Parity violation is evidence that our universe is inside an extremal Kerr black hole

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If our universe is inside an extremal Kerr black hole, then the angular momentum vector of the black hole can be identified as the axial vector responsible for the handedness of the weak interaction. One condition for our universe to be inside such a black hole is that general covariance in general relativity must be abandoned. General covariance (the principle that physical laws should look the same in all coordinate systems) may simplify the math in general relativity, but at the cost of excluding other possible physics. Instead of general relativity this paper uses absolute gravity. A result is that the handedness of the weak interaction is essentially a quantum gravitational effect. Weak interactions in the top and bottom halves of a rotating black hole have opposite handedness, resulting in an overall conservation of parity. The predicted association of the weak interaction with angular momentum is experimentally testable here on Earth. For example, one might measure variations in parity violation with respect to varying angular momentum. Several experiments along these lines have already been performed, with results consistent with our universe being inside a rotating black hole, and consistent with a breakdown of general covariance.

INTRODUCTION

A simple explanation for parity violation is that our universe is inside an extremal Kerr black hole (a black hole that is rotating as fast as possible). The angular momentum vector of the black hole is the axial vector responsible for parity violation. Instead of using general relativity, these results are based on absolute gravity[1][2] — a theory that abandons general covariance.

In the top half of the black hole (see Figure 1), the arrows of gravitational force through the upper universe point in the same direction as the angular momentum vector. In the bottom half, the arrows point in the opposite direction. The upper universe is right-handed; the lower universe is left-handed (like our universe); total parity is conserved. The spreading lines of force through the universes mean the universes are expanding[3]. The circulation of the lines of force leads to a convection model of the universe.

Parity violation is similar to the Aharonov-Bohm effect from electromagnetics, where potentials can have quantum mechanical effects that are not apparent from the fields. Parity violation in the weak force is a quantum gravitational effect.

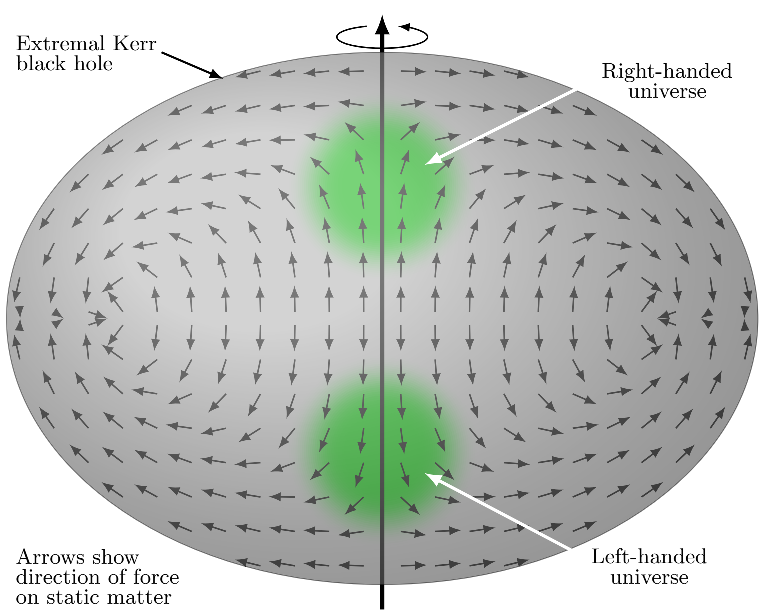

Figure 1: An extremal Kerr black hole containing two universes.

One goal of this paper is to show how the lines of force in Figure 1 were calculated. Another goal is to present information about experimental possibilities and experimental results.

SUMMARY OF OBLATE SPHEROIDAL COORDINATES

The Kerr metric is usually written in oblate spheroidal coordinates, which is not the easiest set of coordinates to work with. Also, different authors use different notations. This section summarizes some properties of the oblate spheroidal coordinates and introduces the notation that I often use.

Coordinates:

$$(x, y, z) = \text{cartesian coordinates}, \tag{1}$$
$$(r, \theta, \phi) = \text{oblate spheroidal coordinates}, \tag{2}$$
$$A = \text{oblate parameter (0 reduces to spherical coordinates, see Figure 2)}. \tag{3}$$

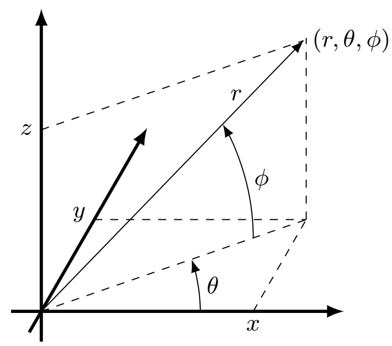

Figure 2: When the oblate parameter $A = 0$, the oblate spheroidal coordinates reduce to the spherical coordinates (r, θ, ϕ).

Two useful functions:

$$\text{pnz}(z) = 1 \text{ if } z > 0, \; -1 \text{ if } z < 0, \text{ or } 0 \text{ if } z = 0, \tag{4}$$
$$\text{atanxy}(x, y) = \text{atan}(\frac{y}{x}), \text{ corrected for the quadrant of } (x, y). \tag{5}$$

Notation for some common subexpressions:

$$r_A = \sqrt{r^2 + A^2}, \tag{6}$$
$$r_{A\phi} = \sqrt{r^2 + A^2 \sin(\phi)^2}, \tag{7}$$
$$r_{\text{cyl}} = \sqrt{x^2 + y^2} \tag{8}$$
$$r_{\text{sph}} = \sqrt{x^2 + y^2 + z^2} \tag{9}$$
$$z_{\text{obl}} = \text{pnz}(z) \sqrt{r_A^2 - r_{\text{cyl}}^2} \tag{10}$$

Cartesian coordinates in terms of oblate spheroidal:

$$x = r_A \cos(\theta) \cos(\phi), \tag{11}$$
$$y = r_A \sin(\theta) \cos(\phi), \tag{12}$$
$$z = r \sin(\phi). \tag{13}$$

Oblate spheroidal coordinates in terms of cartesian:

$$r = \sqrt{\frac{1}{2}(r_{\text{sph}}^2 - A^2) + \sqrt{\frac{1}{4}(r_{\text{sph}}^2 - A^2)^2 + A^2 z^2}}, \tag{14}$$
$$\theta = \text{atanxy}(x, y), \tag{15}$$
$$\phi = \text{pnz}(z) \; \text{acos}\left(\frac{r_{\text{cyl}}}{r_A}\right). \tag{16}$$

Handy substitutions:

$$r^4 = \left(r_{\rm sph}^2 - A^2\right) r^2 + A^2 z^2, \tag{17}$$

$$\cos(\theta) = \frac{x}{r_{\rm cyl}}, \qquad \sin(\theta) = \frac{y}{r_{\rm cyl}}, \qquad \tan(\theta) = \frac{y}{x}, \tag{18}$$

$$\cos(\phi) = \frac{r_{\rm cyl}}{r_A}, \qquad \sin(\phi) = \frac{z_{\rm obl}}{r_A}, \qquad \tan(\phi) = \frac{z_{\rm obl}}{r_{\rm cyl}}. \tag{19}$$

KERR METRIC IN OBLATE SPHEROIDAL COORDINATES

The Kerr metric with signature $(1, -1, -1, -1)$ in oblate spherical coordinates (r, θ, ϕ):

$$(\mathrm{d}s)^2 = (\mathrm{d}c\tau)^2 = \left(1 - \frac{R_{\rm s} r}{r_{A\phi}^2}\right)(\mathrm{d}ct)^2 + 2\frac{A R_{\rm s} r \cos(\phi)^2}{r_{A\phi}^2}(\mathrm{d}ct)(\mathrm{d}\theta) \tag{20}$$

$$- \frac{r_{A\phi}^2}{\Delta}(\mathrm{d}r)^2 - \left(r_A^2 + \frac{A^2 R_{\rm s} r \cos(\phi)^2}{r_{A\phi}^2}\right)\cos(\phi)^2(\mathrm{d}\theta)^2 - r_{A\phi}^2(\mathrm{d}\phi)^2, \tag{21}$$

where

$$R_{\rm s} = \text{Schwarzschild radius} = \frac{2KM}{c^2}, \qquad A = \frac{J}{cM}, \qquad \Delta = r_A^2 - R_{\rm s} r = r^2 - R_{\rm s} r + A^2, \tag{22}$$

$$K = \text{gravitational constant}, \qquad M = \text{black hole mass}, \qquad J = \text{black hole angular momentum}. \tag{23}$$

A Kerr black hole has two event horizons, at radiuses r_- and r_+, given by the solutions to the quadratic equation for $\Delta = 0$:

$$r_\pm = \left(R_{\rm s} \pm \sqrt{R_{\rm s}^2 - 4A^2}\right)/2. \tag{24}$$

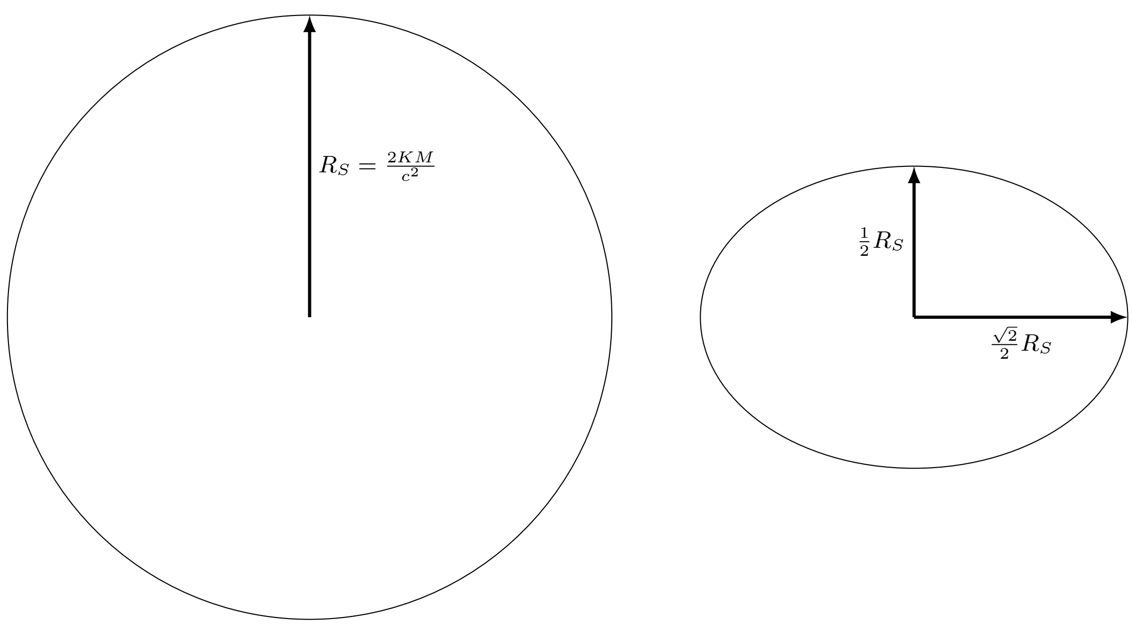

Figure 3: Relative sizes and shapes of the event horizons of Schwarzschildblack holes and extremal Kerr black holes of the same mass M.

For an extremal Kerr black hole the two event horizons coincide, $r_- = r_+$, which occurs when $R_{\rm s}^2 - 4A^2 = 0$, so that:

$$A = R_{\rm s}/2 \tag{25}$$

and

$$r_- = r_+ = R_\mathrm{s}/2. \tag{26}$$

Figure 3 shows the relative sizes and shapes of a Schwarzschild black hole and an extremal Kerr black hole of the same mass M.

FORCE EQUATION

The force equation for absolute gravity is[2]:

$$\begin{aligned}\frac{\mathrm{d}^2 r^i}{\mathrm{d}(x^0)^2} = &-\left(\Gamma^i_{00} + 2\Gamma^i_{0k}\frac{\mathrm{d}r^k}{\mathrm{d}x^0} + \Gamma^i_{jk}\frac{\mathrm{d}r^j}{\mathrm{d}x^0}\frac{\mathrm{d}r^k}{\mathrm{d}x^0}\right)\\ &+\frac{\mathrm{d}r^i}{\mathrm{d}x^0}\left(\Gamma^0_{00} + 2\Gamma^0_{0k}\frac{\mathrm{d}r^k}{\mathrm{d}x^0} + \Gamma^0_{jk}\frac{\mathrm{d}r^j}{\mathrm{d}x^0}\frac{\mathrm{d}r^k}{\mathrm{d}x^0}\right),\end{aligned} \tag{27}$$

where $1 \le i, j, k \le 3$, $r^i = [r, \theta, \phi]$, and $x^0 = ct$.

Mass does not appear in the force equation until electromagnetics is added[4].

FORCE ON STATIC MATTER

For the purposes of this paper, we need only examine the simple case of static matter inside an extremal Kerr black hole. Static matter? Inside a black hole that is rotating as fast as possible? Yep. The physics inside extremal Kerr black holes in absolute gravity is very interesting.

For static matter the velocities $\frac{\mathrm{d}r^i}{\mathrm{d}x^0}$ all go to 0, so the force equation becomes:

$$\frac{\mathrm{d}^2 r^i}{\mathrm{d}(x^0)^2} = -\Gamma^i_{00} = \begin{bmatrix}-\Gamma^1_{00}\\ -\Gamma^2_{00}\\ -\Gamma^3_{00}\end{bmatrix} = \begin{bmatrix}\frac{1}{2}R_\mathrm{s}\frac{\Delta}{r^4_{A\phi}}\left(1 - 2\frac{r^2}{r^2_{A\phi}}\right)\\ 0\\ -A^2 R_\mathrm{s} r\sin(\phi)\cos(\phi)\,/\,r^6_{A\phi}\end{bmatrix} \tag{28}$$

Graphing the direction (not the magnitude) of this force gives Figure 4, or Figure 1 when graphed at lower resolution.

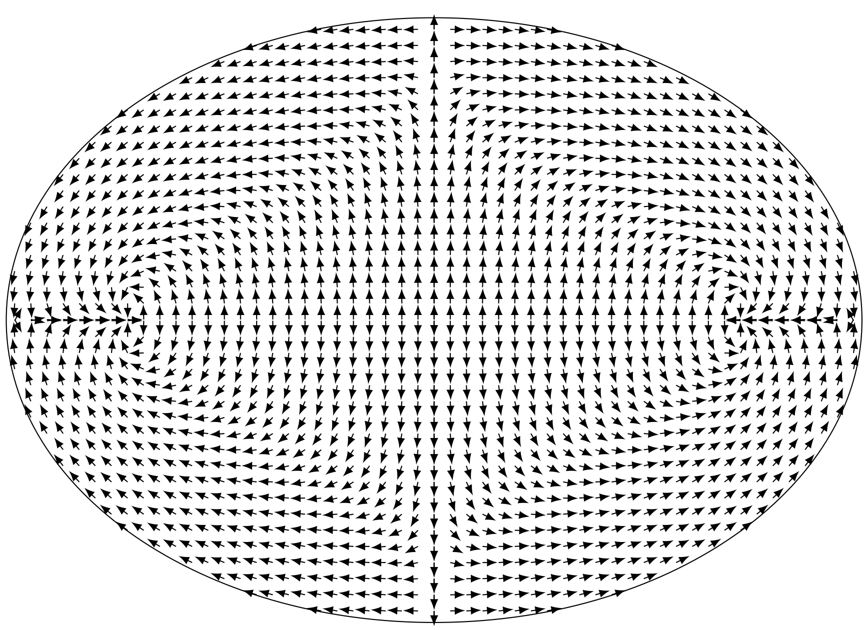

Figure 4: Direction (not magnitude) of force on static matter.

EXPERIMENTAL EVIDENCE

Local angular momentum may be able to modulate the angular momentum of the black hole. For example, fixed laboratories on Earth may be able to detect daily variations in parity violation as the Earth rotates around its axis.

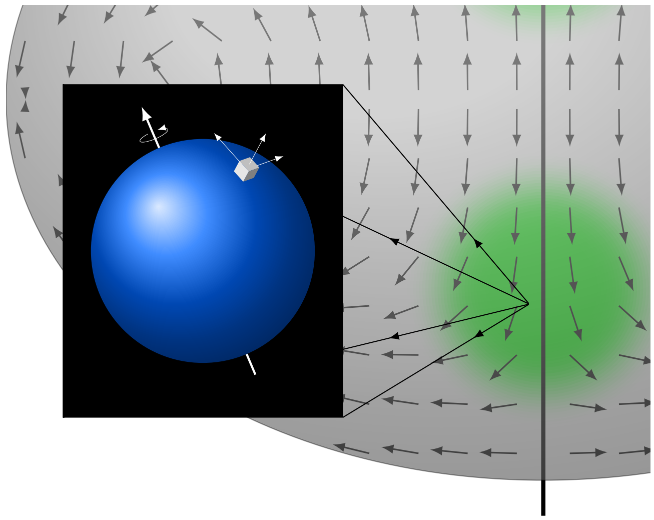

Figure 5: The rotation of the Earth may modulate the black hole's angular momentum.

Experiments along these lines have been conducted since the time of Rutherford.

The most recent paper I found is from YuJian He, et al.[5]. In their paper they also review earlier papers. They measured daily variations in parity violation. They also modulated all sources of external angular momentum by rotating radioactive isotopes in a centrifuge, and measured variations in decay rates.

Their results are consistent with our universe being inside an extremal Kerr black hole, and consistent with a breakdown of general covariance.

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[1] Parker, D. B., "Parity violation is evidence that our universe is inside an extremal Kerr black hole (plus QEG)" poster, https://pgu.org

[2] Parker, D. B., "General relativity in ordinary three-dimensional space", preprint, https://pgu.org

[3] Parker, D. B., "Our universe is inside a black hole; dark energy is gravity", preprint, https://pgu.org

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

[5] YuJian He, LiXi Zeng & ShengChu Qi, "Discussions about whether radioactive half life can be changed by mechanic motion", Sci China Ser B-Chem, May 2009, 52(5):693-698.