Space Respiration and the CMBR Temperature Fluctuations

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Space respiration is defined in the present paper as a periodic expansion and contraction of the invisible Planck vacuum (PV) state. Simple nonrelativistic calculations suggest: that the periodic variations of that state lead to an expansion-contraction cycle for the visible universe, where the inverse Hubble constant H_0^{-1} is the cycle time-period; that a space reservoir is associated with the PV state; and that the normalized cosmic-microwave-background-radiation (CMBR) temperature equals the reciprocal of the normalized PV respiration cycle.

[Reference — Daywitt W.C., " CMBR Temperature Fluctuations: 'Space Respiration' ". To be published in the Galilean Electrodynamics journal.]

1 Introduction

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

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

where the ratio c^4/G is the curvature superforce that appears in the Einstein field equations. From the basic equations (1) it is possible to derive a periodic expression for the expansion and contraction of the PV state, and hence its offspring the visible universe. G is Newton's gravitational constant, c is the speed of light, m_* and r_* are the Planck mass and length respectively [4, p.1234], and e_* is the massless bare charge. The Compton radius $r_*\ (=e_*^2/m_*c^2)$ that connects the constants r_*, m_*, and c^2 to e_*^2 is included in (1).

The two G forces in (1) are of a distinctly different nature. The second force m_*^2G/r_*^2 is clearly a Newtonian force, while the c^4/G is the curvature force that is the maximum distortion force sustainable by the PV state:

$$\frac{m_*c^2}{r_*}\geq\frac{mc^2}{r} \tag{2}$$

where the ratio m/r represents the mass-to-radius ratio of any massive spherical body, the equality holding for the Planck particles $(-e_*, m_*)$ with the Compton radius r_* from the preceding paragraph [3].

The distinct difference between the two G forces implies that

$$G=\pm\left(\frac{c^2r_*}{m_*}\right) \tag{3}$$

when the two forces are equated. Since G is a single positive constant, (3) is either superfluous or it must mirror some important two-step process taking place within the PV state. It will be seen below that that process consists of two branches in the PV respiration system that lead to two respiration cycles. Associating the spatial expansion and contraction with gravitational forces, what follows builds a model for the space-expansion-contraction cycles.

2 Planck Vacuum Respiration

From equation (3)

$$G=\pm\left(\frac{c^2r_*}{m_*}\right)\quad\Longrightarrow\quad G_\pm=\frac{c^2r_\pm}{m_*}=G\frac{r_\pm}{r_*} \tag{4}$$

where $r_\pm\approx r_*$. From (4) it follows that

$$\frac{G_++G_-}{G}=\frac{r_++r_-}{r_*}\approx 2 \tag{5}$$

and

$$\frac{G_+-G_-}{G}=\frac{r_+-r_-}{r_*}\approx 0\,. \tag{6}$$

The two-branch template formed by (5) and (6) is used in the next paragraph to derive a respiration cycle for each branch. To do this it is convenient to use the function $\sin(\omega t+\phi)$. Thus $G_\pm$ and $r_\pm$ are assumed to be PV functions of time.

The space respiration cycles (normalized by G and r_*) are then defined via the following two PV respiration branches

$$\frac{G_+(t)}{G}=\frac{r_+(t)}{r_*}=1+\epsilon\sin(\omega t-\pi/2) \tag{7}$$

and

$$\frac{G_-(t)}{G}=\frac{r_-(t)}{r_*}=1-\epsilon\sin(\omega t-\pi/2) \tag{8}$$

where

$$\frac{r_++r_-}{r_*}=2 \tag{9}$$

and

$$\frac{r_+ - r_-}{r_*} = 2\epsilon \sin(\omega t - \pi/2)\,. \tag{10}$$

The two normalized respiration cycles are then defined by

$$\zeta_+(t) \equiv \frac{r_+(t)}{r_*} = 1 + \epsilon \sin(2\pi t/\tau_* - \pi/2) \tag{11}$$

and

$$\zeta_-(t) \equiv \frac{r_-(t)}{r_*} = 1 - \epsilon \sin(2\pi t/\tau_* - \pi/2) \tag{12}$$

where $\omega = 2\pi/\tau_*$ and τ_* is the respiration period. The present epoch of the offset sinusoid $\zeta_+(t)$ from $t = 0$ to $t = \tau_*$ has a positive slope in $0 < t < \tau_*/2$ and a negative slope in $\tau_*/2 < t < \tau_*$. That is, the positive branch is expanding from 0 to $\tau_*/2$ and contracting from $\tau_*/2$ to τ_*. The corresponding slopes of the function ζ_- are opposite those of ζ_+ — see Fig. 1. The positive branch ζ_+ represents the expansion-contraction cycle of the PV state, while the negative branch ζ_- represents the contraction-expansion of a space reservoir associated with that state. Again, it is clear from the figure that, as the PV expands, the reservoir contracts; and visa versa.

Taking the time derivative of (11) leads to

$$\dot{\zeta}_+(t) = \frac{2\pi\epsilon}{\tau_*} \sin(2\pi t/\tau_*)\,, \tag{13}$$

the time rate of change of the normalized PV space respiration. Then measuring

$$\dot{\zeta}_+(\tau_*/4) = \frac{2\pi\epsilon}{\tau_*} \tag{14}$$

experimentally determines the ratio ϵ/τ_*.

The Compton radius r_* is associated with the Planck particles $(-e_*, m_*)$ that are distributed throughout the PV state, with an average separation distance of roughly $2r_*$ [3]. The ϵ in (11) and (12) is related to the maximum particle excursions $r_*\epsilon$ of these particles from their equilibrium positions within the PV state, due to the expansion-contraction of that state. See Fig. 1. A reasonable magnitude for ϵ is $0 < \epsilon < 0.1$. Taking the cycle period τ_* to be two billion years yields

$$\omega = \frac{2\pi}{\tau_*} = \frac{\pi}{10^9}\ \text{[rad per year]}\,, \tag{15}$$

a vanishingly small radian frequency that justifies the nonrelativistic nature of the preceding calculations.

3 CMBR Temperature

The brightness intensity [4, p.73] [5] of the CMBR is

$$B_\nu(T) = \frac{2\nu^2}{c^2} \frac{h\nu}{e^{h\nu/kT} - 1} \tag{16}$$

where T is the brightness temperature. The units for B_ν are '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, (16) yields the experimental CMBR data curve [4, p.1167].

When the PV (and hence the visible universe) is expanding, the brightness temperature of the CMBR should be decreasing. Likewise, when the PV is contracting, that same temperature should increase. These two conditions find expression in the following two equations

$$RT = T_0 \qquad \text{and} \qquad R = \zeta_+ \tag{17}$$

where the first equation [4, p.1164, eqn.(29.58)] expresses the fact that the temperature T of the CMBR is related to some average temperature T_0 through the scaling factor R which, in the PV theory, is clearly the normalized PV respiration function ζ_+. Combining the equations in (17) then leads to

$$\frac{T}{T_0} = \zeta_+^{-1} = \frac{1}{1 + \epsilon \sin(2\pi t/\tau_* - \pi/2)} \tag{18}$$

in Fig. 2, where the sinusoidal curve is ζ_+ and the other periodic curve is T/T_0. It is clear from the figure that, as the PV expands (from $t = 0$ to $t = \tau_*/2$), T/T_0 decreases; and as the PV contracts (from $t = \tau_*/2$ to $t = \tau_*$), the temperature ratio increases.

In the scenario assumed above and in Fig. 1, the equilibrium temperature T_0 occurs at the times

$$t = \pm(2n - 1)\tau_*/4, \quad \text{for} \quad (n = 1, 2, 3, \ldots) \tag{19}$$

and is equal to the blackbody temperature 2.725 kelvin [4, p.1167].

To illustrate the time fluctuation of the CMBR temperature, it is assumed that $\epsilon = 0.1$ and that $T(\tau_*/4) = 2.725\,\text{K}$. Then (18) leads to $T(0) = 3.0\,\text{K}$, $T(\tau_*/4) = 2.725\,\text{K}$, and $T(\tau_*/2) = 2.5\,\text{K}$ in Fig. 2.

4 Conclusions and Summary

The PV state is assumed to contain a degenerate collection of Planck particles whose important eigenstates are occupied [3], outlawing any macroscopic motion of the particles with respect to one another. Microscopic motion, however, is essential to the existence of the vacuum state, and it is within this context that the PV theory assumes the 'excursions $r_*\epsilon$' (mentioned at the end of Section 2) to operate.

The Hubble formula

$$V = H_0 D \qquad \text{or} \qquad H_0^{-1} = D/V \tag{20}$$

describes the Hubble flow [4, p.1055], where V is the recession velocity of a galaxy at a distance D from an observer, and H_0 is the Hubble constant [6, p.30]. Setting

$$H_0^{-1} = \tau_* = 2 \text{ Gyrs.} \tag{21}$$

for the respiration period [6, p.119, eqn.3.69] leads from (11) to

$$\zeta_+(t) = \frac{r_+(t)}{r_*} = 1 + \epsilon \sin\left(2\pi H_0^{-1} t - \pi/2\right) \tag{22}$$

which describes the normalized respiration cycle of the visible universe. At the present time, the PV and visible universe are expanding; so $0 < t < 1$ Gyr..

In summary, equations (11) and (22) represent the space respiration of the PV state and the visible universe respectively. As noted in the first equality of (21), however, the respiration of the visible universe (22) is derived from the PV respiration period τ_* in (11). Consequently, (11) represents the actual source of the cosmic space-expansion-contraction cycles assumed in the PV theory. The PV respiration system includes a simultaneous contraction-expansion respiration cycle (12), the space reservoir associated with $\zeta_-(t)$, that counterbalances (11). The T/T_0 curve in Fig. 2 represents a unique and believable depiction of the normalized CMBR temperature fluctuations.

Finally, it is noted that the PV theory is the only scientific theory in which a cosmic space reservoir is predicted!

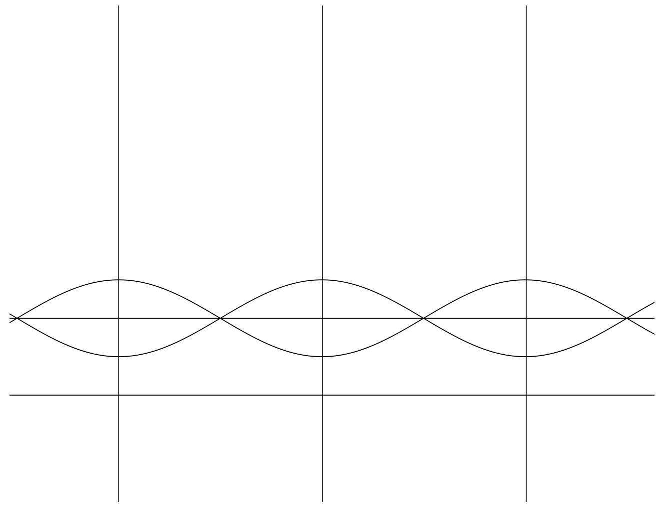

Fig. 1. An unscaled view of the two normalized respiration cycles (11) and (12) from bottom to top (at the ordinate intercepts), with $\epsilon = 0.5$. The horizontal line corresponds to $\zeta_\pm = 1$. The abscissa represents the time t, with the two vertical lines at $t = \tau_*/2$ and $t = \tau_*$. The equilibrium times of the PV and reservoir respiration cycles correspond to $\zeta_\pm[\pm(2n-1)\tau_*/4] = 1$, for $(n = 1, 2, 3, \ldots)$.

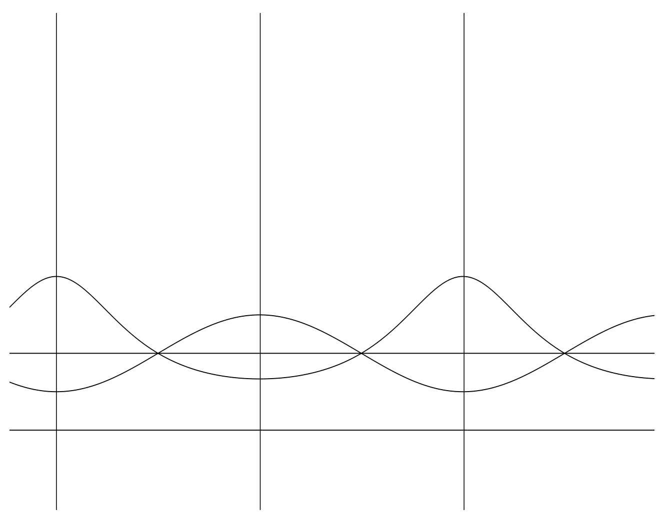

Fig. 2. An unscaled view of the normalized respiration cycle ζ_+ and the normalized temperature T/T_0, where ζ_+ is the sinusoidal curve; for $\epsilon = 0.5$. The horizontal median line corresponds to $\zeta_+ = 1$ and $T/T_0 = 1$. The abscissa represents the time t, with the two vertical lines at $t = \tau_*/2$ and $t = \tau_*$.

References

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