Abstract

A problem with General Relativity is that it is computationally inefficient. This paper shows how to solve that problem by implementing General Relativity in absolute space and absolute time, resulting in Absolute Gravity. Absolute Gravity makes all of the same predictions as General Relativity. The most important result in this letter is the force equation for Absolute Gravity; it corresponds to the geodesic equation in General Relativity. The field equations are the same in both General Relativity and Absolute Gravity, except for their interpretation. Among other things, Absolute Gravity restores simultaneity and eliminates curved spacetime. Absolute Gravity unifies Einstein's General Relativity with Newton's Absolute Space and Absolute Time.

General Relativity in Absolute Space and Absolute Time

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1 Introduction

This is an update on work presented in [3], which demonstrated how to reproduce the results of the Michelson-Morley experiment in absolute space and absolute time. After reproducing individual results from Special and General Relativity, it became clear that Absolute Gravity could reproduce all of them. To demonstrate the equivalence, this letter shows how to derive Absolute Gravity from General Relativity. Absolute Gravity unifies Einstein's General Relativity[1] with Newton's Absolute Space and Absolute Time[2].

Here is the most important result in this letter, the force equation for Absolute Gravity:

$$\frac{\mathrm{d}^2 r^i}{\mathrm{d}t^2} = \left(\frac{1}{c} \frac{\mathrm{d}r^i}{\mathrm{d}t} g^{0\sigma} - g^{i\sigma} \right) [\mu\nu, \sigma] \frac{\mathrm{d}r^\mu}{\mathrm{d}t} \frac{\mathrm{d}r^\nu}{\mathrm{d}t} \tag{1}$$

Equation (1) is written using Einstein's summation convention. The indexes μ, ν, and σ run from 0 to 3. The index i runs from 1 to 3. Equation (1) represents a system of three equations for $i = 1, 2, 3$. t is absolute time. The r^i are the absolute coordinates (r_x, r_y, r_z) of a particle in an absolute (x, y, z) coordinate system, so that $\frac{\mathrm{d}^2 r^i}{\mathrm{d}t^2}$ is the absolute acceleration of a particle that is moving at absolute velocity $\frac{\mathrm{d}r^i}{\mathrm{d}t}$. The $[\mu\nu, \sigma]$ are Christoffel symbols of the first kind. Inside the Christoffel symbols, it is important to remember that $x^0 = ct$ and $x^1, x^2, x^3 = x, y, z$. In the summations on the right hand side, it is important to remember that $r^0 = ct$, so that $\frac{\mathrm{d}r^0}{\mathrm{d}t} = c$. The units for t and x, y, z are ordinary time and length units; for example, seconds and meters. No constants have been set to 1. Mass does not appear in equation (1) because gravitational acceleration is independent of mass.

In Absolute Gravity, the field equation for the generation and propagation of $g_{\mu\nu}$ is the same as the Einstein equation in General Relativity. There is an important difference of interpretation, though. In Absolute Gravity, $g_{\mu\nu}$ is no longer a metric; it is a set of 10 potentials (taking advantage of the symmetry of $g_{\mu\nu}$). These 10 potentials can be written as a scalar gravitational potential g, a 3-vector momentum potential w, and a symmetric 3-by-3 matrix force potential S. These correspond to the gravitational, momentum, and force potentials used to explain the Michelson-Morley experiment in absolute space and absolute time [3].

2 Absolute clocks and rulers

To motivate Absolute Gravity, I think it is useful to consider the difference between the standard clocks and rulers of Special and General Relativity, and the absolute clocks and rulers of Absolute Gravity. Absolute clocks and rulers are standard clocks and rulers that have been corrected for the effects of motion and gravity.

General Relativity uses standard clocks and rulers to measure proper times and distances. One has to be careful about the definition of "standard", though. For example, a pendulum is a kind of clock that cannot be a standard clock because a pendulum stops working in the absence of mechanical or gravitational acceleration. A pendulum is an acceleration clock.

By standard clock or ruler, what is usually meant is an electromagnetic clock or ruler. That is, a clock or ruler whose timekeeping or size are based on classical or quantum electromagnetic effects such as electron transitions, or the flexing of a wind-up spring, or atomic repulsion.

But standard clocks and rulers are more than just electromagnetic clocks and rulers. They both must be corrected for undesirable effects, such as temperature.

Consider two thermally uncorrected electromagnetic clocks and two thermally uncorrected electromagnetic rulers. Place one of each in a hot oven, and one of each in a cold refrigerator. After a while they will probably measure different times and lengths. If you didn't know about thermal effects, you might conclude that household appliances curve space and time.

Similarly, standard clocks and rulers in different circumstances are found to measure different times and lengths. If you take two standard clocks and keep one in your lab while sending the other around the Earth, they will measure different times when brought back together. General Relativity concludes that motion and gravity curve space and time.

Absolute Gravity instead concludes that standard clocks and rulers are uncorrected for motion and gravity.

An absolute clock and ruler can conceptually be created from a standard clock and ruler by adding a pendulum and an omnidirectional microwave antenna. The standard clock and ruler measure proper time and proper length. The pendulum measures the combined effects of the local mechanical and gravitational accelerations. The omnidirectional microwave antenna measures the local red/blue shift with respect to the cosmic microwave background radiation, to obtain the local velocity and mechanical acceleration. The difference between the acceleration measured by the pendulum (combined mechanical and gravitational acceleration) and by the microwave antenna (mechanical acceleration only) gives the gravitational acceleration. This provides sufficient information to correct the standard clock and ruler for motion and gravity.

Using absolute clocks, two events are simultaneous if they occur at the same absolute time. Using absolute rulers, the circumference of a circle is always 2π times the radius.

3 Deriving the Absolute Gravity force equation

Most General Relativity texts give the geodesic equation in a form similar to:

$$\frac{\mathrm{d}^2 r^\alpha}{\mathrm{d}\tau^2} = -\Gamma^\alpha_{\mu\nu} \frac{\mathrm{d}r^\mu}{\mathrm{d}\tau} \frac{\mathrm{d}r^\nu}{\mathrm{d}\tau} \tag{2}$$

τ is the proper time as measured by a standard clock moving with the particle. The trajectory of the particle in four dimensions is $r^\alpha = (r^0, r^1, r^2, r^3)$ where (r^0, r^1, r^2, r^3) are the coordinates of the particle in the coordinate system $x^\alpha = (x^0, x^1, x^2, x^3)$. x^0 is taken to be time coordinate $x^0 = ct$, where in General Relativity x^0 and/or t are called the coordinate time. Later we will take $r^0 = x^0 = ct$, with t the absolute time, and (x^1, x^2, x^3) to be the absolute (x, y, z) coordinate system, but there is work to be done before we can make that leap.

The Christoffel symbol of the second kind in equation (2), $\Gamma^\alpha_{\mu\nu}$, conflates the role of the inverse metric, $g^{\alpha\beta}$ with the derivatives of the metric $g_{\alpha\beta}$ in calculating the geodesic:

$$\Gamma^\alpha_{\mu\nu} = \frac{1}{2} g^{\alpha\sigma} \left(\frac{\partial g_{\sigma\mu}}{\partial x^\nu} + \frac{\partial g_{\nu\sigma}}{\partial x^\mu} - \frac{\partial g_{\mu\nu}}{\partial x^\sigma} \right) \tag{3}$$

We are going to revert to a somewhat more archaic notation (see [1], equations (20d) through (23)) using Christoffel symbols of the first kind, written as $[\mu\nu, \sigma]$, to separate the inverse metric from the derivatives of the metric:

$$[\mu\nu, \sigma] = \frac{1}{2} \left(\frac{\partial g_{\sigma\mu}}{\partial x^\nu} + \frac{\partial g_{\nu\sigma}}{\partial x^\mu} - \frac{\partial g_{\mu\nu}}{\partial x^\sigma} \right) \tag{4}$$

Substituting equation (4) into equation (3) for $\Gamma^\alpha_{\mu\nu}$ gives:

$$\Gamma^\alpha_{\mu\nu} = g^{\alpha\sigma} [\mu\nu, \sigma] \tag{5}$$

Substituting equation (5) into equation (2) for the geodesic gives:

$$\frac{\mathrm{d}^2 r^\alpha}{\mathrm{d}\tau^2} = -g^{\alpha\sigma}[\mu\nu,\sigma]\frac{\mathrm{d}r^\mu}{\mathrm{d}\tau}\frac{\mathrm{d}r^\nu}{\mathrm{d}\tau} \tag{6}$$

We now want to get rid of the derivatives with respect to τ (the proper time), and replace them with derivatives with respect to x^0 (the coordinate time). Applying the chain rule for derivatives gives:

$$\frac{\mathrm{d}r^\alpha}{\mathrm{d}\tau} = \frac{\mathrm{d}r^\alpha}{\mathrm{d}x^0}\frac{\mathrm{d}x^0}{\mathrm{d}\tau}, \qquad \frac{\mathrm{d}^2 r^\alpha}{\mathrm{d}\tau^2} = \left(\frac{\mathrm{d}x^0}{\mathrm{d}\tau}\right)^2\frac{\mathrm{d}^2 r^\alpha}{\mathrm{d}{x^0}^2} + \frac{\mathrm{d}r^\alpha}{\mathrm{d}x^0}\frac{\mathrm{d}^2 x^0}{\mathrm{d}\tau^2} \tag{7}$$

Substituting the derivatives from equations (7) into equation (6):

$$\frac{\mathrm{d}^2 r^\alpha}{\mathrm{d}{x^0}^2}\left(\frac{\mathrm{d}x^0}{\mathrm{d}\tau}\right)^2 + \frac{\mathrm{d}r^\alpha}{\mathrm{d}x^0}\frac{\mathrm{d}^2 x^0}{\mathrm{d}\tau^2} = -g^{\alpha\sigma}[\mu\nu,\sigma]\frac{\mathrm{d}r^\mu}{\mathrm{d}x^0}\frac{\mathrm{d}r^\nu}{\mathrm{d}x^0}\left(\frac{\mathrm{d}x^0}{\mathrm{d}\tau}\right)^2 \tag{8}$$

Multiplying both sides of equation (8) by $\left(\frac{\mathrm{d}x^0}{\mathrm{d}\tau}\right)^{-2}$:

$$\frac{\mathrm{d}^2 r^\alpha}{\mathrm{d}{x^0}^2} + \frac{\mathrm{d}r^\alpha}{\mathrm{d}x^0}\left\{\frac{\mathrm{d}^2 x^0}{\mathrm{d}\tau^2}\left(\frac{\mathrm{d}x^0}{\mathrm{d}\tau}\right)^{-2}\right\} = -g^{\alpha\sigma}[\mu\nu,\sigma]\frac{\mathrm{d}r^\mu}{\mathrm{d}x^0}\frac{\mathrm{d}r^\nu}{\mathrm{d}x^0} \tag{9}$$

We are entering the crucial steps that will separate space from time. Equation (9) has a complicated factor in curly braces. Actually, equation (9) represents four equations, one for each of $\alpha = 0, 1, 2, 3$. The complicated factor, because it depends only on x^0 and τ, is the same for all four equations. We are going to sacrifice one of the equations to solve for the complicated factor. In particular, we are going to sacrifice the equation for $\alpha = 0$.

Separating equation (9) into separate equations for $\alpha = 0$ and $\alpha = 1, 2, 3$, and then using i instead of α to remind ourselves that the index now only goes from 1 to 3:

$$\frac{\mathrm{d}^2 r^0}{\mathrm{d}{x^0}^2} + \frac{\mathrm{d}r^0}{\mathrm{d}x^0}\left\{\frac{\mathrm{d}^2 x^0}{\mathrm{d}\tau^2}\left(\frac{\mathrm{d}x^0}{\mathrm{d}\tau}\right)^{-2}\right\} = -g^{0\sigma}[\mu\nu,\sigma]\frac{\mathrm{d}r^\mu}{\mathrm{d}x^0}\frac{\mathrm{d}r^\nu}{\mathrm{d}x^0} \tag{10a}$$

$$\frac{\mathrm{d}^2 r^i}{\mathrm{d}{x^0}^2} + \frac{\mathrm{d}r^i}{\mathrm{d}x^0}\left\{\frac{\mathrm{d}^2 x^0}{\mathrm{d}\tau^2}\left(\frac{\mathrm{d}x^0}{\mathrm{d}\tau}\right)^{-2}\right\} = -g^{i\sigma}[\mu\nu,\sigma]\frac{\mathrm{d}r^\mu}{\mathrm{d}x^0}\frac{\mathrm{d}r^\nu}{\mathrm{d}x^0} \tag{10b}$$

To solve equation (10a) for the complicated factor, we now assume that space and time are absolute. In particular, we assume that both the particle time r^0 and the coordinate time x^0 are measured in absolute time, hence:

$$\frac{\mathrm{d}r^0}{\mathrm{d}x^0} = 1, \qquad \frac{\mathrm{d}^2 r^0}{\mathrm{d}{x^0}^2} = 0 \tag{11}$$

Solving for the complicated factor by substituting equations (11) into equation (10a) gives:

$$\left\{ \frac{\mathrm{d}^2 x^0}{\mathrm{d}\tau^2} \left(\frac{\mathrm{d}x^0}{\mathrm{d}\tau} \right)^{-2} \right\} = -g^{0\sigma}[\mu\nu,\sigma] \frac{\mathrm{d}r^\mu}{\mathrm{d}x^0} \frac{\mathrm{d}r^\nu}{\mathrm{d}x^0} \tag{12}$$

Substituting equation (12) into equation (10b) and moving the term containing the complicated factor to the right hand side gives:

$$\frac{\mathrm{d}^2 r^i}{\mathrm{d}x^{0\,2}} = \left(\frac{\mathrm{d}r^i}{\mathrm{d}x^0} g^{0\sigma} - g^{i\sigma} \right) [\mu\nu,\sigma] \frac{\mathrm{d}r^\mu}{\mathrm{d}x^0} \frac{\mathrm{d}r^\nu}{\mathrm{d}x^0} \tag{13}$$

Finally, replacing x^0 with ct and multiplying both sides of equation (13) by c^2 gives equation (1).

4 Updates on work being prepared for release

Absolute Electrogravity. Adding the electromagnetic force to Absolute Gravity is straightforward. Absolute Electrogravity unifies Einstein's General Relativity with Maxwell's Electromagnetism in Newton's Absolute Space and Absolute Time.

Examples of Absolute Gravity. Contains Absolute Gravity force equations for the Schwarzschild and Kerr solutions (including charge). Also contains a useful approximation to the force equation around a massive rotating sphere such as the Earth, extending [3].

Absolute Gravity as Classical Mechanics. The force equation (1) can be written in ordinary 3-dimensional scalar/vector/matrix notation, but there are enough steps involved that it merits its own letter.

The Great Shell: Dark Energy is Gravity. In Absolute Gravity, matter falling toward a black hole creates a shell around the event horizon. The increasingly massive shell causes the event horizon to expand, encompassing matter on the inside surface of the shell. This influx of matter to the inside of the event horizon creates a gravitational potential attracting everything inside the black hole toward the inside surface of the shell. The galaxies in our universe are not expanding away from each other; we are all being drawn to the inside surface of the Great Shell. Is there a way for us to break through the Great Shell, to be born into the larger universe outside?

Quantum Electrogravity and the Weak and Strong Forces. If you guessed that the vector w and the matrix S mentioned at the end of the Introduction stood for weak and strong, you guessed correctly.

References

[1] Einstein, A., "The Foundation of the General Theory of Relativity", 1916, pgs 111-164, translated by Perrett, W., and Jeffery G. B., *The Principle of Relativity*, Dover, 1952

[2] Newton, I., *The Principia*, 1726, pgs 13-18, translated by Andrew Motte, Prometheus Books, 1995.

[3] Parker, D. B., "How to explain the Michelson-Morley experiment in ordinary 3-dimensional space", 2010, https://arxiv.org/abs/1006.4596