General relativity in ordinary three-dimensional space

David B. Parker*
pgu.org

(Dated: February 6, 2023)

If you start with general relativity and you keep Einstein's field equation, but you replace the geodesic equation with a particular non-covariant equation for a curved line in flat space, then you get a theory of gravity that makes the same physical predictions as general relativity, except that space is ordinary flat three-dimensional cartesian space and time is ordinary absolute universal time.

If you start with general relativity and you keep Einstein's field equation[1], but you replace the geodesic equation:

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

with the following non-covariant equation for a curved line in flat space:

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

then you get a theory of gravity[2][3][4] that makes the same physical predictions as general relativity, except that space is ordinary flat three-dimensional cartesian space ($x^1, x^2, x^3 = x, y, z$) and time is ordinary absolute universal time ($x^0 = ct$).

---

* Electronic address: `daveparker@pgu.org`

[1] Einstein, A., “The Foundation of the General Theory of Relativity”, 1916, pgs 111-164, translated by Perrett, W., and Jeffery G. B.,
[2] Parker, D. B., “General relativity, general covariance, and absolute gravity”, 2023, preprint, https://pgu.org
[3] Parker, D. B., “On absolute clocks and rulers”, 2023, preprint, https://pgu.org
[4] Parker, D. B., “General Relativity in Absolute Space and Time”, 2022, preprint, https://pgu.org