General Relativity in the Planck Vacuum Theory

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***Abstract*—This short paper compares the classical Newton gravitational equation to the Einstein curvature tensor and shows that the two are intimately related. The calculation expands the Newton force to be more in line with the Einstein and Schwarzschild tensors.**

***Index Terms*—Einstein Curvature Tensor, Newton Gravitational Equation, Planck Vacuum Theory.**

I. Introduction

THE spacetime of the Planck vacuum (PV) theory consists of a continuum pervaded by a degenerate collection of Planck particle (PP) cores $(\pm e_*, m_*)$ whose vacuum energy is many orders-of-magnitude higher than ordinary free-space particle energies. As a result the theoretical foundation [1] [2] [3] [4] of the PV rests upon the unification of the Einstein, Newton, and Coulomb superforces:

$$\frac{c^4}{G}\left(=\frac{m_* c^2}{r_*}\right)=\frac{m_*^2 G}{r_*^2}=\frac{e_*^2}{r_*^2}\to r_* m_* c=\frac{e_*^2}{c}\quad(=\hbar) \qquad (1)$$

where the ratio c^4/G is the curvature superforce that appears in the Einstein field equations. G is Newton's gravitational constant, c is the speed of light, m_* and r_* are the Planck mass and length respectively [5, p.1234], and e_* is the massless bare (or coupling) charge. The Planck time is $t_* = r_*/c$ [5, p.1233]. The fine structure constant is given by the ratio $\alpha \equiv e^2/e_*^2$, where e is the observed electronic charge magnitude. The ratio e_*^2/c to the right of the arrow is the spin coefficient for the PP, the proton, and the electron cores, where $\hbar$ is the reduced Planck constant. The Newton constants can be obtained from the three superforces above and are [6]

$$G=\frac{r_* c^2}{m_*}=\frac{e_*^2}{m_*^2}\,. \qquad (2)$$

The proton and electron cores and their antiparticles are $(\pm e_*, m_p)$ and $(\pm e_*, m_e)$ respectively.

The next section introduces the Einstein tensor with its Schwarzschild solution and compares it to the classical Newton equation.

II. Comments and Conclusions

In general relativity [7], the Einstein tensor equation can be expressed as $(\mu,\nu = 0,1,2,3)$

$$G_{\mu\nu}=R_{\mu\nu}-\frac{1}{2}Rg_{\mu\nu}+\Lambda g_{\mu\nu}=\frac{8\pi G}{c^4}T_{\mu\nu} \qquad (3)$$

where $R_{\mu\nu}$ is the Ricci tensor and R is its scalar, $g_{\mu\nu}$ is the metric tensor, and Λ is the cosmological constant. In most calculations $\Lambda g_{\mu\nu}$ is vanishingly small and can be ignored.

Dropping the cosmological constant leads to the Einstein curvature tensor that can be expressed as [2]

$$G_{\mu\nu}=\frac{8\pi G}{c^4}T_{\mu\nu}=\frac{8\pi}{c^4/G}T_{\mu\nu}=\frac{8\pi}{m_* c^2/r_*}T_{\mu\nu} \qquad (4)$$

using (1), where $m_* c^2/r_*$ is a normalizing force. $T_{\mu\nu}$ is the stress-energy tensor. The Schwarzschild metric tensor (assuming a spherical mass with no charge or angular momentum) that solves this equation is then

$$ds^2=-[1-2n(r)]c^2dt^2+\frac{dr^2}{[1-2n(r)]}+r^2d\Omega^2 \qquad (5)$$

where

$$n(r)\equiv\frac{mc^2/r}{c^4/G}=\frac{mc^2/r}{m_* c^2/r_*}<\frac{1}{2}\,. \qquad (6)$$

The classical Newton equation can be related more closely to the tensor equations (4) and (5):

$$-F_{gr}(r)=\frac{m_1 m_2 G}{r^2}=\frac{(m_1c^2/r)(m_2c^2/r)}{c^4/G}$$
$$=\frac{(m_1c^2/r)(m_2c^2/r)}{m_* c^2/r_*}=n_1(r)n_2(r)\frac{m_* c^2}{r_*} \qquad (7)$$

where again

$$n_i(r)\equiv\frac{m_i c^2/r}{m_* c^2/r_*}<1 \qquad (8)$$

and this Newton equation can be easily compared to (4) and (5).

The salient feature to note in the comparison is that the force $m_* c^2/r_*$ acts as a normalizing force in (4) and (5), and as a source constant for the Newton equation (7).

References

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