A Possible Refutation of the Relativity

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The general relativity might be ruled out using the Fatio-Le Sage idea with the cosmic microwave background radiation. The special relativity might be ruled out because in it the wave equation for the light in the vacuum cannot be used.

Key words: GR, Fatio-Le Sage idea, CMBR, SR, wave equation, mass-energy relation.

In a recent article [1], we have given another explanation of the force of the gravity using the Fatio-Le Sage idea with the cosmic microwave background radiation (CMBR): the force of attraction between two bodies would be produced because both bodies are pushed the one against the other by the microwaves of the CMBR. This rules out the general relativity (GR) of Einstein where the gravity bends the space.

With respect to the special relativity (SR) of Einstein we have the following considerations. We have two reference systems, S and S', where S is at rest and S' is moving in the positive x coordinate direction with a constant speed v with respect to S.

Then, in the Galileo relativity, we have the Galileo transformation

$$x' = x - vt,\ y' = y,\ z' = z \text{ and } t' = t \qquad (1)$$

where x, y and z and x', y' and z' are the space coordinates and t y t' the time, in S and S', respectively, and, a priori, it is $0 \leq v < \infty$. From (1), $dx'/dt' = dx'/dt = dx/dt - v$, and for the speed of the light in the vacuum, it would be $c' = dx'/dt' = dx/dt - v = c - v$. Also, $d^2x'/dt'^2 = (d/dt')(dx'/dt') = (d/dt)(dx/dt - v) = d^2x/dt^2$, and the acceleration does not change, $a' = d^2x'/dt'^2 = d^2x/dt^2 = a$, then the forces -and, hence, the laws- do not change, $F' = m' a' = m a = F$, since, a priori, it is $m' = m$, where m is the mass.

In the SR, we have the Lorentz transformation

$$x' = \gamma(x - vt),\ y' = y,\ z' = z \text{ and } t' = \gamma(t - vx/c^2) \qquad (2)$$

where $\gamma = (1 - v^2/c^2)^{-1/2}$, which implies $0 \leq v < c$, because $v = c$ would give $\gamma = \infty$. Note that the value of γ is obtained [2] (pp. 22-24) from the equations, $x' = k(x - vt)$ and $x = k(x' + vt')$, where this last equation is because S moves in the negative x coordinate direction with a constant speed $-v$ with respect to S', and where k is a constant ($k = 1$, in the Galileo transformation); and from considering, supposedly, that $c' = c$, and then for the light, $x' = c't' = ct'$ and $x = ct$. Operating with these equations it is obtained that $k = (1 - v^2/c^2)^{-1/2} \equiv \gamma$. Note also that for $v << c$ it is considered $\gamma \approx 1$ that corresponds only to a restricted Galileo transformation with $0 \leq v << c$ instead of $0 \leq v < \infty$.

If we have a signal of light between two points (x_1, y_1, z_1) and (x_2, y_2, z_2) of the vacuum at the respective times t_1 and t_2, the square of the (space-time) intervals in S and S' are defined respectively as [3] (pp. 5-7) [4] (pp. 295-296):

$$s^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2 - c^2(t_2 - t_1)^2 = 0 \tag{3}$$

$$s'^2 = (x_2' - x_1')^2 + (y_2' - y_1')^2 + (z_2' - z_1')^2 - c^2(t_2' - t_1')^2 = 0 \tag{4}$$

since $c' = c$. The intervals are invariant, $s' = s$, and pseudo-Euclidean. In the Galileo relativity such intervals are not invariant because $c' = c - v$, although the space and time intervals are invariant separately

$$(x_2' - x_1')^2 + (y_2' - y_1')^2 + (z_2' - z_1')^2 = (x_2 - x_1)^2 + (y_2 - y_1)^2 + (z_2 - z_1)^2 \tag{5}$$

$$t_2' - t_1' = t_2 - t_1 \tag{6}$$

Now, let ψ be a wave that propagates in the space, in the positive x (coordinate) direction, with a constant speed v with respect to a reference system S at rest, and considering a system S' that moves also in the positive x direction with the same speed v; then, from both, the Galileo transformation and the Lorentz transformation, we obtain the same wave equation in one dimension [5] (pp. 12-14) (see the appendix):

$$\partial^2\psi/\partial x^2 - (1/v^2)\partial^2\psi/\partial t^2 = 0 \tag{7}$$

but with $0 < v < \infty$ in the first case and $0 < v < c$ in the second case. Therefore, in the vacuum, for an electromagnetic wave, that is, for the light, the equation would be

$$\partial^2\psi/\partial x^2 - (1/c^2)\partial^2\psi/\partial t^2 = 0 \tag{8}$$

which is (7) with $v = c$, and without any problem using the Galileo transformation. However, (8), that is, (7) with $v = c$, cannot be used with the Lorentz transformation because $v = c$ implies $\gamma = \infty$. This invalidates (3) and (4), which invalidates the invariance of the intervals.

In addition, from $x' = x - vt$, from (1), we have that $-x'/v = -x/v + t = t - x/v$ is the elapsed time when the wave ψ arrives to x' in S' or to x in S. Now, using this time, $t - x/v$, as the elapsed time when the wave ψ arrives to x in S, and also using that time as the variable, and remembering that ψ is a wave that propagates in the space, in the positive x coordinate direction, with a constant speed v with respect to the reference system S at rest, then, we have:

$\psi(x,t) = f(b) = f(t - x/v)$, where f is a function, with $b = t - x/v$
$\partial\psi/\partial x = \partial f/\partial x = (\partial f/\partial b)(\partial b/\partial x) = (\partial f/\partial b)(-1/v)$
$\partial\psi/\partial t = \partial f/\partial t = (\partial f/\partial b)(\partial b/\partial t) = (\partial f/\partial b)$, since $(\partial b/\partial t) = 1$
$\partial^2\psi/\partial x^2 = (-1/v)(\partial/\partial x)(\partial f/\partial b) = (-1/v)(\partial/\partial b)(\partial f/\partial x) = (1/v^2)\partial^2 f/\partial b^2$
$\partial^2\psi/\partial t^2 = (\partial/\partial t)(\partial f/\partial b) = (\partial/\partial b)(\partial f/\partial t) = (\partial/\partial b)(\partial f/\partial b) = \partial^2 f/\partial b^2$
$\partial^2\psi/\partial x^2 = (1/v^2)\partial^2 f/\partial b^2 = (1/v^2)\partial^2\psi/\partial t^2$
$\partial^2\psi/\partial x^2 - (1/v^2)\partial^2\psi/\partial t^2 = 0$

which is the wave equation in one dimension (7), with $0 < v < \infty$, and without using neither the Galileo transformation nor the Lorentz transformation. That is, the Galileo relativity and the SR are sufficient but not necessary, because a wave is a function of the variable $t - x/v$, it is an inherent characteristic of the waves with respect to reference systems at rest. For an electromagnetic wave, that is, for the light, in the vacuum, $v = c$, the equation would be (8).

Therefore, do we really need the SR?, where is that need?, why $c' = c$?, are the intervals in the SR really invariant?, and remember that (8), that is, (7) with $v = c$, which is the wave equation for the light in the vacuum, cannot be used with the Lorentz transformation because $v = c$ implies $\gamma = \infty$. All this rules out the SR.

On the other hand, the mass-energy relation applies, but only in the form: $E_0 = m_0 c^2$. We can deduce it without using the SR as follows: when an atom absorbs a photon, the energy is converted into matter, that is, into mass. Thus, an atom at rest of mass m_0 recoils with a speed v when it absorbs a photon of an energy E that corresponds to a mass μ. The momentum of the photon would be $p = F\tau = F\lambda/c = W/c = E/c$, where F is the force exerted by the photon, $\tau = \lambda/c$ the duration of the event, λ the wavelength, c the speed of the light in the vacuum and $W = F\lambda$ the work done by the photon (the energy E is converted into the work W during the event). (Note that as $E = hf$ and $c = \lambda f$, then $p = E/c = hf/\lambda f = h/\lambda$, where h is the Planck's constant and f the frequency; and also that $\tau = \lambda/c = \lambda/\lambda f = 1/f$). From the conservation of the momentum, $(p_1 + p_2)_{final} = (p_1 + p_2)_{initial}$, where the subscript 1 is for the atom and the 2 for the photon; we would have that $mv + 0 = 0 + E/c$, or $mv = E/c = (E/c^2)c = \mu c$, where m is the moving mass of the atom and $\mu = E/c^2 = hf/c^2$ the so-called "effective mass" of the photon. From the conservation of the energy, $(E_1 + E_2)_{final} = (E_1 + E_2)_{initial}$, we would have that $E_a + 0 = E_{0a} + \mu c^2$, $E_a - E_{0a} = \mu c^2$, and as $\mu = m - m_0$, then $E_a = mc^2$, $E_{0a} = m_0c^2$ and $T_a = \mu c^2$, where E_a, E_{0a} and T_a are, respectively, the total, rest and kinetic energies of the atom.

If we do $m = \gamma m_0$, then $\gamma m_0 = m = m_0 + \mu$, $(\gamma - 1)m_0 = \mu$, $(\gamma - 1)m_0c = \mu c = mv = \gamma m_0 v$, $(\gamma - 1)c = \gamma v$ and $\gamma = (1 - v/c)^{-1}$. Therefore, for a body of rest and moving masses m_0 and m its energy would be $E = mc^2 = \gamma m_0c^2 = (1 - v/c)^{-1}m_0c^2$, and for $v << c$, $E \approx m_0c^2 + m_0vc + m_0v^2$, which is a balanced expression but erroneous. In the SR, it is $\gamma = (1 - v^2/c^2)^{-1/2}$ and $E = mc^2 = \gamma m_0c^2 = (1 - v^2/c^2)^{-1/2}m_0c^2$, and for $v^2 << c^2$, $E \approx m_0c^2 + (1/2)m_0v^2$, which is correct because $(1/2)m_0v^2$ is the Newton's kinetic energy. It seems that from the absorption process we cannot obtain the correct value for the gamma factor, and that we need the SR.

However, this is not true because $m = \gamma m_0$ is a fallacy since it supposes the conversion of energy into matter in a simple process of absorption of a photon. In this process, the photon energy (which is only kinetic energy: $E = p\,c$) is transformed in kinetic energy of the atom. Therefore, we have obtained that $E_{0a} = m_0 c^2$, and that $E_a = E_{0a} + T_a = m_0c^2 + hf$, that is, the total energy is the rest energy plus the kinetic energy.

In summary, the GR might be ruled out using the Fatio-Le Sage idea with the CMBR. The SR might be ruled out because in it the wave equation for the light in the vacuum cannot be used.

Appendix

From the Galileo transformation, we have:

$x' = x - vt$
$\psi(x,t) = f(x') = f(x - vt)$, where f is a function
$\partial\psi/\partial x = \partial f/\partial x = (\partial f/\partial x')(\partial x'/\partial x) = \partial f/\partial x'$, since $\partial x'/\partial x = 1$
$\partial\psi/\partial t = \partial f/\partial t = (\partial f/\partial x')(\partial x'/\partial t) = (\partial f/\partial x')(-v) = -v\partial f/\partial x'$
$\partial^2 \psi/\partial x^2 = (\partial/\partial x)(\partial f/\partial x') = (\partial/\partial x')(\partial f/\partial x) = (\partial/\partial x')(\partial f/\partial x') = \partial^2 f/\partial x'^2$
$\partial^2 \psi/\partial t^2 = (\partial/\partial t)(-v\partial f/\partial x') = -v(\partial/\partial x')(\partial f/\partial t) = -v(\partial/\partial x')(-v\partial f/\partial x') = v^2\partial^2 f/\partial x'^2$
$\partial^2 \psi/\partial x^2 = \partial^2 f/\partial x'^2 = (1/v^2)\partial^2 \psi/\partial t^2$
$\partial^2 \psi/\partial x^2 - (1/v^2)\partial^2 \psi/\partial t^2 = 0$

which is the wave equation in one dimension, with $0 < v < \infty$.

And, from the Lorentz transformation, we have:

$x' = \gamma(x - vt)$, with $\gamma = (1 - v^2/c^2)^{-1/2}$
$\psi(x,t) = f(x') = f(\gamma(x - vt))$
$\partial\psi/\partial x = \partial f/\partial x = (\partial f/\partial x')(\partial x'/\partial x) = (\partial f/\partial x')\gamma = \gamma\partial f/\partial x'$
$\partial\psi/\partial t = \partial f/\partial t = (\partial f/\partial x')(\partial x'/\partial t) = (\partial f/\partial x')(-\gamma v) = -\gamma v\partial f/\partial x'$
$\partial^2 \psi/\partial x^2 = (\partial/\partial x)(\gamma\partial f/\partial x') = \gamma(\partial/\partial x')(\partial f/\partial x) = \gamma(\partial/\partial x')(\gamma\partial f/\partial x') = \gamma^2\partial^2 f/\partial x'^2$
$\partial^2 \psi/\partial t^2 = (\partial/\partial t)(-\gamma v\partial f/\partial x') = -\gamma v(\partial/\partial x')(\partial f/\partial t) = -\gamma v(\partial/\partial x')(-\gamma v\partial f/\partial x') = \gamma^2 v^2\partial^2 f/\partial x'^2$
$\partial^2 \psi/\partial x^2 = \gamma^2\partial^2 f/\partial x'^2 = (1/v^2)\partial^2 \psi/\partial t^2$
$\partial^2 \psi/\partial x^2 - (1/v^2)\partial^2 \psi/\partial t^2 = 0$

which is again the wave equation in one dimension, but now by virtue of the SR it would be $0 < v < c$, because $v = c$ would imply $\gamma = \infty$.

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