Gravitational Holographic Teleportation

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A process of teleportation is here studied. It involves holography and reduction of the gravitational mass of the bodies to be transported. We show that if a holographic three-dimensional image of a body is created and sent to another site *and* the gravitational mass of the body is reduced to a specific range, then the body will disappear and posteriorly will reappear exactly where its holographic three-dimensional image was sent.

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1. Introduction

During long time evidences have been shown that *spacetime is holographic*. A holographic principle has been conjectured to apply not just to black holes, but to *any spacetime* [1, 2, 3, 4]. Covariant holographic entropy bounds generalize to other spacetimes [5, 6]. Fully holographic theories have now been demonstrated, in which a system of quantum fields and dynamical gravity in N dimensions is dual to a system of quantum fields in N − 1 classical dimensions [7, 8, 9, 10, 11].

Recently, scientists from University of Arizona led by Nasser Peyghambarian have invented a system that creates *holographic, three-dimensional images that may be viewed at another site* [12]. Peyghambarian says the machine could potentially transport a person's image over vast distances.

Here, we show that if a holographic three-dimensional image of a body is created and sent to another site *and* the gravitational mass of the body is reduced to a specific range, then the body will disappear and posteriorly will reappear exactly where its holographic three-dimensional image was sent.

2. Theory

From the quantization of gravity it follows that the *gravitational mass* m_g and the *inertial mass* m_i are correlated by means of the following factor [13]:

$$\chi = \frac{m_g}{m_{i0}} = \left\{1 - 2\left[\sqrt{1+\left(\frac{\Delta p}{m_{i0}c}\right)^2} - 1\right]\right\} \qquad (1)$$

where m_{i0} is the *rest* inertial mass of the particle and Δp is the variation in the particle's *kinetic momentum*; c is the speed of light.

This equation shows that only for $\Delta p = 0$ the gravitational mass is equal to the inertial mass.

In general, the *momentum* variation Δp is expressed by $\Delta p = F\Delta t$ where F is the applied force during a time interval Δt. Note that there is no restriction concerning the *nature* of the force F, i.e., it can be mechanical, electromagnetic, etc.

Equation (1) tells us that the *gravitational mass* can be *negative*. This fact is highly relevant because shows that the well-known *action integral* for a free-particle: $S = -m\,c\int_a^b ds$, $m > 0$, must be generalized for the following form (where m_g can be *positive* or *negative*):

$$S = -m_g c\int_a^b ds \qquad (2)$$

or

$$S = -\int_{t_1}^{t_2} m_g c^2\sqrt{1 - V^2/c^2}\,dt \qquad (3)$$

where the Lagrange's function is

$$L = -m_g c^2\sqrt{1 - V^2/c^2}. \qquad (4)$$

The integral $S = \int_{t_1}^{t_2} m_g c^2\sqrt{1 - V^2/c^2}\,dt$, preceded by the *plus* sign, cannot have a *minimum*. Thus, the integrand of Eq.(3) must be *always positive*. Therefore, if $m_g > 0$, then necessarily $t > 0$; if $m_g < 0$, then $t < 0$. The possibility of $t < 0$ is based on the well-known equation $t = \pm t_0 \big/ \sqrt{1 - V^2/c^2}$ of Einstein's Theory.

Thus if the *gravitational mass* of a particle is *positive,* then t is also *positive* and, therefore, given by $t=+t_0\big/\sqrt{1-V^2/c^2}$. This leads to the well-known relativistic prediction that the particle goes to the *future,* if $V \to c$. However, if the *gravitational mass* of the particle is *negative,* then t is *negative* and given by $t=-t_0\big/\sqrt{1-V^2/c^2}$. In this case, the prediction is that the particle goes to the *past,* if $V \to c$. Consequently, $m_g < 0$ *is the necessary condition for the particle to go to the past.*

The Lorentz's transforms follow the same rule for $m_g > 0$ and $m_g < 0$, i.e., the sign before $\sqrt{1-V^2/c^2}$ will be $(+)$ when $m_g > 0$ and $(-)$ if $m_g < 0$.

The *momentum*, as we know, is the vector $\vec{p}=\partial L/\partial\vec{V}$.Thus, from Eq.(4) we obtain

$$\vec{p} = \frac{m_g\vec{V}}{\pm\sqrt{1-V^2/c^2}} = M_g\vec{V} \qquad (5)$$

The $(+)$ sign in the equation above will be used when $m_g > 0$ and the $(-)$ sign if $m_g < 0$. Consequently, we can express the momentum $\vec{p}$ in the following form

$$\vec{p} = \frac{m_g\vec{V}}{\sqrt{1-V^2/c^2}} = M_g\vec{V} \qquad (6)$$

whence we get a new relativistic expression for the gravitational mass, i.e.,

$$M_g = \frac{m_g}{\sqrt{1-V^2/c^2}} \qquad (7)$$

Note that m_g *is not the gravitational mass at rest*, which is obtained making $\Delta p = 0$ in Eq. (1), i.e., $m_{g0} = m_{i0}$. In this case, the equation above reduces to the well-known Einstein's equation:

$$M_i = \frac{m_{i0}}{\sqrt{1-V^2/c^2}}$$

Substitution of Eq. (1) into Eq. (7) leads to the following equation

$$M_g = \frac{m_g}{\sqrt{1-V^2/c^2}} = \frac{\chi\ m_{i0}}{\sqrt{1-V^2/c^2}} = \chi M_i \qquad (8)$$

It is known that the *uncertainty principle* can also be written as a function of ΔE (uncertainty in the energy) and Δt (uncertainty in the time), i.e.,

$$\Delta E.\Delta t \geq \hbar \qquad (9)$$

This expression shows that a variation of energy ΔE, during a time interval Δt, can only be detected if $\Delta t \geq \hbar/\Delta E$. Consequently, a variation of energy ΔE, during a time interval $\Delta t < \hbar/\Delta E$, cannot be experimentally detected. This is a limitation imposed by Nature and not by our equipments.

Thus, a *quantum* of energy $\Delta E = hf$ that varies during a time interval $\Delta t = 1/f = \lambda/c < \hbar/\Delta E$ (wave period) cannot be experimentally detected. This is an *imaginary* photon or a "*virtual*" photon.

Now, consider a particle with energy $M_g c^2$. The DeBroglie's gravitational and inertial wavelengths are respectively $\lambda_g = h/M_g c$ and $\lambda_i = h/M_i c$. In Quantum Mechanics, particles of matter and quanta of radiation are described by means of *wave packet* (DeBroglie's waves) with average wavelength λ_i. Therefore, we can say that during a time interval $\Delta t = \lambda_i/c$, a *quantum* of energy $\Delta E = M_g c^2$ varies. According to the uncertainty principle, the particle will be detected if $\Delta t \geq \hbar/\Delta E$, i.e., if $\lambda_i/c \geq \hbar/M_g c^2$ or $\lambda_i \geq \lambda_g/2\pi$. This condition is usually satisfied when $M_g = M_i$. In this case, $\lambda_g = \lambda_i$ and obviously, $\lambda_i > \lambda_i/2\pi$. However, when M_g decreases λ_g increases and $\lambda_g/2\pi$ can become bigger than λ_i, making the particle *non-detectable* or *imaginary*.

Since the condition to make the particle *imaginary* is

$$\lambda_i < \frac{\lambda_g}{2\pi}$$

and

$$\frac{\lambda_g}{2\pi} = \frac{\hbar}{M_g c} = \frac{\hbar}{\chi M_i c} = \frac{\lambda_i}{2\pi\chi}$$

Then we get

$$\chi < \frac{1}{2\pi} = 0.159$$

However, χ can be positive or negative ($\chi < +0.159$ or $\chi > -0.159$). This means that when

$$-0.159 < \chi < +0.159 \qquad (10)$$

the particle becomes *imaginary*. Consequently, it leaves our *Real* Universe, i.e., it performs a transition to the *Imaginary* Universe, which contains our *Real* Universe. The terms real and imaginary are borrowed from mathematics (real and imaginary numbers).

All these conclusions were originally deduced in a previous article [13].

Quantum Mechanics tells us that if an experiment involves a large number of identical particles, all described by the same wave function Ψ , *real* density of mass ρ of these particles in x, y, z, t is proportional to the corresponding value Ψ^2 (Ψ^2 is known as *density of probability*. If Ψ is *imaginary* then $\Psi^2 = \Psi\Psi^*$. Thus, $\rho \propto \Psi^2 = \Psi.\Psi^*$). Similarly, in the case of imaginary particles, the *density of imaginary gravitational mass*, $\rho_{g(imaginary)}$, in x, y, z, will be expressed by $\rho_{g(imaginary)} \propto \Psi^2 = \Psi\,\Psi^*$. Since Ψ^2 is always *real* and *positive* and $\rho_{g(imaginary)} = m_{g(imaginary)}/V$ is an *imaginary* quantity then, in order to transform the proportionality above into an equation, we can write

$$\Psi^2 = k\left|\rho_{g(imaginary)}\right| \qquad (11)$$

Since the *modulus* of an imaginary number is always real and positive; k is a *proportionality constant* (real and positive) to be determined.

The *Mutual Affinity* is a dimensionless quantity with which we are familiarized and of which we have perfect understanding as to its meaning. It is revealed in the molecular formation, where atoms with strong mutual affinity combine to form molecules. It is the case, for example of the water molecules, in which two Hydrogen atoms join an Oxygen atom. It is the so-called *Chemical Affinity*.

The degree of *Mutual Affinity*, A, in the case of imaginary particles , respectively described by the wave functions Ψ_1 and Ψ_2, might be correlated to Ψ_1^2 and Ψ_2^2. Only a simple algebraic form fills the requirements of interchange of the indices, the product

$$\Psi_1^2.\Psi_2^2 = \Psi_2^2.\Psi_1^2 = \\ = \left|A_{1,2}\right| = \left|A_{2,1}\right| = |A| \qquad (12)$$

In the above expression, $|A|$ is due to the product $\Psi_1^2.\Psi_2^2$ will be always positive. From equations (11) and (12) we get

$$|A| = \Psi_1^2.\Psi_2^2 = k^2\left|\rho_{1g(imaginary)}\right|\left|\rho_{2g(imaginary)}\right| = \\ = k^2\frac{\left|m_{1g(imaginary)}\right|}{V_1}\frac{\left|m_{2g(imaginary)}\right|}{V_2} \qquad (13)$$

Since *imaginary* gravitational masses are equivalent to *real* gravitational masses then the equations of the *Real Gravitational Interaction* are also applied to the *Imaginary Gravitational Interaction*. However, due to imaginary gravitational mass, $m_{g(imaginary)}$, to be an *imaginary* quantity, it is necessary to put $\left|m_{g(imaginary)}\right|$ into the mentioned equations in order to homogenize them, because as we know, the module of an imaginary number is always real and positive.

Thus, based on gravity theory, we can write the equation of the *imaginary gravitational field* in *nonrelativistic* Mechanics.

$$\Delta\Phi = 4\pi G\left|\rho_{g(imaginary)}\right| \qquad (14)$$

It is similar to the equation of the real gravitational field, with the difference that now instead of the density of real gravitational mass we have the density of *imaginary gravitational mass*. Then, we can write the general solution of Eq. (14), in the following form:

$$\Phi = -G\int\frac{\left|\rho_{g(imaginary)}\right|dV}{r^2} \qquad (15)$$

This equation expresses, with nonrelativistic approximation, the potential of the imaginary gravitational field of any distribution of imaginary gravitational mass.

Particularly, for the potential of the field of only one particle with imaginary gravitational mass $m_{g(imaginary)}$, we get:

$$\Phi = -\frac{G\left|m_{g(imaginary)}\right|}{r} \qquad (16)$$

Then the force produced by this field upon another particle with imaginary gravitational mass $m'_{g(imaginary)}$ is

$$\left|\vec{F}_{g(imaginary)}\right| = \left|-\vec{F}'_{g(imaginary)}\right| = -\left|m'_{g(imaginary)}\right|\frac{\partial\Phi}{\partial r} =$$

$$= -G\frac{\left|m_{g(imaginary)}\right|\left|m'_{g(imaginary)}\right|}{r^2} \qquad (17)$$

By comparing equations (17) and (13) we obtain

$$\left|\vec{F}_{12}\right| = \left|-\vec{F}_{21}\right| = -G|A|\frac{V_1V_2}{k^2r^2} \qquad (18)$$

In the *vectorial* form the above equation is written as follows

$$\vec{F}_{12} = -\vec{F}_{21} = -GA\frac{V_1V_2}{k^2r^2}\hat{\mu} \qquad (19)$$

V*ersor* $\hat{\mu}$ has the direction of the line connecting the mass centers (imaginary masses) of both particles and oriented from 1 to 2.

In general, we may distinguish and quantify two types of mutual affinity: *positive* and *negative*. The occurrence of the first type is synonym of *attraction*, (as in the case of the atoms in the water molecule) while the aversion is synonym of *repulsion*. In fact, Eq. (19) shows that the forces $\vec{F}_{12}$ and $\vec{F}_{21}$ are attractive, if A is *positive* (expressing *positive* mutual affinity between the two *imaginary particles*), and *repulsive* if A is *negative* (expressing *negative* mutual affinity between the two *imaginary particles*).

Now, after this theoretical background, we can explain the *Gravitational Holographic Teleportation*.

Initially, is created a holographic three-dimensional image of the bodies and sent to another site. The technology for this is already known [12]. Next, the gravitational masses of the bodies are reduced to a range $-0.159m_{i0} < m_g < +0.159m_{i0}$. When this occur the gravitational masses becomes *imaginaries* and the bodies perform transitions to the *Imaginary* Universe (leaving the Real Universe) (See Eq. (10)). However, the physical phenomenon that caused the reduction of the gravitational masses of the bodies stays at the Real Universe. *Consequently, the bodies return immediately to the Real Universe* for the same positions they were before the transition to the Imaginary Universe. This is due to the Imaginary Gravitational Interaction between the imaginary gravitational masses of the bodies and the imaginary gravitational masses of the forms shaped by the bodies in the imaginary spacetime[1] before the transition to the Imaginary Universe. These imaginary forms initially shaped by the bodies are preserved in the imaginary spacetime by *quantum coherence effects* [14, 15, 16, 17].

Since spacetime is holographic then an imaginary form shaped in imaginary spacetime by the holographic three-dimensional image of a body has much more *similarity* with the body than the imaginary form shaped in the imaginary spacetime by the real body.

Mutual affinity is directly related to *similarity*. This means that the *degree of mutual affinity*, A, between the imaginary bodies (which were sent to the Imaginary Universe) and the imaginary forms *shaped by their holographic images* is far greater than the degree of mutual affinity between the imaginary bodies and the imaginary forms shaped in the imaginary spacetime by the real bodies before the transition to the Imaginary Universe. Thus, according to Eq. (19), the bodies are strongly attracted to the holographic three-dimensional image placed in the far site. Consequently, the bodies do not return for the positions they were before the transition, they reappear as real bodies exactly where their holographic three-dimensional images were sent. Thus, is carried out the teleportation of the bodies to the far site. Since the process combines holography and gravitation, we have called this process of *Gravitational Holographic Teleportation*.

[1] The *real spacetime* is contained in the *imaginary spacetime*. Such as the set of real numbers is contained in the set of imaginary numbers.

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