**A New Method to Calculate The Temperature of MBR Turm = 2.7k**

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**Preface:** Author demonstrated already that our Universe has been a real Schwarzschild black hole (BH) in Reference [1], and the expansive law of standard model of our universal “Big Bang” could much better be in accordance with the expansive law of our Universe as a Cosmo-BH. Then, we may apply the new formulas of BH- theory proposed by author and the standard model of our universal “Big Bang” to find out the temperature of MBR (Microwave background Radiations) Turm = 2.7k.

[Zhang Dongsheng. **A New Method to Calculate The Temperature of MBR Turm = 2.7k.** *N Y Sci J* 2014;7(3):84-87]. (ISSN: 1554-0200). <http://www.sciencepub.net/newyork>. 13

**Key Words:** temperature of MBR; the expansive law of our Universe; the evolution of standard model of our universal “Big Bang”; the general laws of BHs;

**《1》。**The evolution of standard model of our universal “Big Bang”

Figure 1. The relationship between T and t in the evolution of standard model of our universal “Big Bang” [10]

T----the radiation tempertature of our Universe; t----the characteristic time;

Figure 1 shows the relationship between T and t in the evolution of standard model of our universal “Big Bang”. Data in figure 1 are originated from References [2] and [3], t----the characteristic time of our Universe, T----the universal (radiation energy) temperature. The relationship between t and T can be expressed with formulas(1a) and (1b).

From the beginning of ‘the Big Bang’ time t = 10—44s to the end of Radiation Era, i.e, **t ≈ 385000 yrs,** the formula may be:

**Tt1/2= k1 [3][4](1a)**

From t **≈** 385000yrs tothe present of **t = 1.37×1010 yrs,** it was the Matter- dominated Era, the formula may be:

**Tt2/3= k2 [3][4](1b)**

It must be pointed out, formulas (1a) and(1b) stemmed from observational data; they had some error, (1a) was more precise. However, the error of (1b) had much more error, because in the ‘matter-nominated Era’, due to matter -particles separating from radiation energy, the temperature of radiation was lowered much more than the particles’. Besides, the contract of large particles must produce stars and nuclear fusion, and emit a large amount of heat into universal space. Therefore, it would be very difficult to estimate and measure precisely the radiation temperature T in the Universe.

**《2》。Our Universe would have been a real Schwarzschild (gravitational) Cosmo-BH, so, the laws of its birth、growth、decline and death could completely accord with the laws of BHs.**

**1\*；In References [1], i.e, <**The The Originative Blackhole- Cosmogony**>,** author completed the BH-theory; proposed many new formulas. It was strictly proved that our Universe would have been a real Schwarzschild (gravitational) BH; proved that our Universe was born from countless Planck particles--mp = Mbm— virtual minimum BH; and proved that the expansion of our Universe was just the expansions caused from the combinations by those countless mp = Mbm. [1]

**2\*；Some general formulas on the radius Rb of any BH**

**MbTb = (C 3/4G) × (h /2πκ) ≈ 1027gk [6]** (2a)

**mss = κTb /C2 [4]  (2b)**

**mss Mb = hC/8πG = 1.187×10--10g2** [1] **(2c)**

**GMb/ Rb = C 2/2 [1][4]** (2d)

**mss = Mbm = (hC/8πG)1/2 = mp = 1.09×10—5g**[5][1]**(2e)**

Data of parameters of mp = Mbm,

Rbm≡Lp [5]≡(Gh/2πC3 )1/2≡1.61×10—33cm (2f)

Tbm ≡T p [5]≡0.71× 1032k (2g)

(2a) is the famous Hawking formula of temperature Tb on Rb; (2b) is the energy transformation on Rb of Hawking radiation mss.

(2c) is a new geneeal formula on Rb newlyderived by author from (2a) and (2b), it let BH theory go to perfection. (2d) is Schwarzschild special solution to the Equation of the General Theory of Relativity, it defined the necessary condition of BH existence.

**Mb –-** mass of a BH**, Rb–-**radius of the Event Horizon of a BH**, Tb**–- temperature on Event Horizon Rb of a BH**, mss –-** mass of a Hawking quantum radiation, **h**—Planck constant = 6.63×10—27 gcm2/s , **C**–-light speed =3×1010cm/s, **G–-** gravitational constant = 6.67 ×10—8cm3/s2\*g, **κ—**Bolzmann constant **=**1.38× 10—16g\*cm2/s2\*k, **mp–-**Planck participle**, Lp**-- Planck length**, Tp**---Planck temperature**, Mbm—** mass of virtual minimum BH, Lp = Rbm —Planck length；Tp=Tbm—Planck temperature； Compton time tc = Schwarzschild time t**s**bm , so，

**tsbm** = Rbm/C =1.61×10--33/3×1010 =

**0.537×10—43s,** (2h)

**bm = 0.6×1093g/cm3 (2i)**

**3\*; The parameters of our Universe as a Cosmo-BH,** [1]

Owing to the age Au = 1.37×1010yrs of our Universe measured precisely by modern obcervational instrument, then, the radius **Ru** of our Universe as a BH, Ru = CAu, and from (2d),

**Ru= Rb = CAu = 1.3×1028cm； (2j)**

**Mu = Mb = 8.8×1055g ≈ 1056g； (2j)**

**ρu**=3/(8πGAu2)=0.958×10--29g/cm3 **(2j)**

Owing to Mu originated from Nu **×** mp, andmp = Mbm = **1.09×10—5g**，so, Nu = Mu/mp.

**Nu = Mu/**mp = **8.8×1055g/1.09×10—5g = 8×1060 ≈**1061 **(2k)**

**Also Nu = Ru/Rbm = 1.3×1028/**1.61×10—33 = **8× 1060 ≈**1061 **(2l)**

**(2k) = (2l) shows our Universe must be a real BH and in accordance with formula** (2d).

**《3》。The heat history of our Universe**[5] **. This paragraph is wholly quoted from p.56 of§3.6 of References[5], the demonstrations are omitted.**

About 35 minuteslater from the ‘Big Bang’, ourUniverse could go on a stably expansive process in accordance with Hubble law,and the radiation temperature T of our universe would continously decrease along with its expansion. Before the end of Radiation Era, the radiation (energy) composition and matter composition were coupled together through Compton effect; then, the whole Universe had the same temperature T, because it was in the condition of heat balance, and was not daiphanous. However, Afterthe end of Radiation Era, when the temperature T of the Universe lowered intoT **≈ 4000k, protons and electrons would integrate to hydrogens, matter particles could separate from radiations, and both had different temoerature. The whole Universe became daiphphanous.** [5]

Let Tr be the radiation temperature, and Tm be the temperature of matter particles, after the Universe expanded to size R, then,

**Tr ∝ 1/R (3a)**

**Tm ∝ 1/R2 (3b)**

It is said, if their mixture had a same temperature before, after the Universe expanded to some size R, then **Tr >****Tm.**

**《4》。Finding the radiation temperature Tr**= **4720k at the Universal age of tr = 385000 yrs, i.e., at the end of ‘Radiation Era’.** The real temperature Turm of Microwave background Radiations (MBR ) at present is Turm= 2.7k；

**1\*;** From**(1a)**，**Tt1/2= k1，**

**∴**Tbm**(tsbm)1/2 = Tr(tr)1/2,** and,

**Tr =** Tbm(tsbm/tr)1/2=0.71×1032k(0.537×10—43 /385000×3.156×107)1/2 = **4720k** **(4a)**

**2\*; From tr =**385000yrs to Au = 1.37×1010 yrs，applying **(1b) in the whole matter -dominated Era up to the present, get a calculated temperature of MBR Tucm**,

From**(1b),** Trtr2/3=**T**ucm**Au**2/3**；**

4700 (385000)2/3 = Tucm (1.37×1010)2/3;

∴ Tucm1 = 4720(385000/1.37×1010)**2/3=0.667**= 4720(2.8×10--5)2/3=**4.36k (4b)**

Owing to Tucm1(4.36k) > Turm (2.7k); it can be seen, the error of **Tucm1(4.36k) is too bigger than Turm (2.7k),** it doesnot tally with the actual situation. **For finding the precise temperature of MBR T**ucm**2，it is needed to change the exponential number of (1b),**

Let **Tucm2 =** 4720(385000/1.37×1010)**0.712= 2.71k ， so, (1b) of** Trtr2/3 = 0.667 = k2 should be changed into (4c),

**∴Trtr0.712 = k2 (4c)**

Above calculated results show that (4b)，Trtr2/3=0.667 = k2 is not actual, **only (4c) is more precise**. **However, for finding the precise Turm theoretically, a new method should be adopted in 3\*and 4\* paragraphs below.**

It is known that (1b) expresses the common expansions of radiation energy and matter particles together in the Matter-dominated Era. However, according to (3a) and (3b), to radiation energy, **Rt = k3,** but the exponential number of (4c) is bigger than (4b)’s, i. e.. 0.712 > 0.667. Then, (4c) is more precise than (4b) shows in the Matter-dominated Era, radiation energy should have more expansion.

At the end of radiation Era, the space (=1/2RR) occupied by radiation energy should be about equal to the space (1/2RR) of matter particles, but from that time to the present, from RR to Ru, the expansion of matter particles should be much less than Ru/2, then, the expansion of radiation energy must be much more than Ru/2. **The final result may let Tucm2(2.71k) < Tucm1(4.36k)**.

**3\*；**Finding the whole size RR (radius) of the Universe at tr=385000 yrs of the end of radiation Era. Finding a ‘mini BH’--Mr at tr=385000 yrs, radius **Rr of** Mr, numbers **Nr of** Mr, density **r of Mr.**

From (2j), Mu = 8.8×1055g≈1056g，Ru = 1.3×1028cm；Nu = 1061 Planck particles mp=Mbm=1.09×10—5g are known numbers. If let mp=Mbm =1.09×10—5g be called as ‘mini BH’ in the Planck Era, then, in the expansive process of 1.37×1010 yrs, our Universe had different size and numbers of ‘mini BHs’ at every instant to form the whole Universe Mu. Then,

**Rr =** Ctr = 3×1010×385000×3.156×107 = **3.645×1023cm；**

**Mr** = C2 Rr/2G = **2.46×1051g;**

**Nr = Mu/**Mr = **1056/2.46×1051 = 3.6×104**

r **=** 3Mr/4πRr3 **= 1.2×10—20g/cm3;**

**Owing to the density r of Mr‘mini BH’should just be the same density of Mu at that time,** so, RR is，

**RR =** (3Mu/4πr)1/3 **= 1.26×1025cm; (4d)**

**4\*; Finding the temperature Tucm of MBR at present,**

From above mentioned, at tr = 385000 yrs

of the end of Radiation Era, the space of radiation energy = the space of matter particles = RR/2. From (2d), Mb ∝ Rb. From (3a), Tr ∝ 1/R. So, Tr R = Const。 Suppose the expansoin of matter particles may be neglected in the period from tr to the present,then, the expansion of radiation energy would be from RR/2 to present Ru = 1.3×1028cm. (**the space** RR/2 of matter particles may be neglected, because RR/2 << Ru/2 **）。**Thus, from (3a), Tucm can be got。

**∴Tucm =** TrRR/2Ru = 4720×0.63×1025/1.3× 1028 **= 2.3k (4e)**

**Above calculated temperature of MBR Tucm (2.3k) is smaller than the actual temperature of MBR Turm( 2.7k)，i.e., Tucm < Turm**. The actual reasons may be: 1; the matter particles could really have some small expansion due to the universal pressure and temoerature lowered. 2; A large amount of heat caused from the nuclear fusion in stars, it would increase in some temperature of MBR.

**《5》。Some conjectures;**

**1\*；**On the end time of Radiation Era tr =385000 yrs ，the radiation temperature Tr = 4720k. From (2b)，mss = κTb /C2, find mass mne of corresponding particles,

**mne** = κTr /C2 =1.38×10—16×4720/9×1020 =**7.23×10—34g (5a)**

What could be mne = 7.23×10—34g？the upper limit of a electrical neutrino e = 9.1×10—33g，the corresponding mass of a photon =4.2×10—33g，mass of an electron = 9.11× 10—28g，the upper limit of a µ-neutrino = 4.8× 10—28g。It can be seen, **mne should be the various neutrinos. They might be the smallest matter-particles in the Universe, and to couple with radiation before the end of Radiation Era.** After that time, radiations would unsolve the coupling with neutrino mne, then, the Universe could become daiphanous. Therefore, radiations would continuously expand up to the present to obey Hubble’s law. On the other side, the matter particles could continuously contract up to form galaxies, stars, planets, etc. Owing to the nuclear fusion caused in stars, on some planets the intelligent living things could be evolved out.

**2\*；mass of a proton mp = 1.67×10—24g, then，**

**mp/mne = 1.67×10—24/7.23×10—34g = 2.3×109 ≈ 109 ：1 (5b)**

**The proportion of 109 ：1 may be just the same proportion of photon numbers /baryon numbers in the Universe.**

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3/19/2014