The Cosmic Microwave Background Radiation as Viewed in the Planck Vacuum Theory

William C. Daywitt

***Abstract*—The invisible Planck vacuum (PV) state is a degenerate collection of Planck particle (PP) cores that fills a seven-dimensional spacetime. The degenerate nature of this PV state assures that the only motion available to the separate PP cores is a spin angular momentum and a local random PP motion. This spherical confinement of each PP core in the vacuum state leads to the cosmic-microwave-background-radiation (CMBR) spectrum seen in the free-space night sky.**

The CMBR is the experimental proof for the PV theory.

***Index Terms*—PV State, PP Core, Planck Oscillator, CMBR.**

I. Introduction

THE theoretical foundation [1] [2] [3] [4] of the PV theory rests upon the unification of the Einstein, Newton, and Coulomb superforces:

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

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 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 e_*^2 in (1) is the squared coupling charge, where one of the e_*s belongs to one of the PP cores $(\pm e_*, m_*)$ in the PV state and the other e_*s belong to the remaining cores in that state, leading to the quantum oscillations of the PP cores [6].

The degenerate nature of the PP cores in the vacuum state insure that each of the cores $(\pm e_*, m_*)$ is confined to a spherical volume of roughly $3\pi r_*^3/4$, implying that the particle motion consists of the spin and a random motion of the cores.

After the Introduction in Section I, Section II presents an important result from a previous paper [6] concerning the single PP core, and Section III calculates equations for the CMBR. Section IV presents conclusions.

II. Planck Particle Oscillator

The oscillator energy [6] of a single PP core within the PV state is $(n=0,1,2,\cdots)$

$$u_n=A_n\nu=\left(\frac{1}{2}+n\right)h\nu\tag{2}$$

DOI: http://dx.doi.org/10.24018/ejphysics.2022.4.1.145
Published on January 15, 2022.
William C. Daywitt is retired from the National Institute of Standards and Technology, Boulder, CO 80305 USA (e-mail: wcdaywitt@me.com).

where h is the Planck constant and $h\nu$ is a photon energy. This energy u_n is due to the quantization of the single PP energy and is derived from first principles in the reference.

III. Thermodynamic Oscillator

From the second term $(nh\nu)$ on the right side of equation (2): $u_i=ih\nu$ $(i=0,1,2,\cdots)$, where the thermodynamic occupation numbers for the u_i are given by the Boltzmann equations [7, p.209]

$$N_i=N_0e^{-ih\nu/kT}\tag{3}$$

and

$$N=N_0\sum e^{-ih\nu/kT}=\frac{N_0}{1-e^{-h\nu/kT}}\tag{4}$$

where k is the Boltzmann constant and T is the absolute temperature.

Differentiating both sides of equation (4) with respect to $(1/kT)$ and canceling negative signs leads to the identity

$$N_0\sum(ih\nu)e^{-ih\nu/kT}=\frac{N_0h\nu e^{-h\nu/kT}}{(1-e^{-h\nu/kT})^2}\tag{5}$$

where the left hand side of (5) is just the thermodynamic energy $U-U_0$. Then substituting for N_0 from (4) on the right of (5) leads to

$$U-\frac{Nh\nu}{2}=\frac{Nh\nu}{e^{h\nu/kT}-1}\,.\tag{6}$$

For the single Planck particle oscillator, (6) leads to the equation

$$u(\nu,T)-\frac{h\nu}{2}=\frac{h\nu}{e^{h\nu/kT}-1}\tag{7}$$

where the expression on the right refers to a blackbody process. *So the PP oscillators in the PV state are effectively black-body emitters responsible for the CMBR.*

In a different setting, applying the previous calculations to an astrophysical system leads to the brightness (intensity) expression [5, p.73] for the blackbody spectrum

$$B_\nu(T)=\frac{2\nu^2}{c^2}\frac{h\nu}{e^{h\nu/kT}-1}\tag{8}$$

with the units 'energy per unit time per unit surface area per unit solid angle' in the frequency range between ν and $\nu+d\nu$. For $T=2.725$ kelvin, (8) yields the experimental CMBR curve [5, p.1167]. In conclusion then, *the calculations in Sections II and III imply that the omnipresent nature of the PV state is the source of this brightness energy density.*

IV. Comments and Conclusions

The invisible PV state is a degenerate collection of PP cores that fills a seven-dimensional spacetime. The degenerate nature of this PV state assures that the only motion available to the separate PP cores is a spin angular momentum and a local random PP motion, leading to the thermodynamic energy equation

$$u(\nu, T) = \frac{h\nu}{2} + \frac{h\nu}{e^{h\nu/kT} - 1} \tag{9}$$

for each PP core in the vacuum state. This yields the CMBR spectrum [6] seen in the free-space night sky. In effect, the CMBR is the experimental proof for the PV theory.

References

[1] P. Davies, *Superforce: the Search for a Grand Unified Theory of Nature*. Simon and Schuster, Inc., New York, 1984.

[2] W.C. Daywitt, "A Model for Davies' Universal Superforce", Galilean Electrodynamics, Sept./Oct., 83, 2006. See also www.planckvacuumDOTcom.

[3] W.C. Daywitt, "The Trouble with the Equations of Modern Fundamental Physics", American Journal of Modern Physics. Special Issue: "Physics without Higgs and without Supersymmetry", v. 5, no. 1-1, 22, 2016.

[4] W.C. Daywitt, "Comparing the Planck-Vacuum and the Urantia-Book Depictions of the Seven-Dimensional Spacetime", European Journal of Engineering Research and Science, Vol.5, No.12, December, 2020.

[5] B.W. Carroll, D.A. Ostlie, *An Introduction to Modern Astrophysics*. (Addison-Wesley, San Francisco, Boston, New York, Cape Town, Hong Kong, London, Madrid, Mexico City, Montreal, Munich, Paris, Singapore, Sidney, Tokyo, Toronto, 2007).

[6] W.C. Daywitt, Zero-Point Oscillations in the Planck Vacuum State and Its Coordinate Uncertainty, European Journal of Engineer Research and Science, VOL. 6, NO. 4, 2021.

[7] W.P. Allis, M.A. Herlin, *Thermodynamics and Statistical Mechanics*. McGraw-Hill Book Co., New York, Toronto, London, 1952.