Black Holes and Quantum Gravity from a Planck Vacuum Perspective

William C. Daywitt

National Institute for Standards and Technology (retired), Boulder, Colorado, USA

E-mail: wcdaywitt@earthlink.net

This note explores the question of whether or not the Planck vacuum theory can explain black holes and quantum gravity. It is argued that black holes do not physically exist in nature and that the term "quantum gravity" makes no sense. The importance of the Planck vacuum in constraining the n-ratio in the Schwarzschild line element is noted.

The Planck vacuum (PV) [1] is an omnipresent degenerate gas of negative-energy Planck particles (PP) characterized by the triad (e_*, m_*, r_*), where e_*, m_*, and r_* $(\lambda_*/2\pi)$ are the PP charge, mass, and Compton radius respectively. The vacuum is held together by van der Waals forces. The charge e_* is the bare (true) electronic charge common to all charged elementary particles and is related to the observed electronic charge e through the fine structure constant $\alpha = e^2/e_*^2$ which is a manifestation of the PV polarizability. The PP mass and Compton radius are equal to the Planck mass and length respectively. The particle-PV interaction is the source of the gravitational $(G = e_*^2/m_*^2)$ and Planck $(\hbar = e_*^2/c)$ constants, and the Compton relations $(r_* m_* c^2 = r_c m c^2 = e_*^2)$ relating the PV and its PPs to the observed elementary particles, where the charged elementary particles are characterized by the triad (e_*, m, r_c), m and r_c being the mass and Compton radius $(\lambda_c/2\pi)$ of the particle (particle spin is not yet included in the theory). A feedback mechanism in the particle-PV interaction leads to the Lorentz transformation. The zero-point random motion of the PP charges e_* about their equilibrium positions within the PV, and the PV dynamics, are the source of the quantum vacuum [2]. Neutrinos appear to be phonon packets that exist and propagate within the PV [3].

General relativity describes the spacetime-curvature aspects of the PV [1]. So it is natural to assume that this vacuum state has something to do with black holes, "tunnels in spacetime", and "wormholes connecting different universes" [4, p. 642] if such things do indeed exist.

The Einstein metric equation, and the "Schwarzschild" line element outside a static sphere of mass m, expressed in terms of the PV parameters, are [1]

$$G_{\mu\nu} = \frac{8\pi T_{\mu\nu}}{c^4/G} = \frac{8\pi T_{\mu\nu}}{m_* c^2/r_*} \tag{1}$$

and

$$ds^2 = -\left[1 - 2n_r\right] c^2 dt^2 + \frac{dr^2}{\left[1 - 2n_r\right]} + r^2\, d\Omega^2, \tag{2}$$

where the n-ratio is

$$n_r \equiv n_r(m/r) \equiv \frac{mc^2/r}{c^4/G} = \frac{mc^2/r}{m_* c^2/r_*} \tag{3}$$

with $0 \leqslant n_r < 1$. Here $d\Omega^2 \equiv d\theta^2 + \sin^2\theta\, d\phi^2$.

The force mc^2/r is the distortion or curvature force the mass m exerts on the PV at a distance r from the center of the mass [1]. This curvature force is always smaller than the ultimate curvature force $c^4/G = m_* c^2/r_*$. As $r \to \infty$ the n-ratio vanishes where the metric bracket $\left[1 - n_r\right]$ is unity and the spacetime is flat. At the surface of the sun, a white dwarf, or a neutron star, n_r is roughly 0.00001, 0.001, and 0.5 respectively. Only at $m_* c^2/r_*$ is n_r equal to one. Thus the n-ratio is limited to $n_r < 1$ by the nature of the PV.

The metric structure of (2) leads to a black hole with its event horizon at $n_r = 1/2$ and to the corresponding "Schwarzschild radius" $R_s = 2Mc^2/(m_* c^2/r_*)$ [4, pp. 630–636]. From here such ideas as "tunnels" and "wormholes" arise. However, (2) is apparently incorrect [5–8]. For a point mass m at $r = 0$, the original and correct Schwarzschild line element [5] is

$$ds^2 = -\left[1 - 2n(R)\right] c^2 dt^2 + \frac{dR^2}{\left[1 - 2n(R)\right]} + R^2\, d\Omega^2, \tag{4}$$

where

$$R = r[1 + 8n_r^3]^{1/3} \tag{5}$$

and where (4) is only valid for $r > 0$. The metric bracket is now

$$1 - 2n(R) = 1 - \frac{2n_r}{[1 + 8n_r^3]^{1/3}}\,, \tag{6}$$

which is monotonically decreasing from 1 at $n_r = 0$ to $0.0385\ldots$ at $n_r = 1$. Thus, in the allowable range of n_r, the line element ds in equation (4) is well behaved. Again the metric bracket is unity as $r \to \infty$ where both n_r and $n(R)$ vanish.

The velocity of a radial photon starting from infinity and heading toward $r = 0$ can be found by setting $d\Omega^2 = 0$ and $ds = 0$ in (4). Its velocity dr/dt relative to its velocity (c) at infinity is easily shown to be

$$\beta(n_r) = \left(1 + 8n_r^3\right)^{2/3} \left[1 - \frac{2n_r}{\left(1 + 8n_r^3\right)^{1/3}}\right], \tag{7}$$

which yields $\beta(0) = 1$ as it should, and $\beta(1) \approx 1/6$ for a PP $(n_r = 1)$ positioned at $r = 0$.

From the two preceding paragraphs it is clear that nothing singular happens to the Schwarzschild line element of (4) in the allowed range of n_r. Furthermore, the PV theory does not

need to explain the black hole or its "tunneling" and "wormhole" attributes since the black hole does not exist.

The metric gravity discussed above deals with what happens when the curvature force mc^2/r of an isolated mass perturbs the PV. If "electromagnetics" is what happens when the polarization force e_*^2/r^2 of an isolated bare charge e_* perturbs the PV, then it can be shown that electromagnetics leads to the Maxwell equations, the relativistic electric and magnetic fields of a moving charge, and the Lorentz transformation [1]. Both of these phenomena deal with a *single* force acting on the PV. In either case, the terms "quantum gravity" or "quantum electromagnetics" make no sense because the word "quantum" applies to what happens when both forces, mc^2/r and e_*^2/r^2, perturb the PV simultaneously and lead to the Planck constant

$$r_c mc = \frac{e_*^2}{c} = \hbar \tag{8}$$

at $r = r_c$ where the two forces are equal. The standard name for this dual-force perturbation is, of course, "quantum electrodynamics" when dealing with an electron containing both mass and charge. In summary, the search for a theory of "quantum gravity" appears to make no sense.

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