance of the effective mass of a non-dissipative gravitating object is here accepted as experimentally proven and as a widely acknowledged fact. Matter as mass is not conserved *per se*. If rest mass were conserved gravitationally we would not have fusion and stars that shine. No rest mass would be converted into kinetic energy and gravitational acceleration would not exist.

The "weight" of a gravitating object always changes with altitude, however minute the change, because the gravity acceleration F/m changes with altitude, like the gravity refraction index gradient.

Free-moving massive objects in gravity fields would obey Snell's simple law of light refraction, modified for subluminal speeds, if the gravitational rest mass conversion into and re-conversion from kinetic energy did not occur. This rest mass conversion, occurring whenever a mass object has a velocity component radially aligned with the gravity centre, is the very reason that planets gain or lose "potential" energy and concurrently lose or gain kinetic energy. The conversion of rest mass into kinetic energy when a mass object approaches the gravity centre, and the reconversion of this kinetic energy into rest mass when it moves away from the centre, explains why planets are able to orbit. Without mass-to-energy conversion controlled by the gravitationally induced refraction gradient of vacuum space, orbital motion is impossible. Light is unable to orbit under even ideal theoretical conditions for the simple reason that it has no rest mass to convert.

Photon deflection

Photon deflection by the Sun can be interpreted as due to a gravitationally induced anisotropy in the refraction of vacuum space. This interpretation is based on Snell's law (see Figure 1):

$$n_1\sin\alpha_1=n_2\sin\alpha_2 \qquad (1)$$

His equation must be modified for spherical anisotropy, where the differential of Snell's law must be used. Now the differential for a smoothly varying refraction in the z-direction and a planimetrically constant index in the (x,y) direction is

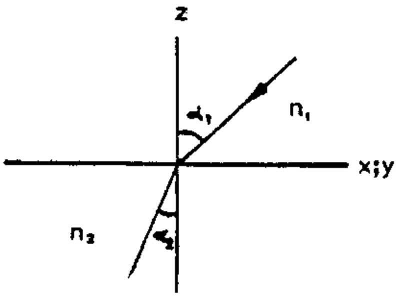


Fig.1

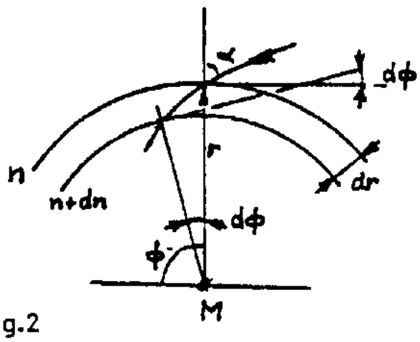


Fig.2

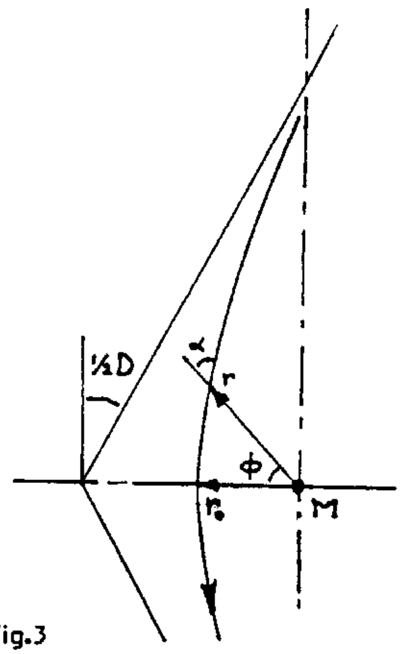


Fig.3

$$\frac{dn}{n}+\cot\alpha\, d\alpha=0$$

$$d\alpha=-\frac{dn}{n}\tan\alpha \qquad (2)$$

The differential is adapted to spherically varying refraction as follows (see Figure 2):

$$d(\alpha+\phi)=-\frac{dn}{n}\tan\alpha \qquad (3)$$

where $d\phi=\left(dr/r\right)\tan\alpha$.

Eliminating ϕ to determine angle a yields

$$d\alpha=-\tan\alpha\left(\frac{dn}{n}+\frac{dr}{r}\right) \qquad (4)$$

and by substituting $n=1+R_s/r$, where R_s is the Schwarzschild radius we get

$$\cot\alpha\, d\alpha=-\left(\frac{dn}{n}+\frac{dr}{r}\right) \qquad (5)$$

Integration then results in

$$\sin\alpha=\frac{r_0+R_s}{r+R_s} \qquad r\geq r_0$$

$$=\frac{n_0}{n}\cdot\frac{n-1}{n_0-1}$$

Equation (5) is Snell's law of light refraction modified for a spherical anisotropy of the refraction medium. This law can also be written as:

$$\frac{n_1\sin\alpha_1}{n_1-1}=\frac{n_2\sin\alpha_2}{n_2-1}$$

The integral for ϕ is

$$\phi_{\max}=\int_{r_0}^{r=\infty}\tan\alpha\left(\frac{dr}{r}\right)$$

Substituting $r=(r_0+R_s)/\sin\alpha-R_s$ and integrating, we have

$$\phi_{\max}=\frac{2(r_0+R_s)}{\sqrt{r_0^2+2r_0R_s}}\left[\tan^{-1}\sqrt{\frac{r_0}{r_0+2R_s}}+\tan^{-1}\sqrt{\frac{R_s^2}{r_0^2+2r_0R_s}}\right] \qquad (6)$$

Equation (6) can be approximated as follows, using $R_s << r_0$

$$\phi_{\max}=\frac{\pi}{2}+\frac{R_s}{r_0}$$

From Figure 3, photon deflection D is given as

$$D=2\phi_{\max}-\pi=\frac{2R_s}{r_0}=\frac{4GM}{c^2r_0} \qquad (7)$$

Thus, electromagnetic waves grazing the Sun are deflected 8.5×10^{-6} radians, or 1.75 arc seconds. Further computed refraction values are given in Table 1.

Radar dilation by the Sun

The proposed gravitationally induced vacuum space refraction increment $n-1=2GM/c^2r$ reduces the velocity of electromagnetic waves in the vicinity of the Sun. Radar signals grazing the Sun and bounced back by a planet are retarded. For the time delay calculation, the radar signal path can be approximated by a straight line, as in Figure 4. Radar transit time in vacuum space of zero gravity is

$$T=\int dt=\int\frac{dx}{c}$$

In a gravity field the light velocity is reduced to

$$c_1 = \frac{c}{n} = \frac{c}{1+R_s/r}$$

And radar transit time through the gravity field is

$$T_1 = \int dt_1 = \int \frac{dx}{c_1} = \frac{1}{c}\int n dx$$

Consequently, the time delay occurring on a radar signal's round trip through the Sun's gravitational field is

$$\Delta T = (T - T_1) = \frac{2}{c}\int_{r_{earth}}^{r_{planet}} (1-n)dx$$

$$= -\int_{r_1}^{r_2} \frac{4GM}{c^3} \log\left[\frac{x}{r_0} + \sqrt{1+\left(\frac{x}{r_0}\right)^2}\right] \quad (8)$$

$$= -\frac{4GM}{c^2}\log\left(\frac{4r_1 r_2}{r_0^2}\right)$$

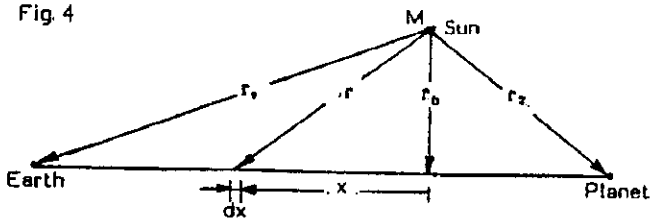
The final approximated result is identical to the relativistic prediction. For mathematical reasons, it is obvious that radar dilation and photon deflection by the Sun should both be correctly or incorrectly predicted from the premise of gravitationally incremented space refraction. In the event both are correct, they must be seen as a single confirmation of the theory.

Alternatives to $n = 1 + R_s/r$

The squared light velocity in $n = 1 + 2GM/c^2 r$ is either the local gravitationally reduced $c_1 = c/n$, or it is c for zero gravity space. Which one is correct? The answer is important for the theory, although for zero order gravity phenomena, it is only of second order significance. Mercury's precession is a higher order phenomenon, for which the velocity difference could conceivably play a role. The right choice of light velocity can be made and verified only with gravity theory. This is also important for atomic theory based on vacuum refraction, owing to the similarity between the gravity force and the Coulomb force. An erroneous choice of light velocity would introduce significant deviations in fine-structure related predictions.

Table 1—Theoeretical refraction increments

At the surface of a body	**(n–1)**
Sun	4.2×10^{-6}
Earth	1.4×10^{-9}
Moon	6.3×10^{-11}
From a distant body at the surface of the earth	
Milky Way	10^{-5}
Sun	2×10^{-8}
Moon	2.9×10^{-13}
Compare with the atmosphere:	*(n–1) = 2.9x10⁻⁴*



To settle these doubts in terms of gravitation, it must be borne in mind that the vacuum refraction model is a discovery process, where principles must be tested experimentally to reveal details. We do not rely on *ad hoc* theoretical developments devoid of experimental foundation. As a result, we must investigate the meaning of the light velocity in the refraction equation.

It is conceivable that the light velocity in the equation varies with gravity, *i.e.* as $c_1 = c/n$, or it is c the light velocity in zero gravity. In the first case we have

$$n = 1 + \frac{2GM}{c_1^2 r} = 1 + \frac{2n^2 GM}{c^2 r}$$

$$n^2 - \frac{r}{R_s}n + \frac{r}{R_s} = 0$$

The two roots to zero order approximation are

$$n_1 \cong \frac{r}{R_s} - 1 \quad and \quad n_2 \cong 1 + \frac{2R_s}{r}$$

The first root is absurd and the second root predicts twice the observed photon deflection and radar dilation by the Sun. The correct choice of light velocity is therefore c for zero gravity space.

Another conceivable alternative equation is $n = 1/(1 - R_s/r)$, which is merely a mathematical speculation that also produces the correct predictions for the photon deflection and radar dilation by the Sun. But for strong gravity fields, this alternative equation leads to impossible results. At the Schwarzschild radius the space refraction index would become infinite. The rest mass of all mass particles reaching R_s would be converted into kinetic energy and the particles would be transformed into light. The infinitely large refraction index would zero the light velocity. Inside R_s the refraction index would be negative, and the Schwarzschild radius would become the interface between positive and negative refraction. This alternative also leads to impossible results.

There are undoubtedly other alternatives, but none can match the simplicity and conceptual consistency of the one used here. Indeed, it is a principle of science that the simplest choice of concept or equation is generally favoured, and in many cases is confirmed by experiment. Of course this theoretical guideline is only useful for discovering zero order mathematical formulations. There are no physical laws which in themselves are infinitely accurate. All primary principles suffer from inaccuracies at their limit, and these require the introduction of secondary and even higher order corrections that usually represent new, though subordinate, principles and concepts.

Conclusion. The refraction equation used here is fully acceptable for stellar gravity phenomena.

On a universal scale, this equation is also plausible. The observed isotropy of space, which conceivably implies an infinite universe, is theoretically possible when the equation is changed minutely with an eigenspace correction in accordance with the proper theory. The correction is insignificant for stellar gravity phenomena, but places a finite limit on the gravity force. Island universes within an infinite omniverse are therefore feasible.

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