# Using gravitation to emulate electromagnetism.

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**Abstract**

The possibility of Universe-scale black holes living in closed 3D space of constant positive curvature was briefly considered in previous work. Further consideration of this possibility is given here. A possible link between gravitation and electromagnetism is discussed.

## 1 Introduction

Consider a Universe-scale black hole living in closed 3D space of constant positive curvature [1, 2].

Where $R_U$ is the Euclidean 4-radius of the Universe, an equatorial-sized black hole (e.g., $A = 4\pi R_U^2$) has a rest energy $E_0$ of

$$E_0 = E_{\text{eq}} = \frac{\sqrt{E_p^2 R_U^2}}{2\ell_p}. \tag{1}$$

The maximum rest energy of any black hole is

$$E_0 = E_{\text{max}} = 2E_{\text{eq}}. \tag{2}$$

The black hole event horizon colatitude $\Phi = (0, \pi)$ is

$$\Phi = \begin{cases} E_0 < E_{\text{eq}}, & \arccos\left[\sqrt{\frac{E_p^2 R_U^2 - 4(E_0^2 \ell_p^2)}{E_p^2 R_U^2}}\right], \\ E_0 = E_{\text{eq}}, & \frac{1}{2}\pi, \\ E_0 > E_{\text{eq}}, & 1 - \arccos\left[\sqrt{\frac{E_p^2 R_U^2 - 4([2E_{\text{eq}} - E_0]^2 \ell_p^2)}{E_p^2 R_U^2}}\right], \end{cases} \tag{3}$$

and the black hole event horizon area is

$$A = 4\pi(R_U^2 - R_U^2 \cos^2(\Phi)). \tag{4}$$

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The black hole's entropy is

$$S = 4\pi \frac{E_0^2}{E_p^2}. \tag{5}$$

Where $E_0 \leq E_{\text{eq}}$, the entropy to area ratio is constant

$$\frac{S}{A} \equiv \frac{1}{4\ell_p^2} \approx 9.57 \times 10^{68}. \tag{6}$$

Else, where $2E_{\text{eq}} > E_0 > E_{\text{eq}}$, the entropy to area ratio is variable

$$\frac{S}{A} = \left( \frac{1}{4\ell_p^2}, \infty \right). \tag{7}$$

The increase in entropy to area ratio is equivalent to an increase in interaction strength

$$G' = \frac{4SG^2\hbar}{Ac^3}. \tag{8}$$

For instance, by manually setting $G' = G \times 10^{40} \approx 6.67 \times 10^{29}$ in an attempt to emulate the electromagnetic interaction, the result is that $S/A \approx 9.57 \times 10^{108}$, and that the corresponding length scale

$$\ell' = \sqrt{\frac{\hbar G'}{c^3}} \tag{9}$$

is $\ell' \approx 1.6 \times 10^{-15}$.

Do these results imply that electromagnetically interacting fundamental particles are Universe-scale black holes (e.g., $\Phi \approx \pi$, $E_0 \approx 1.2 \times 10^{69}$ Joules where $R_U \approx 1 \times 10^{25}$ metres)? If so, then it can be seen why the Heisenberg uncertainty principle implies that a fundamental particle is everywhere at once. This is because a fundamental particle (e.g., a Universe-scale black hole) literally envelops everything else within the Universe. As well, it seems likely that a fundamental particle's large surplus of hidden energy (e.g., $(E_0 - 8 \times 10^{-14}) \approx E_0$ Joules for an electron) would serve as the source of its "virtual" energy.

# References


[1] Halayka S. Can the Edges of a Complete Graph Form a Radially Symmetric Field in Closed Space of Constant Positive Curvature? (2010) viXra:1007.0039

[2] Halayka S. Closed space fitness test C++ code v1.1. (2010) `http://code.google.com/p/completegraphcurved/downloads/list`