Time and the Black-hole White-hole Universe

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Outlined is a model of an expanding black-hole with a contracting white-hole twin. In dimensional terms the black-hole is expanding at the speed of light in integer Planck unit (Planck mass, Planck time, Planck length) increments transferred from the white-hole to the black-hole thereby forcing an expansion of the black-hole at the expense of the (contracting) white-hole. This outwards expansion gives a rationale for the arrow of time, the speed of light, dark energy and dark matter. Comparing related cosmic microwave background CMB parameters calculated using age in units of Planck time give a best fit for a 14.624 billion year old black-hole.

Table 1	Black-hole [1]	Cosmic microwave background
Age (billions of years)	14.624	13.8 [4]
Age (units of Planck time)	0.4281 x 10^{61}	
Cold dark matter density	0.21 x $10^{-26} kg.m^{-3}$ (eq.1)	0.24 x $10^{-26} kg.m^{-3}$ [6]
Radiation density	0.417 x $10^{-13} kg.m^{-3}$ (eq.10)	0.417 x $10^{-13} kg.m^{-3}$ [4]
Hubble constant	66.86 km/s/Mpc (eq.13)	67.74(46) km/s/Mpc [5]
CMB temperature	2.7272K (eq.7)	2.7255K [4]
CMB peak frequency	160.200GHz (eq.17)	160.2GHz [4]
Cosmological constant	1.0137 x 10^{123} (eq.21)	3.4 x 10^{121} [3]

keywords:
cosmic microwave background, CMB, cosmological constant, Planck unit theory, Mathematical Universe Hypothesis, black-hole universe, white-hole universe, Planck time, arrow of time, dark energy, relativity, Hubble constant, expanding universe;

1 Premise

Let us suppose that there is an expanding black-hole with a contracting white-hole twin. Let us further suppose that discrete Planck 'drops', defined as that 'entity' which is the source of the Planck units (such as micro black-holes), are transferred one by one from the white-hole to the black-hole thereby forcing an expansion of the black-hole at the expense of the contracting white-hole in incremental Planck unit steps.

The expansion steps correlate with units of Planck time.

In dimensional terms the speed of this expansion equates to the speed of light. The speed of light is therefore a constant.

It is the constant addition of these Planck 'drops' that forces the expansion of the black-hole, and so an independent dark energy is not required.

As the fabric of a black-hole is the black-hole itself, an independent dark matter may not be required (the cold dark matter density of the universe can equate to the mass density of the black-hole, see table 1).

The constant outward expansion of the black-hole in discrete steps (the clock rate) gives an omni-directional (forward) arrow of time.

When the black-hole has reached the limit of its expansion (i.e.: when it reaches absolute zero), the clock will stop. The direction of transfer and so arrow of time will reverse; the expanding black-hole becomes the contracting white-hole feeding its now expanding black-hole twin.

2 Mass density

We do not know either the mass or size of our universe, but we can estimate its mass density. Assuming that for each expansion of the black-hole, it adds Planck time t_p, Planck mass m_P and Planck (spherical) volume (Planck length = l_p), such that we can calculate the mass density of this black-hole for any chosen instant where t_{age} is the age of the black-hole as measured in units of Planck time and t_{sec} the age of the black-hole as measured in seconds.

$$t_p = 2l_p/c$$

$$mass : m_{blackhole} = 2t_{age} m_P$$

$$volume : v_{blackhole} = 4\pi r^3/3 \quad (r = 4l_p t_{age} = 2ct_{sec})$$

$$\frac{m_{blackhole}}{v_{blackhole}} = 2t_{age} m_P . \frac{3}{4\pi(4l_p t_{age})^3} = \frac{3m_P}{2^7 \pi t_{age}^2 l_p^3} (\frac{kg}{m^3}) \quad (1)$$

Gravitation constant G as Planck units;

$$G = \frac{c^2 l_p}{m_P} \quad (2)$$

From the Friedman equation; replacing p with the above mass density formula, $\sqrt{\lambda}$ reduces to the radius of the universe;

$$\lambda = \frac{3c^2}{8\pi G p} = 4c^2 t_{sec}^2 \quad (3)$$

$$\sqrt{\lambda} = radius\ r = 2ct_{sec}\ (m) \tag{4}$$

Critical density p_c using for H eq(13)

$$p_c = \frac{3H^2}{8\pi G} = (1Mpc).\frac{3m_P}{2^5 \pi t_{age}^2 l_p^3} = \frac{(1Mpc)}{4}.\frac{m_{blackhole}}{v_{blackhole}} \tag{5}$$

3 Temperature

Black-hole temperature $T_{blackhole}$
mass M = n.m_P (n integrals of Planck mass)
Planck temperature = T_P;

$$T_{blackhole} = \frac{hc^3}{16\pi^2 G k_B M} = \frac{T_P}{8\pi n}\ (K) \tag{6}$$

$$T_{universe} = \frac{T_P}{8\pi \sqrt{t_{age}}} \tag{7}$$

The $mass/volume$ formula uses t_{age}^2, the $temperature$ formula uses $\sqrt{t_{age}}$. We may therefore eliminate the age variable t_{age} and combine both formulas into a single constant of proportionality that resembles the radiation density constant.

$$\frac{m_{blackhole}}{v_{blackhole} T_{blackhole}^4} = \frac{3m_P}{128\pi t_{age}^2 l_p^3}.\frac{1}{T_{blackhole}^4} = \frac{2^8 3\pi^6 k_B^4}{h^3 c^5} \tag{8}$$

4 Radiation density

From Stefan Boltzmann constant

$$\sigma_{SB} = \frac{2\pi^5 k_B^4}{15h^3c^2} \tag{9}$$

$$\frac{4\sigma_{SB}}{c^3}T^4 = \frac{8\pi^5 k_B^4}{15h^3c^5}.(\frac{T_P}{8\pi \sqrt{t_{age}}})^4 = \frac{c^2}{480}.\frac{m_{blackhole}}{3\pi v_{blackhole}} \tag{10}$$

5 Casimir formula

F = force, A = plate area, $d_c l_p$ = distance between plates calculated in units of Planck length

$$\frac{-F_c}{A} = \frac{\pi hc}{480(d_c l_p)^4} = \frac{\pi^2 m_P c^2}{240 d_c^4 l_p^3} \tag{11}$$

if $d_c = 4\pi \sqrt{t_{age}}$, then eq(10) = eq(11).

$$\frac{1}{15}.\frac{\pi^2 m_P c^2}{16 d_c^4 l_p^3} = \frac{1}{15}.\frac{m_P c^2}{2^{12}\pi^2 l_p^3 t_{age}^2} = \frac{c^2}{480}.\frac{m_{blackhole}}{3\pi v_{blackhole}} \tag{12}$$

6 Hubble constant

1 Mpc = 3.08567758 x 10^{22}m.

$$H = \frac{1Mpc}{t_{age} t_p} \tag{13}$$

7 Wien's displacement law

$$\frac{xe^x}{e^x - 1} - 5 = 0, x = 4.965114231... \tag{14}$$

$$\lambda_{peak} = \frac{2\pi l_p T_P}{x T_{blackhole}} = \frac{16\pi^2 l_p \sqrt{t_{age}}}{x} \tag{15}$$

8 Black body peak frequency

$$\frac{xe^x}{e^x - 1} - 3 = 0, x = 2.821439372... \tag{16}$$

$$v_{peak} = \frac{k_B T_{blackhole} x}{h} = \frac{x}{8\pi^2 t_p \sqrt{t_{age}}} \tag{17}$$

$$f_{peak} = \frac{xc}{16\pi^2 l_p \sqrt{t_{age}}} \tag{18}$$

9 Cosmological constant

Riess and Perlmutter (notes 2) using Type 1a supernovae calculated the end of the universe $t_{end} \sim 1.7$ x $10^{-121} \sim 0.588$ x 10^{121} units of Planck time;

$$t_{end} \sim 0.588x10^{121}\ \sim 0.2x10^{71} yrs \tag{19}$$

The maximum temperature T_{max} would be when $t_{age} = 1$. What is of equal importance is the minimum possible temperature T_{min} - that temperature 1 unit above absolute zero, for in the context of this expansion theory, this temperature would signify the limit of expansion (the black-hole could expand no further). For example, if we simply set the minimum temperature as the inverse of the maximum temperature;

$$T_{min} \sim \frac{1}{T_{max}} \sim \frac{8\pi}{T_P} \sim 0.177\ 10^{-30}\ K \tag{20}$$

This would then give us a value 'the end' in units of Planck time ($\sim$ 0.35 10^{73} yrs) which is close to Riess and Perlmutter;

$$t_{end} = T_{max}^4 \sim 1.014\ 10^{123} \tag{21}$$

The mid way point ($T_{mid} = 1K$) becomes $T_{max}^2 \sim 3.18\ 10^{61} \sim$ 108.77 billion years.

10 Comments

In comparing this black-hole with cosmic microwave background data, I took the peak frequency value 160.2 GHz as my reference and used this to solve t_{age} eq(18) and from there the other formulas. The best fit for the above parameters in comparison to the CMB data (see table, page 1) is for a 14.624 billion year old black-hole. I used a contracting white-hole as the source of the Planck units as this provides a neat solution but if micro black-holes are dimensionless (they sum to unity) then the white hole can be dispensed with.

Notes:

1. Further discussion of this model can be referenced at: http://planckmomentum.com/

2. The Schwarzschild metric admits negative square root as well as positive square root solutions.

The complete Schwarzschild geometry consists of a black hole, a white hole, and the two Universes are connected at their horizons by a wormhole.

The negative square root solution inside the horizon represents a white-hole. A white-hole is a black-hole running backwards in time. Just as black-holes swallow things irretrievably, so also do white-holes spit them out [2].

3. ... in 1998, two independent groups, led by Riess and Perlmutter used Type 1a supernovae to show that the universe is accelerating. This discovery provided the first direct evidence that Ω is non-zero, with $\Omega \sim 1.7 \times 10^{-121}$ Planck units.

This remarkable discovery has highlighted the question of why Ω has this unusually small value. So far, no explanations have been offered for the proximity of Ω to $1/t_u{}^2 \sim 1.6 \times 10^{-122}$, where $t_u \sim 8 \times 10^{60}$ is the present expansion age of the universe in Planck time units. Attempts to explain why $\Omega \sim 1/t_u{}^2$ have relied upon ensembles of possible universes, in which all possible values of Ω are found [3].

4. The cosmic microwave background (CMB) is the thermal radiation left over from the time of recombination in Big Bang cosmology. The CMB is a snapshot of the oldest light in our Universe, imprinted on the sky when the Universe was just 380,000 years old. Precise measurements of the CMB are critical to cosmology, since any proposed model of the universe must explain this radiation. The CMB has a thermal black body spectrum at a temperature of 2.72548(57) K. The spectral radiance peaks at 160.2 GHz.

References

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