Einstein's General Relativity is Electromagnetic

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Abstract Einstein perceived Special Relativity as a forceless mechanical theory that may be generalized to a gravitational force theory.

In Einstein's Special Relativity, light is a stream of photons, characterized by their speed c. And Einstein assumed that Gravitational waves too propagate at light speed c.

But Light is an electromagnetic wave, which speed depends exclusively on the permittivity, and the permeability of the media in which it propagates.

Due to that exclusive dependence, only photons propagate at light speed, and Einstein's Gravitational Radiation that propagates at light speed, is actually Electromagnetic,

Furthermore, Einstein's Retarded Gravitational Potential is electromagnetic as well.

Thus, Einstein's General Relativity obtains Gravitation as an extension of Electromagnetism.

Since Gravitation is absolutely separate from electromagnetism,

Einstein's General Relativity is a fallacy.
In particular, we submit that the precession of the perihelion of Mercury does not confirm General relativity.

Keywords Gravitation, Gravitational Waves, Perihelion Precession, General Relativity, Electro-Magnetic Waves, Retarded Potential. GravitoMagnetism, Gravitons, Photon, Faster Than Light, Tests of General Relativity,

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Contents

1.

Einstein's Gravitational Potential is Electromagnetic

Space-time coordinates are

$$x^{\mu} = (x, y, z, t).$$

A metric on space-time is the differential form

$$(ds)^2 = \sum_{\mu=1}^{\mu=4} \sum_{\nu=1}^{\nu=4} g_{\mu\nu} dx^{\mu} dx^{\nu} .$$

The 4×4 symmetric matrix $g_{\mu\nu}(x^{\alpha})$ is the metric tensor.

To first order we take [Einstein2],

$$g_{\mu\nu}(x^{\alpha}) = \begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} + \gamma_{\mu\nu}(x^{\alpha}),$$

$$\text{with } \left|\gamma_{\mu\nu}(x^{\alpha})\right| \ll 1.$$

The components of the $4 \times 4 \times 4$ symmetric 3-dimensional matrix

$$\Gamma_{\lambda\mu\nu}(x^{\alpha}) = \tfrac{1}{2}\left[\partial_{x_{\lambda}} g_{\mu\nu} + \partial_{x_{\mu}} g_{\lambda\nu} - \partial_{x_{\nu}} g_{\lambda\mu}\right]$$

are Christoffel symbols of the 1st kind.

The components of the $4 \times 4 \times 4$ symmetric 3-dimensional matrix

$$\Gamma^{\tau}_{\lambda\mu}(x^{\alpha}) = g^{\tau\nu}\Gamma_{\lambda\mu\nu}$$

are Christoffel symbols of the 2nd kind.

Christoffel symbols do not satisfy the transformation rule of a Tensor, and are the Gravitational Potentials.

Following the notations in [Einstein1], the equation of motion of a material point along a geodetic in space-time is

$$\frac{d^2 x_\tau}{ds^2} = \Gamma_{\mu\nu\tau} \frac{dx_\mu}{ds} \frac{dx_\nu}{ds}. \quad \text{(22), on p.132}$$

(equation (46), p.158, is the same, except for a misprint)

On p. 158, Einstein assumes non-relativistic speed

$$v = \sqrt{\left(\frac{dx_1}{dx_4}\right)^2 + \left(\frac{dx_2}{dx_4}\right)^2 + \left(\frac{dx_3}{dx_4}\right)^2} \ll 1,$$

and concludes that

$$\left|\frac{dx_1}{ds}\right|, \left|\frac{dx_2}{ds}\right|, \left|\frac{dx_3}{ds}\right| \sim 0, \text{ while } \left|\frac{dx_4}{ds}\right| \sim 1.$$

Also, the gravitational potentials $\Gamma_{\mu\nu\tau}$ are small. Dropping the small size terms and keeping only the terms with $\mu = \nu = 4$, equation (46), becomes

$$\frac{d^2 x_\tau}{ds^2} = \Gamma_{44\tau} = \tfrac{1}{2}\left[\partial_4 g_{4\tau} + \partial_4 g_{4\tau} - \partial_\tau g_{44}\right],$$

$$\sim -\partial_\tau \left(\tfrac{1}{2} g_{44}\right), \quad (67).$$

Taking $dx_4 = ds = dt$,

$$\frac{d^2 x_\tau}{dt^2} = \Gamma_{44\tau} \sim -\nabla\left(\tfrac{1}{2} g_{44}\right)$$

Thus, by Newton's law, the Gravitational Potential is $\frac{1}{2}g_{44}$.

From equation (53) on p. 149, (misprint corrected) Einstein has

$$\partial_{x_\tau} T_{\mu\nu\tau} + T^{\alpha}_{\mu\beta} T^{\beta}_{\nu\alpha} = -\kappa(T_{\mu\nu} - \tfrac{1}{2} g_{\mu\nu} T),$$

where κ is a proportion factor.

Substituting

$$\mu = \nu = 4,$$

and

$$T_{44} = T = \rho(\vec{r}) = \text{matter density},$$

Einstein has

$$\underbrace{\partial_{x_\tau}}_{\nabla\cdot} \underbrace{T_{44\tau}}_{-\nabla(\frac{1}{2}g_{44})} + \underbrace{T^{\alpha}_{4\beta} T^{\beta}_{4\alpha}}_{\text{2nd order}} = -\kappa \underbrace{(T_{44} - \tfrac{1}{2} \underbrace{g_{44}}_{\sim 1} T)}_{\frac{1}{2}\rho(\vec{r})},$$

Hence, up to first order,

$$\nabla^2 \left(\tfrac{1}{2} g_{44}\right) = \tfrac{1}{2}\kappa\rho.$$

Using $\int \delta(r) d\tau = 1$, and $\nabla^2 \dfrac{1}{r} = -4\pi\delta(r)$,

$$\nabla^2 \left(\tfrac{1}{2} g_{44}\right) = -\tfrac{1}{8\pi}\kappa \int \underbrace{\nabla^2 \frac{1}{r}}_{-4\pi\delta(r)} \rho(\vec{r}) d\tau$$

$$= \nabla^2 \left(-\tfrac{1}{8\pi}\kappa \int \frac{\rho(\vec{r})}{r} d\tau \right).$$

Therefore, Einstein's Gravitational Potential is

$$\tfrac{1}{2} g_{44} = -\tfrac{1}{8\pi}\kappa \int \frac{\rho(\vec{r})}{r} d\tau.$$

To determine κ, Einstein compares his potential with Newton's gravitational potential, $-G\int \frac{\rho(\vec{r})}{r} d\tau$.

To satisfy his ct axis, Einstein divides by c^2, and in [Einstein1 p.159-160] concludes with

"…Newton's Theory, with our chosen unit of time, gives (for the Gravitational Potential) $-\frac{G}{c^2}\int \frac{\rho(\vec{r})}{r} d\tau$

where $G = 6.7 \times 10^{-8}$ *is the Gravitation constant.*

By comparison, $\kappa = \frac{1}{c^2} 8\pi G$*"*

The CGS system, that Einstein used, and his purely mechanical conception of light as particles having speed c, ignore the crucial

vacuum permittivity ε_0,

and vacuum permeability μ_0,

and do not recognize the exclusiveness of

$$c^2 = \frac{1}{\varepsilon_0 \mu_0},$$

to electromagnetism.

Translated into MKS unit system, Einstein statement is

"…Newton's Theory, with our chosen unit of time, gives (for the Gravitational Potential) $-G\varepsilon_0\mu_0 \int \frac{\rho(\vec{r})}{r} d\tau$

where $G = 6.7 \times 10^{-11}$ *is the Gravitation constant.*

By comparison, $\kappa = 8\pi \varepsilon_0 \mu_0 G$*"*

But Permittivity and Permeability are irrelevant to Gravitation, and their appearance here indicates that Einstein's Potential is Electromagnetic

Einstein also missed the exclusiveness of a photon, to thermal, and electromagnetic radiation.

2.

Retarded Potentials and Gravito-Magnetism

To obtain a Retarded Gravitational Potential, we can follow the derivation of a Retarded Electromagnetic Potential:

In Electrostatics, we assume an Electric Field $\vec{E}(r)$, derived from an Electric Potential $\phi(r)$, so that

$$\vec{E} = -\nabla\phi,$$

and generated by a charge distribution with density $\rho_{\mathrm{E}}(r)$ so that

$$\nabla \cdot \underbrace{\vec{E}}_{-\nabla\phi} = \frac{\rho_{\mathrm{E}}}{\varepsilon_0},$$

where ε_0 is the Electric Permittivity of the vacuum. Thus,

$$\nabla^2\phi = -\frac{\rho_{\mathrm{E}}}{\varepsilon_0},$$

$$\phi = \frac{1}{4\pi\varepsilon_0}\int \frac{\rho_{\mathrm{E}}(r)}{r} dV .$$

In Electrodynamics, we assume Magnetic Induction $\vec{B}(\vec{r},t)$, derived from a Magnetic Vector Potential $\vec{A}(\vec{r},t)$, so that

$$\vec{B} = \vec{\nabla} \times \vec{A},$$

and Electric Field $\vec{E}(\vec{r},t)$, derived from an Electric Potential $\phi(\vec{r},t)$, so that

$$\vec{E} = -\nabla\phi - \partial_t \vec{A}.$$

Then,

$$\nabla \cdot \underbrace{\vec{E}}_{-\nabla\phi - \partial_t \vec{A}} = \frac{\rho_{\mathrm{E}}}{\varepsilon_0},$$

$$\nabla^2\phi + \partial_t \nabla \cdot \vec{A} = -\frac{\rho_{\mathrm{E}}}{\varepsilon_0}.$$

Assuming Lorentz Condition, $\nabla \cdot \vec{A} = -\varepsilon_0\mu_0\partial_t\phi$, where μ_0 is the Magnetic Permeability of the vacuum,

$$\nabla^2\phi - \underbrace{\varepsilon_0\mu_0}_{\frac{1}{c^2}}\partial_t^2\phi = -\frac{\rho_{\mathrm{E}}}{\varepsilon_0}.$$

This is an electromagnetic wave equation for ϕ, with propagation speed

$$c = \frac{1}{\sqrt{\varepsilon_0\mu_0}}.$$

Then, the potential $\phi(\vec{r},t)$ at $\vec{r}$, at time t, is the summation of contributions at $\vec{\xi}$, at the retarded time $t - \frac{r}{c}$,

$$\phi(\vec{r},t) = \frac{1}{4\pi\varepsilon_0}\int \frac{\rho_{\mathrm{E}}(\vec{\xi}, t - \frac{r}{c})}{\left|\vec{r} - \vec{\xi}\right|} dV_{\vec{\xi}}.$$

For Gravitation to follow from this formulation, we have to assume a Gravito-Magnetic Field $\vec{B}_G$, derived from a Gravito-Magnetic $\vec{A}_G$, that was never detected, so that

$$\vec{B}_G = \vec{\nabla} \times \vec{A}_G,$$

and a Gravitational Field $\vec{E}_G(\vec{r},t)$, derived from a Potential $\phi_G(\vec{r},t)$, so that

$$\vec{E}_G = -\nabla\phi_G - \partial_t\vec{A}_G.$$

Assuming Lorentz Condition, $\nabla \cdot \vec{A}_G = -\varepsilon_G\mu_G\partial_t\phi_G$, where μ_G is the Gravito-Magnetic Permeability of the vacuum,

$$\nabla^2\phi_G - \underbrace{\varepsilon_G\mu_G}_{\frac{1}{v_G^2}}\partial_t^2\phi_G = -\frac{\rho_G}{\varepsilon_G}.$$

This is a gravito-magnetic wave equation for ϕ_G, with propagation speed

$$v_G = \frac{1}{\sqrt{\varepsilon_G\mu_G}}.$$

Then, the potential $\phi_G(\vec{r},t)$ at $\vec{r}$, at time t, is the summation of contributions at $\vec{\xi}$, at the retarded time $t - \frac{r}{c}$,

$$\phi_G(\vec{r},t) = \frac{1}{4\pi\varepsilon_G}\int \frac{\rho_G(\vec{\xi}, t - \frac{r}{c})}{\left|\vec{r} - \vec{\xi}\right|}dV_{\vec{\xi}}.$$

Nevertheless, we do not know how to determine ε_G, and we know not of another way to obtain a retarded Gravitational potential.

3.

Einstein's Gravitational Waves are Electromagnetic

In [Einstein2], Einstein restates his belief that Gravitational Waves propagate at light speed.

To first order Einstein has [Einstein2],

$$g_{\mu\nu}(x^{\alpha}) \sim \begin{bmatrix} -1 & 0 & 0 & 0 \\ 0 & -1 & 0 & 0 \\ 0 & 0 & -1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} + \gamma_{\mu\nu}(x^{\alpha}), \qquad \text{(1) on p.201}$$

$$\text{where } \left|\gamma_{\mu\nu}(x^{\alpha})\right| \ll 1.$$

To first order, the Field Equations are

$$\sum_{\alpha}\left[\frac{\partial^2\gamma_{\mu\alpha}}{\partial x_{\nu}\partial x_{\alpha}} + \frac{\partial^2\gamma_{\nu\alpha}}{\partial x_{\mu}\partial x_{\alpha}} - \frac{\partial^2\gamma_{\mu\nu}}{\partial x_{\alpha}^2}\right] - \frac{\partial^2\sum_{\alpha}\gamma_{\alpha\alpha}}{\partial x_{\mu}\partial x_{\nu}} \sim -2\kappa(T_{\mu\nu} - \tfrac{1}{2}\delta_{\mu\nu})\sum_{\alpha} T_{\alpha\alpha}\,, \quad (2)$$

where $\kappa = \dfrac{8\pi G}{c^2}$ from [Einstein1], predetermines that

Gravitational waves propagate at light speed c.

Einstein substitutes

$$\gamma_{\mu\nu} = \gamma'_{\mu\nu} + \psi\delta_{\mu\nu}\,, \qquad (3)$$

where

$$\sum_{\nu} \partial_{x_\nu} \gamma'_{\mu\nu} = 0, \qquad (4)$$

$$\sum_{\alpha} \gamma'_{\alpha\alpha} = -2\psi, \qquad (5)$$

and obtains

$$\sum_{\alpha} \frac{\partial^2 \gamma'_{\mu\nu}}{\partial x_\alpha^2} = 2\kappa T_{\mu\nu}. \qquad (6)$$

He concludes with

"... the $\gamma'_{\mu\nu}$ are the retarded potentials

$$\gamma'_{\nu\mu} = -\tfrac{1}{2\pi}\kappa \int \frac{T_{\mu\nu}(x_0, y_0, z_0, t-r)}{r} dV_0 \qquad (9)"$$

And sums up on page 206,

" It follows from (6) and (9) that gravitational fields always propagate with velocity 1, that is, with the speed of light."

But $\dfrac{1}{\varepsilon_0 \mu_0} = c^2$ is exclusive to Electro-Magnetics, and

$$\kappa = \frac{8\pi G}{c^2} = 8\pi G \varepsilon_0 \mu_0$$

assumes the setup of special relativity,

where an electron emits a photon,

instead of gravitation, where a mass emits a graviton

The only radiation quantum that propagates at light speed is the photon. It is unique to electromagnetism, specifically, to Black Body thermal radiation.

The photon is a charge-less packet of energy $h\nu$, with equivalent mass $\frac{h\nu}{c^2}$. It is emitted from charged particles, and carries the Electromagnetic Field.

No other particle has the photon characteristic that in the vacuum it travels at light speed. Other particles that have been presumed to travel at light speed, such as gluons have never been detected, and their speeds have never been measured.

To say that Gravitational waves propagate at light speed, is to say that the quantum of gravitational radiation is a photon, and that charged electrons, that emit photons, are the same as uncharged mass particles that emit gravitons.

Missing the crucial role of vacuum permittivity, ε_0, and vacuum permeability, μ_0, in determining the speed of electromagnetic waves, makes Einstein's Gravitational waves Electromagnetic.

Einstein perceived special Relativity as a kinematic forceless theory that may be generalized to a dynamical gravitational force theory. But the mechanical properties of light do not describe light completely. Light is electromagnetic waves, and Special Relativity belongs in Electromagnetism.

After tossing around tensors, the Electromagnetic nature of light shows up, and the supposedly gravitational waves turn out to be electromagnetic, precisely as they were assumed to be.

Gravitation is not a generalization of Electromagnetism

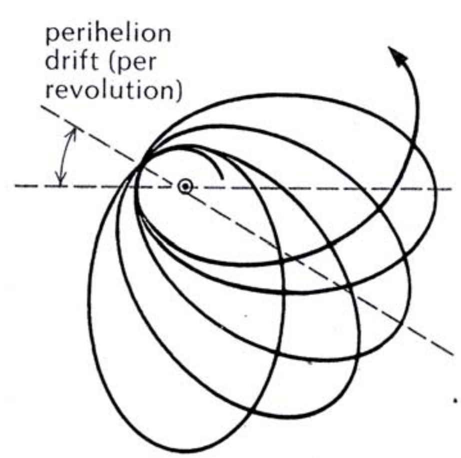
The relation $\frac{1}{\varepsilon_0 \mu_0} = c^2$ is exclusive to Electro-Magnetics.

In Gravitation, ε_0, and μ_0, have no concrete parallel, and at most we can assume that Gravitational Waves exist, and propagate at some speed v_G.

4. The Precession of the Perihelion of Mercury does not confirm General Relativity

Einstein claimed that the unexplained part in the observed precession of the perihelion of the planet Mercury around the sun is explained by his General Relativity.

A planet elliptical orbit rotates slowly in the direction of its motion and its perihelion encircles the sun.



Einstein proposed that the unexplained precession in radians per revolution is

$$24\pi^3 \frac{a^2}{T^2 c^2 (1-e^2)},$$

where

$a =$ half the major axis of the ellipse (in centimeters)

$e =$ eccentricity

$c =$ light speed in the vacuum (in centimeters)

$T =$ period of a revolution (in seconds)

Substituting $c^2 = 8\pi G / \kappa$, the unexplained precession is

$$3\pi^2 \frac{a^2}{T^2 G(1-e^2)} \kappa$$

According to Einstein, it equals the unexplained precession of the perihelion of Mercury by $43''$ per hundred years.

But $\kappa = 8\pi G / c^2$ is based on Einstein's erroneous claims that gravitational potential and Gravitational waves are electromagnetic.

Consequently, Einstein's General Relativity is not confirmed by the unexplained part in the observed precession of the perihelion of the planet Mercury around the sun.

Nevertheless, perhaps, the correct precession formula is

$$24\pi^3 \frac{a^2}{T^2 v_G^2 (1-e^2)}$$

where $v_G =$ average speed of gravitational waves.

Then, if the $43''$ per hundred years can be trusted, we could compute v_G.

But the $43''$ value is highly speculative.

By the Wikipedia's "Tests of General Relativity",

the observed perihelion precession of Mercury is $574''$.

By unspecified arguments, Gravitational pull of other planets accounts for $531''$, and $43''$ is unaccounted for.

Since the certainty of these claims is unknown, we have to consider them in terms of statistical confidence.

Note that 97% confidence in $531''$, allows for 3% error in $531''$ which is $15.93''$. But that means a 37% error in $43''$ which allows only 63% confidence in the $43''$.

Note that 95% confidence in $531''$ allows for $26.55''$ error, and only 38% confidence in the $43''$.

By obtaining the $43''$ with erroneous κ, Einstein's General Relativity establishes with 100% confidence that the unaccounted for perihelion precession of Mercury is NOT $43''$.

In an 11/28/1919 letter to the London Times, Einstein submitted that had any of his tests been wrong, the whole theory would be beyond repair, and would have to be given up:

> *"The chief attraction of the theory lies in its logical completeness. If a single one of the conclusions drawn from it proves wrong, it must be given up; to modify it without destroying the whole structure seems to be impossible"*

Einstein might have suspected that his theory was not confirmed by the perihelion precession of Mercury.

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