General relativity, general covariance, and absolute gravity

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(Dated: February 5, 2023)

General covariance is the principle that the equations for the laws of physics should appear the same in all coordinate systems. A weak point in general covariance is that we have only one universe, so it is sufficient if the laws of physics work in only one coordinate system. If we use absolute cartesian coordinates for that one coordinate system, then general relativity reduces from tensor equations in curved spacetime to three-dimensional vector calculus in ordinary uncurved three-dimensional space with ordinary absolute time. Einstein's field equation for general relativity comes over whole into absolute gravity, requiring only reinterpretation. The geodesic equation, which is where the conflict between general covariance and cartesian coordinates lies, requires modification.

INTRODUCTION

General covariance is the principle that the equations for the laws of physics should appear the same in all coordinate systems. A weak point in general covariance is that we have only one universe, so it is sufficient if the laws of physics work in only one coordinate system. If we use absolute cartesian coordinates for that one coordinate system, then general relativity reduces from tensor equations in curved spacetime to three-dimensional vector calculus in ordinary uncurved three-dimensional space with ordinary absolute time[2].

There are two main components to general relativity: Einstein's field equation and the geodesic equation.

The field equation comes over whole into absolute gravity. The field equation itself does not curve space and time. The field equation does not calculate changes in the coordinates; the field equation calculates changes in the gravitational field. Einstein's field equation works as well for absolute cartesian coordinates with absolute time as for any other coordinate system.

Where general relativity curves space and time is in the interpretation of the gravitational field. General relativity interprets the gravitational field as the metric $g_{\mu\nu}$ for curved space and time. Absolute gravity instead interprets the gravitational field as absolute time-varying potentials in absolute three-dimensional space.

GEODESIC EQUATION VERSUS FORCE EQUATION

General relativity's interpretation of the gravitational field as a metric is realized in the geodesic equation – general relativity's version of a force equation. The geodesic equation is the point where general covariance separates general relativity from absolute gravity.

The geodesic equation of general relativity is:

$$\frac{\mathrm{d}^2 x^\alpha}{\mathrm{d}\tau^2} = -\Gamma^\alpha_{\beta\gamma}\frac{\mathrm{d}x^\beta}{\mathrm{d}\tau}\frac{\mathrm{d}x^\gamma}{\mathrm{d}\tau}. \tag{1}$$

The metric interpretation of the gravitational field appears in the definitions of the proper time differentials $\mathrm{d}\tau^2$ and $\mathrm{d}\tau$ (in a metric with signature $(1,-1,-1,-1)$):

$$\mathrm{d}\tau^2 = g_{\mu\nu}\,\mathrm{d}x^\mu\,\mathrm{d}x^\nu, \qquad \mathrm{d}\tau = \sqrt{g_{\mu\nu}\,\mathrm{d}x^\mu\,\mathrm{d}x^\nu}. \tag{2}$$

Changes in any of the x^δ in equation (1) are dependent on changes in any of the other x^δ via equation (2). For example, changes in space can cause changes in time. The geodesic equation (1) is generally covariant; when you change the coordinate system the equation stays the same.

The force equation of absolute gravity is:

$$\begin{aligned}\frac{\mathrm{d}^2 x^i}{\mathrm{d}(x^0)^2} = &-\left(\Gamma^i_{00} + 2\Gamma^i_{j0}\frac{\mathrm{d}x^j}{\mathrm{d}x^0} + \Gamma^i_{jk}\frac{\mathrm{d}x^j}{\mathrm{d}x^0}\frac{\mathrm{d}x^k}{\mathrm{d}x^0}\right)\\ &+\frac{\mathrm{d}x^i}{\mathrm{d}x^0}\left(\Gamma^0_{00} + 2\Gamma^0_{j0}\frac{\mathrm{d}x^j}{\mathrm{d}x^0} + \Gamma^0_{jk}\frac{\mathrm{d}x^j}{\mathrm{d}x^0}\frac{\mathrm{d}x^k}{\mathrm{d}x^0}\right),\end{aligned} \tag{3}$$

where $i,j,k = 1,2,3$. Mass does not appear because the force of gravity is independent of mass. Note that the force equation (3) represents three individual equations for $i = 1,2,3$, compared to the four individual equations in the geodesic equation (1). The force equation (3) is not generally covariant; it was derived to only be valid in cartesian coordinates[1].

CONCLUSION

Despite their different interpretations of the metric $g_{\mu\nu}$, general relativity and absolute gravity produce the same physical predictions. General relativity says that a rock thrown through the air follows a straight path; it is space and time that are curved. Absolute gravity says that a rock thrown through the air follows a curved path; space and time have no curvature. In both cases, the observed behavior of the rock is the same.

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[1] Parker, D. B., "General Relativity in Absolute Space and Time", 2022, preprint, https://pgu.org

[2] Parker, D. B., "The absolute gravity force equation as classical mechanics", 2023, preprint, https://pgu.org