The New Concepts to Big Bang and to Black Holes: Both Had No Singularity at All (Part 1)

Dongsheng Zhang

Graduated in 1957 From Beijing University of Aeronautics and Astronautics. China.
Permanent address: 17 Pontiac Road, West Hartford, CT 06117-2129, U. S. A.
Email: ZhangDS12@hotmail.com;

Abstract: 1. Our Universe was born from Quantum Micro Black Holes (its mass ≈ 10^{-5} g), but not from Singularity or Big Bang of Singularity. 2. No Singularity existed in star-formed Schwarzchild's black holes, a steady mini black hole (its mass ≈ 10^{15} g) of long lifetime would certainly exist inside as a core to obstruct the collapse of energy-matters to become Singularity. The steady mini black hole (m_{om} ≈ 10^{15} g) in black holes instead of Singularity called by General Theory of Relativity could resist the gravitational collapse. [Nature and Science. 2004;2(4):1-10].

Key Words: universe; singularity; big bang; black holes; Plank's era: cosmology:

Part One. Our Universe was born out from quantum micro black holes (QMBHs, its mass $m_t \approx 10^{-5}$ g), but not born out from Singularity or "Big Bang" of Singularity

Introduction: In part one of this article, based on some general laws of astronomy and physics, the calculated results could prove that our present expanding Universe was impossible to be born from Singularity or from the Big Bang of Singularity but from the Big Crunch of pre-universe.

Once pre-universe collapsed to (t = -10^{-43} s, T = 10^{32} k) of Plank's Era (see figure 1 on next page), every particle and radiation simultaneously broke off its gravitational linkage between its closest neighbors and stopped their collapse at the state of no gravity. Furthermore, every particle at that moment would exactly become a quantum micro black hole (QMBH, its mass $m_t \approx 10^{-5}$ g), their presences jointly obstructed the pre-universe from collapsing into Singularity and directly led the disappearance of pre-universe in the quantum field of Plank's Era. The lifetime of 10^{-43} s of every QMBH was just synchronous with the disappearance of pre-universe. After that, the total small bangs caused by all new QMBHs born from Plank's quantum field would make up an "inflation" (or so-called Big Bang) and formed the present expanding universe. It was the genesis of our present Universe. The process above showed the changed process from the disappearance of old universe to the genesis of new universe. Other conclusions of part one can be seen in conclusions of 7th paragraph. (< > number of reference).

1. The Laws and formulas of Our Universal Evolution

The laws of our universe's evolution can be simply and precisely described by two different methods, which are based on the achievements of modern physics (GTR & particle physics)and astro-cosmology.

First, Figure 1 specifies the numerical values of time (t) corresponding to Temperature (T) at different time in our universe's evolution.<3><4><2>

Second, Formulas (1a) below describes our universe's evolution relevant between Radiation Era and Big Bang in Figure (1), (from t = 10^{-43} s to t = 1/3×10^6 years).<3><4><

$Tt^{1/2} = k_1$, <4><6>, $R = k_2 t^{1/2}$, $RT = k_3$, $R = k_4 \lambda$ **(1α)**

t—Characteristic Expansion Time, T—Temperature of Radiations, R—Characteristic Size or Dimension of the Universe, λ--Wavelength of Radiation, k_1, k_2, k_3, k_4—Constants,

Formula (1b) below describes our universe's evolution relevant within the Matter-Dominated Era in Figure 1, (from t = 1/3 ×10^6 years to the present).<3><4><6>

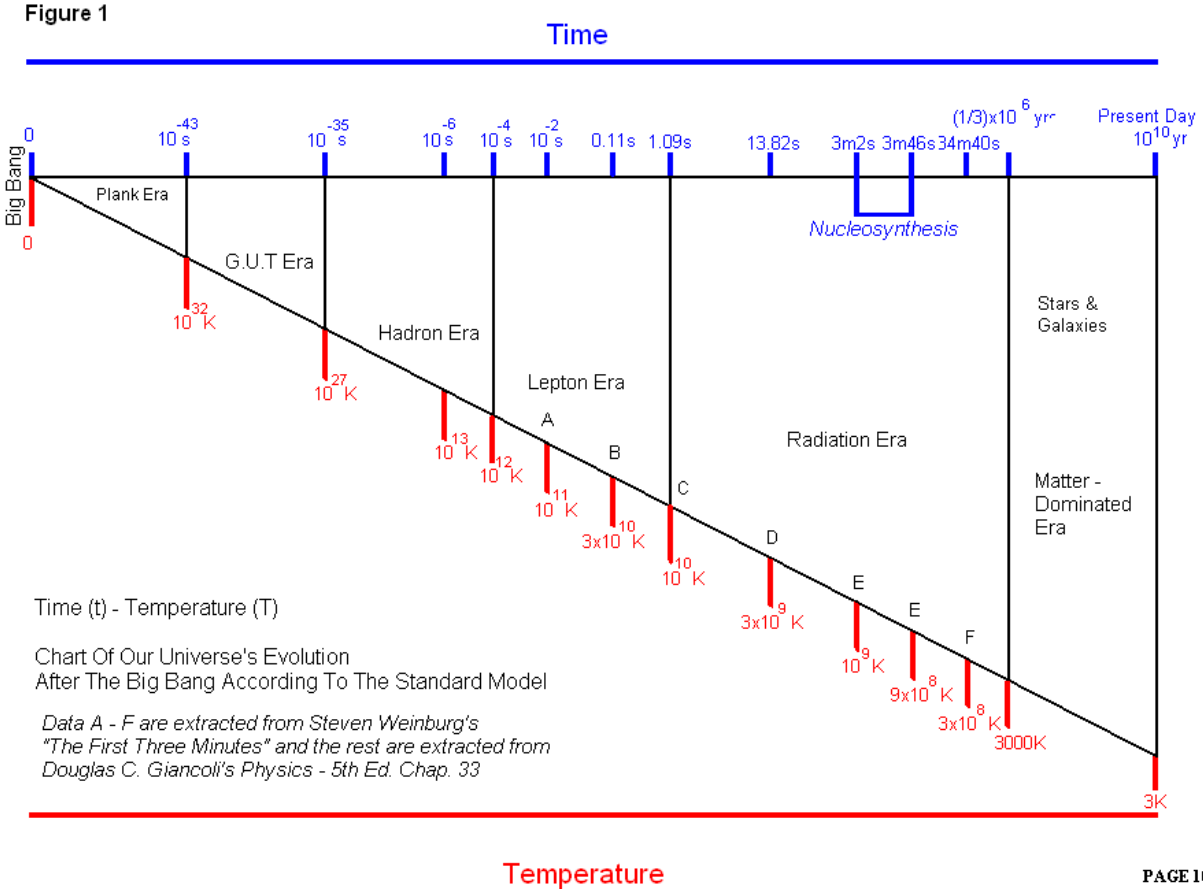
$Tt^{2/3} = k_6$, <4><6> $R = k_7 t^{2/3}$, $RT = k_8$, $R = k_9 \lambda$ **(1b)**

t – Characteristic Expansion Time, T – Temperature of the Radiation, R – Characteristic Size or Dimension of the Universe, λ – Wavelength of the Radiation, k_6, k_7, k_8, k_9 – Constants

$R = k_2 t^{1/2}$ in Formulas (1a) and $R = k_7 t^{2/3}$ in (1b) conform to Cosmological principle, GTR, Newton's Mechanics and modern observations, and can be derived from the law of energy conservation ($V^2/2 = GM/R$). (See appendix of "The First Three Minutes", by S. Weinberg and 9th paragraph behind).

The numerical values of Figure 1 above and the calculated results from Formulas (1a) and (1b) are put on Chart 1 of Appendix A for comparison, both can almost obtain the same numerical values or the same results. Those values of the universe's evolution are the sources from different theories and different calculating methods. It confirms that the laws (1a) and (1b) of our universe's evolution are reliable and correct.

Figure 1



If a group of special numerical values taken from Appendix A replace k_n, Formulas (1a) and (1b) can be used to calculate out the values of some other physical parameters.

For example, in Matter-Dominated Era, the numerical values below calculated out from Formula (1b) accord with the values on Figure 1 above and Chart 1 on Appendix A behind.

$R_1/R_2 = (t_1/t_2)^{2/3}$, $^{<3><4><6>}$ $R_1T_1 = R_2T_2$, $R_1/R_2 = \lambda_1/\lambda_2$,

When $t_1 = (13 \times 10^9$ yr) to $t_2 = (4.0 \times 10^5$ yr), $t_1/t_2 \approx 32{,}500$, $(t_1/t_2)^{2/3} \approx 1{,}000$

$R_1/R_2 = (12 \times 10^{27}\text{cm}) / (12 \times 10^{24}\text{cm}) \approx 1{,}000$

$T_1/T_2 = 3\text{K} / 3{,}000\text{K} \approx 1/1{,}000$, $\lambda_1/\lambda_2 = 0.1\text{cm} / 10^{-4}\text{cm} \approx 1{,}000$,

From the beginnings of the Matter-Dominated Era to the present, the numerical values show that, as time (t) in the universe's evolution enlarged 32,500 times, its size (R) enlarged 1,000 times, its radiant temperature (T) decreased 1,000 times, and wavelength (λ) of radiation increased 1,000 times. The results above are consistent with the modern observations and MBR (Microwave Background Radiation).

The size of our newborn universe might be like a grain of "Grape". That "Grape" might come from two ways. One way to come from Singularity is impossible. Another way is that "Grape" could come from the Big Crunch of pre-universe. It will be proved as below. Formulas (1a) is effective to the early expanding process of present universe, and effective to the later collapsing process of pre-universe too. Those two processes were all under the action of the sole gravity produced by the total energy-matters of the universe and were all in an isolated system.

2. In Newborn-hood Universe, the Properties of Radiations and Particles in the States of Super High Temperature

Quantum Mechanics (QM) indicates that all matters and radiations have the duality of particles and waves. In earliest universe, particles and radiations had same grade of ultra-high energy and could transfer between each other. Three formulas of energy below are equally valid for particles and radiations in the state of the ultra-high temperature;

$E = mc^2$, $E = \kappa T$, $E = Ch/\lambda$ (2a)

$m = \kappa T/C^2$, $\lambda \propto R$, $R \propto 1/T$ (2b)

E – Energy of single particle or radiation. m - Mass of particle, C- Light Speedκ- Boltzmann's Constant,C-Light Speed, κ- Boltzmann's Constant, h - Plank's Constant , λ - Wavelength of Radiation

Therefore, In early universe, when Temperature (T) became higher than the valve temperature of some particles, those particles would become a state of thermodynamic equilibrium with the radiation and would not stop transforming between each others. That demonstrates no differences between radiations and particles. Thus, Formulas (2a) and (2b) was effectively applied in early universe.

Formula (2b) indicates that **when the particle's Temperature (T) goes up, its Mass (m) will correspondingly increase proportionally. Inevitably, it leads to the increase in gravitational force between two closest particles.** That shows exactly why pre-universe could not stop to contract its volume (R) to a cosmic "Grape" or the Big Crunch.

3. The Condition Occurred from Big Crunch of Pre-universe to Big Explosion (Big Bang) of Present Universe

From the formulas (1a) $R = k_2 t^{1/2}$, when pre-universe contracted its size (R) to the Big Crunch, correspondingly its Temperature (T) and Mass (M) would increase, and its time (t) would too much shorten. At an extreme circumstance, when (R) contracted to such an infinitesimal dimension, the real distance between the two neighboring particles would finally become greater than the product of C (light speed) multiplied by t (time). It shows that there would not be enough time to transmit the gravity between neighboring particles. At that moment, all adjacent particles would instantaneously break off the linkage of gravitational forces and lead the pre-universe to stop contraction. Thus, the pre-universe would change its state from the Big Crunch to the Big Explosion of the present universe. That is scientifically better known as "phase transition." Such a process is different with the Big Bang as an infinitesimal explosive point of Singularity known by most individuals. In reality, Big Crunch was just a big contraction; Big Bang was just a big expansion.

Of course, the detailed process of changing states should be extremely complicated**. Once the expansion of the present universe steadily took place, due to that the increase in size (R) was much less than the increase in time (t), the gravitational force of the two closest particles would recur and renew to connect them together.** Subsequently, our universe would begin a completely new process of uniform expansion until present.

The transitive condition occurred from the Big Crunch of pre-universe to the Big Bang of the present universe is demonstrated by Formula (3) below:

$$\mathbf{dm > |\, t|\, C \quad or \quad -d_m \le C \times t \le d_m \quad or \quad -d_m / C \le t \;\&\; t \le d_m / C} \qquad \mathbf{(3)}$$

t – Characteristic Expansion Time, dm – Distance between Two Closest Particle

C – Light Speed

Let ρ = energy-matter density g/cm^3, H = Hubble's Constant

$\rho dm^3 = m \qquad m = \kappa T/c^2 \qquad \therefore t^3 < (\kappa T)/(\rho c^5)$ **(3a)**

$\rho = \underline{3H^2/(8\pi G)} = \underline{3/(8\pi G t^2)}$ <3> $\qquad \therefore t < T(8\pi G\kappa)/(3C^5)$ **(3b)**

From (1a) $Tt^{(1/2)} = k_1 \qquad \therefore t^{(3/2)} < k_1(8\pi G\kappa)/(3C^5)$ **(3c)**

Formulas (3a), (3b), (3c) are all derived from Formula (3), and have the same value of (t). They accord with the principles of GTR.

Now the numerical value of (t) can be calculated as below.

First, select k_1 in Formula (1a) from column (C) of Chart 1 on Appendix A behind,

t = 1.09 s, T = 10^{10} k. [the same results can be gotten by other than column (C)]

$k_1 = Tt^{(1/2)} = (10^{10}) \times (1.09s)^{(1/2)} \approx 10^{10}$ (in some books, $T \times t^{1/2} \approx 10^{10}$ may be as a experiential formula),

From Formula (3c), $t^{(3/2)} < [(8\pi G\kappa)k_1 / (3C^5)]$

$G = 6.67 \times 10^{-8}$ (cm^3/gs^2), $\kappa = 1.38 \times 10^{-23}$ J/k = 1.38×10^{-16} gcm^2/s^{2}k, $C = 3 \times 10^{10}$ cm/s

$t^{3/2} \le [8\pi(6.67\times10^{-8})(1.38\times10^{-16})(10^{10})] / [3(3\times10^{10})^5] = 0.32\times10^{-64}$

$\therefore\ \mathbf{t \le +10^{-43}s}$ **and** $\mathbf{t \ge -10^{-43}s}$ **(3d)**

Corresponding $T = k_1/t^{(1/2)} = 10^{10}/(10^{-43})^{1/2} = 0.32 \times 10^{32}$k, $\mathbf{T \approx 0.32 \times 10^{32}\ k}$ **(3e)**

From Formula (2b), mass of particle, $m = \kappa T/C^2 = 10^{-5}$g, $m = 0.5\times10^{-5}$g.

$\rho = 3/(8\pi Gt^2) \approx 1.8\times10^{92}$ g/cm^3, $d_m{}^3 = m/\rho$, so, $d_m \approx 14\times10^{-33}$ cm, $C\times t = 3\times10^{10}\times 10^{-43} = 3\times10^{-33}$ cm.

So, $\mathbf{d_m > C \times t.}$ **(3f)**

Thus, **the gravities of closest particles had surely broken off at time of ($\mathbf{t = -10^{-43}}$ s).**

The calculated values $t \ge -10^{-43}$s, $t \le +10^{-43}$s, and $T \approx 0.32 \times 10^{32}$k are precisely in accordance with the values at the beginning or ending of Plank's Era on Figure (1).

The calculations shows that once the Big Crunch of pre-universe contracted to $t = -10^{-43}$ s and $T = 0.32 \times 10^{32}$ k, the gravity connected to the two closest particles would thus disappear. **No gravity is equal to no power for contraction, and then $T \approx 10^{32}$ k become the**

highest temperature in Universe. With no gravity, the only way for the pre-universe and for particles was to stop their contraction and then started the expansion to the present universe at the highest temperature of $T \approx 10^{32}$ k. After that, $t = +10^{-43}$ s would become the time required for recovering the gravitational linkage between two neighboring particles at the genesis of our present expanded universe.

Between $t = -10^{-43}$ s and $t = +10^{-43}$ s, there should be appearance of time (t = 0). However, **time (t = 0) does not signify the presence of Singularity at all,** since at that point of (t = 0), the temperature $T \approx 10^{32}$ k, T was not infinity. The density $\rho \approx 10^{92}$g/cm$^3 \neq 0$, and the actual radius of universe $R \neq 0$. So, **the point of (t = 0) is just a bridge between contracted state ($t = -10^{-43}$ s, +R) and expanded state ($t = +10^{-43}$ s, +R).**

4. Quantum Micro Black Holes (QMBHs)

From Formulas (3) and (3c) of paragraph 3, once pre-universe collapsed to ($t = -10^{-43}$ s, $T = 10^{32}$ k), the gravitational linkage between the closest particles would break off. At that moment, the mass of any particle or radiation m_t is gotten from (2b),

$$m_t = \kappa T / C^2 = 1.38\times10^{-16}\times10^{32}/(3\times10^{10})^2 = 1.5\times10^{-5}\ \text{g} \quad (4a)$$

From (3b), $\rho_t = 3 / (8\pi G t^2) \approx 7\times10^{92}$g /cm^3 , so, radius r_t of m_t,

$$r_t = (3m_t / 4\pi\rho_t)^{1/3} = 1.4\times10^{-33}\ \text{cm} \quad (4b)$$

If each particle ($m_t = 10^{-5}$g) is as a QMBH, its Schwarzchild's radius r_b is:

$$r_b = 2Gm_t / C^{2\ <3>} = 2\times6.67\times10^{-8}/(3\times10)^2 = 1.48\times10^{-33}\text{cm} \quad (4c)$$

So, **$r_b = r_t = 1.5\times10^{-33}$cm, and ($m_t \approx 10^{-5}$g) is a exact micro black hole.**

Formula (4c) has proved that ($m_t = 10^{-5}$ g) is a sure QMBH at the state ($t = -10^{-43}$s, $T = 10^{32}$ k). Due to the density ρ_t of ($m_t = 10^{-5}$g), $\rho_t \approx 10^{93}$g/cm$^3 >> 10^{15}$ g/cm^3 (density of a neutron broken up). Thus, m_t as a micro black hole was composed by the perfectly micro quantum. The temperature T_b of Hawking's formula of m_t as a QMBH is: (M_θ - Mass of sun)

$$T_b \approx 0.4\times10^{-6}\, M_\theta / m_t = 0.5\times10^{32}\text{k},\ ^{<5>} \quad (4d)$$

$$T_b = T \approx 10^{32}\text{k} \quad (4e)$$

Formula (4e) shows that any particle m_t is a perfect QMBH.

The lifetime τ_b of Hawking's formula of the QMBH m_t is: $\tau_b \approx 10^{-27} m_t^3 \approx 10^{-43}$s $^{<5>}$ (4f)

τ_b was consistent with the time which pre-universe collapsed from ($t = -10^{-43}$s) to (t = 0), or **QMBHs would disappear simultaneously with the disappearance of pre-universe in the Quantum Field.** Then, the genesis of our universe came out from the Quantum Field in Plank's Era, but not Singularity.

$$t_b \times r_b = 0.5\times10^{32}\text{k}\times1.5\times10^{-33}\text{cm} \approx 0.075\text{cmk} \quad (4g)$$

Formula (4g) indicates that the property of QMBHs accords with the Uncertainty Principle of Quantum Mechanics.

5. Uncertainty Principle of QM Was Applied to Quantum Gravitation $^{<6>}$

According to the Uncertainty Principle of QM, (Quantum Mechanics)

$$\Delta E_* \times \Delta t \approx h/2\pi \quad (5a)$$

$h = 6.625\times10^{-27}$ erg s, h – Plank's constant. Applying formula (5a) to the reactional process of two elementary particles, $\Delta E = 2mC^2$ (5b)

Δt is the time producing or annihilating two particles (m – mass of particle), $\Delta t = t_c = h/(4\pi mC^2)$ (5c)

t_c – Compton time. t_s – Schwarzchild's time, i. e. the time of light passing through the Schwarzchild's radius of particle. $t_s = 2Gm/C^3$ (5d)

Generally, $t_c < t_s$, in case of $t_c = t_s$, then $m = m_p$, m_p - Plank;s mass, $m_p = (hC/8\pi G)^{1/2} = 10^{-5}$g (5e)

According to Uncertainty Principle, time t_p is corresponding to m_p,

$$t_p = (Gh/2\pi C^5)^{1/2} = 0.539\times10^{-43}\text{s} \quad (5f)$$

t_p is called as Plank's time, l_p is Plank's length corresponding to t_p, temperature T,

$$l_p = t_p \times C = (Gh/2\pi C^3)^{1/2} = 1.6\times10^{-33}\text{cm} \quad (5g)$$

$$T = m_p \times C^2/\kappa = 0.65\times10^{32}\text{k} = 10^{19}\text{GeV} \quad (5h)$$

When the universal age was less than the Plank's time t_p, the quantum effect would appear, time might not be measured precisely.

Plank's time ($+t_p$) only has the positive value in original meaning, the new concept above shows that **the negative value ($-t_p$) has the meaning of time too, at time ($-t_p$), pre-universe collapsed to lose gravity between the closest particles and stopped collapsing.**

Checking up the numerical values above, the results are compared as below:

No Linkage of Gravity	QMBH	UPQM
$t = -10^{-43}$s & 10^{-43}s ,	$\tau_b = 10^{-43}$s,	$t_p \approx 0.5\times10^{-43}$s,
$T \approx 0.32\times10^{32}$k,	$T = 0.5\times10^{32}$k ,	$T = 0.65\times10^{32}$ k,
$m \approx 0.5\times10^{-5}$ g,	$m_t \approx 1.5\times10^{-5}$ g,	$m_p = 10^{-5}$ g,
$d_m/2 \approx 7\times10^{-33}$ cm,	$r_b \approx 1.5\times10^{-33}$cm,	$l_p \approx 1.6\times10^{-33}$ cm,

6. Reviews to Our Present Universe

Our present universe looks like a gigantic black hole. If the age of our universe is

$L_u = 140\times10^8$years, its Schwarzchild's radius $R_u = L_u \times C$.

The total mass inside the Event Horizon of our universe: $M_u = C^3 L_u / 2G \approx 10^{56}\text{g} \approx 10^{23} M_\theta$,

The radius r_o (before "Inflation") of M_u at the genesis of original Universe;

$r_o = (3M_u/4\ \pi\ \rho)^{1/3} = (3\times10^{56}/4\ \pi\ \times10^{93})^{1/3} = 1.3\times10^{-12}$cm.

The size of original Universe of M_u looks like the size of a present proton or a neutron.

The numbers of particles or QMBHs of M_u in the original Universe are;

$N_o=M_n/m_t=10^{56}/10^{-5}=10^{61}$

The proton numbers of M_u of original Universe are;

$N_{op}=M_u/m_{proton}=10^{56}/1.67\times10^{-24}\approx 10^{80}$.

Mankind lives in the gigantic universal black hole, a great number of small and big black holes have scattered in the boundless space.

7. Conclusion: The origin and process turned from the disappearance of pre-universe to the birth of present universe in Plank's Era ($-10^{-43}s \le t \le +10^{-43}s$)

(A) The transitive origin caused from the big contraction of pre-universe to the big expansion of present universe

The calculated results above show that, once pre-universe collapsed to $t = -10^{-43}$s and then began to make a "phase transition" from the past contracted universe to the present expanding universe**. From new formula (3c) $t^{3/2} \le k_1(8\pi G\kappa)/(3C^5)$, value of ($t = 10^{-43}$s) can be exactly calculated out.** In the extremely short interval of time ($-10^{-43}s \le t \le +10^{-43}$), every particle and radiation in whole universe were in micro-quantum field of Plank's Era and would become a QMBH ($m_t=10^{-5}$g, $r_b=10^{-33}$cm, $T=10^{32}$k). They simultaneously entered three states: **no gravitational linkages between the closest particles, quantization and micro black holes (which were all at the explosive state) (see 19th paragraph of part two behind). Such three states of particles and radiations jointly obstructed the appearance of Singularity in the process of the big contraction of pre-universe, and then led the genesis of our present Universe from new QMBHs. That is one of the new concepts in this article.** Each of the physical parameters in the three states above had the equivalent numerical values at the same time. Those numerical values derived from many current classical theories can successfully reach the same results. **The important contribution in this article is to have found out QMBHs ($m_t \approx 10^{-5}$g).** Only the process of such a "phase transition" at the birth of our universe can exactly accord with the causality, the second law of thermodynamics and the law of energy conservation. Singularity possessed some infinite physical amounts has no possibility to become a stable being inside and outside, so it cannot appear and exist in universe.

(B) The gradual vanish of pre-universe in the interval of time ($-10^{-43}s \le t$) $\Rightarrow$ ($t \approx 0$) in Plank's Era

Once the past universe collapsed to the time ($t \ge -10^{-43}$s) of Plank's Era, every particle became an isolate QMBH of ($m_t \approx 10^{-5}$g) and had no gravity between each other. Gravitational transmissions between two closest particles needed time 10^{-43}s or more. Thus, **all MQBHs had no enough time to attain combination, but could only emit Hawking Radiations until gradually thorough disappearance within time 10^{-43}s i.e. ($-10^{-43}s$)$\Rightarrow$($t \approx 0$). The completely pre-universe would synchronous disappear too.** The disappeared process of a single MQBH at the super-high temperature might be a small bang like a double-bang firecracker, and the disappeared process of completely pre-universe included countless MQBHs might be like a great lump of beautiful firework. The vanish of the old universe in quantum field would not hand down any information or trace of pre-universe to present universe.

According to definition of GTR, formulas of a Schwarzchild's BH are:

$$C^2/2 = Gm_b/r_b, \text{ or } C^2 r_b/(2G) = m_b, \quad C\times t = r_b, \quad (7a)$$

m_b –mass of BH, r_b–Schwarzchild's radius of BH, ρ_b–density of BH, for a spherical BH,

$$m_b = 4\pi\rho_b r_b^3/3 , \quad (7b)$$

From (7a), (7b),

$$t^2 = 3/(8\pi G\rho_b) \quad (7c)$$

Formula (7c) indicates that a certain density of BH ρ_b is only corresponding to a sole time t (t-time of light passing through BH). In other words, **for a steady BH, once a parameter such as m_b is decided as a certainly numerical value, all other parameters of BH (r_b,t, t_b,ρ_b and etc.) will be solely decided with the first one. That is the essential quality of any BH**. In Plank's Era, $\rho_b \approx 1.8\times10^{92}$ g/cm^3 $\approx$ constant, as a result, $t = 10^{-43}$ s, $m_b \approx 1.5\times10^{-5}$ g, $r_b \approx 1.5\times10^{-33}$ cm, $t_b \approx 10^{32}$ k.

It is said, under the condition of $\rho_b \approx 10^{92}$g/cm^3, time (t) of forming a BH ($m_b \approx 10^{-5}$ g) must need $t \ge 10^{-43}$ s. In case of $t < 10^{-43}$ s, if some new particles (its mass $m << 10^{-5}$ g) formed in this interval of time, they would not become smaller QMBHs at all, because a smaller BH of ($m_b << 10^{-5}$ g) must be formed by the greater density ($\rho_b >> 10^{92}$ g/cm3).

(C) The genesis of our new universe within Plank's Era of ($t \approx 0$)$\Rightarrow$($t \le +10^{-43}$ s)

The mini embryos of particles($m << 10^{-5}$g) might be formed at first, but they should have enough time growing up to QMBHs of ($m_b \approx 10^{-5}$g) within this interval of 10^{-43}s. However, in these two intervals of sections (C) and (B), the universal temperature (T, t_b) and density (ρ_b) should lower a little bit expansion at ultra-high temperature with no gravity. Thus, the **new QMBHs (or particles)** re-combined possibly from micro quantum should have a little bigger size: $m_{bn} > 10^{-5}$g, $r_{bn} > 10^{-33}$cm, $t_n > 10^{-43}$s. It is said, in case of time (t) reached 10^{-43}s, there would not be enough time for particles to grow up to the complete bigger QMBHs ($m_b > 10^{-5}$g). Particles had to become bigger QMBHs only with the time prolonged over ($t > 10^{-43}$s). Thus, the bigger QMBHs ($m_b > 10^{-5}$g) could only compose and re-combine or collide out of Plank's Era ($t > 10^{-43}$s) i. e. into GUT Era. That was the origin of "Primordial Inflation" at the birth of our present universe. However, particles grown up to mass $\approx 10^{-5}$g

would not be BHs due to temperature and density lowered a little bit.

(D) "Inflation Era" of the primordial universe ($t > +10^{-43}s$)⇒ GUT Era

Owing to the decrease in the universal density ρ_b, the little bigger QMBHs might form into GUT Era of ($t > 10^{-43}s$), due to its formed time to be prolonged. According to the principle of BH, if a new BH was formed from the collision of two old BHs, the properties of new BH are as behind: Suppose parameters of old BH 1; $C^2/2 = GM_1/R_1$, old BH 2; $C^2/2 = GM_2/R_2$,

M,R,-parameters of new BH.

Due to $M = M_1 + M_2$, as a result; $R = R_1 + R_2$. That is the origin of "Inflation".

Above formula clearly indicates: a), the collision of two or more BHs would certainly cause "Inflation". b) "Inflation" caused in GUT Era . c) A new BH formed from the collisions of two or more old BHs was a real and a complete bigger BH.

Every small explosion caused from collisions between adjacent QMBHs at every point of newborn universe would compose jointly a greatest burst (i.e. so-called Big Bang) in whole universe. However, those explosions were not a suddenly strong burst at one point like so-called "Big Bang" of Singularity, but certainly caused "Primordial Inflation" of newborn universe from GUT Era. That was the parturient pangs and the real birth of our present new universe. After collisions, QMBHs would combine and merge for a very long time until becoming a new perfect BH. That was an extremely long expanded process.

(E) The reason for nonstop expansion of our universe until present

Let us look back to formula (7c), $t^2 = 3/(8\pi G\rho_b)$. Formula (7c) is derived from principles of BH, (t) is the time of that, light (C) passes through Schwarzchild's radius (r_b) of a BH. However, formula (7c) can express our present universal expanding law, if density of BH ρ_b is replaced by our universal real density ρ. As a result, $t^2 = 3/(8\pi G\rho)$. Here(t) would express the age of our universe. It is the complete same with formula (3b), which is easily derived from famous Hubble's law (V=HR, H = 1/t) and from the law of energy conservation ($V^2/2 = GM/R$, and $M = 4\pi\rho R^3/3$) in the universal evolution. **It shows in a sufficient expanded universe, its boundary would combine with Event Horizon of sufficient expanded universal BH, and then (V=C).**

(3b) ≅ (7c) **(7d)**

Check up the calculated numerical values: At the birth of our universe, for a QMBH, its mass $m_t \approx 10^{-5}$g, its Schwarzchild's radius $r_b \approx 1.5\times10^{-33}$cm. If our present universal BH is surely composed from the combinations of "primordial inflation" of QMBHs at the birth of universe, hence, the radius of Event Horizon of present universe R_u must be equal to the total sum of the radius of primordial QMBHs (r_b). From 6th paragraph, the mass of present universe within Event Horizon $M_u \approx 10^{56}$g, the numbers of primordial particles (QMBHs) corresponding to M_u are: $N_o \approx 10^{61}$.

As a result: $M_u = m_t \times N_o = 10^{-5}\times10^{61} \approx 10^{56}$g, $R_u = r_b \times N_o = 1.5\times10^{-33}\times10^{61} \approx 1.5\times10^{28}$cm. Checking the real size (R) of present universe on Appendix A (Chart 1) behind,

$R \approx 12\times10^{27}$cm, so, **$R = R_u \approx 10^{28}$cm** **(7e)**

Therefore, the present expansion of our universe did surely come from the collisions or combinations(primordial inflation) of countless QMBHs from GUT Era to later time.

(7e) shows that, our present universe is a perfect gigantic BH expanded from $N_o \times m_t$.

(F) Whether or not expansion of our universe at present would not depend on the universal real density ρ, but only depend on the total energy of primordial universal packet M_o, the end of our universe

From (7c), (7d), (7e), it will be seen that, for a steady BH (mass = M_b), only a sole density ρ_b can correspond with certain M_b. Certainly, $\rho = \rho_b$ is all right for any BH. That is the character of BHs. Obviously, **$\rho_b = \rho = \rho_c$, or $\Omega = \rho/\rho_c = 1$, that is an inevitable outcome to our sufficient expanded universe as well as a sufficient expanded BH**. Therefore, in several decades ago, the debates or researches about ($\Omega \neq 1$ or $\Omega = 1$) seemingly had no significance.

Now let us review how to get mass M_u of our universe within its Event Horizon, firstly, real density $\rho \approx 2\times10^{-29}$ g/cm^{3}could be measured, then, from formula (3b), $t^2 = 3/(8\pi G\rho)$, t is the age of our universe, $t \approx 4.23\times10^{17}$ s $\approx 1.35\times10^{10}$ yrs. Thus, the radius of Event Horizon $R_u = t\times C = 1.2\times10^{28}$cm, and $M_u = C^2R_u/(2G) \approx 10^{56}$g $\approx 10^{23}\ M_\theta$. Since our universe is a real BH, a certain M_u should correspond with a certain and sole ρ. Thus, a deduction below should be gotten. If there is more mass ($M_o - M_u$) outside Event Horizon, M_o – total mass of our originally universal packet, M_u will increase as the enlargement of Event Horizon. Only under the condition of $M_o - M_u = 0$, or $M_o = M_u$, our universe will stop to expand. After that, our universe will only show to emit Hawking's radiation, to lose energy-matters and to contract its size till thorough disappearance. The lifetime of disappearance (τ_o) is extremely long, (τ_o) can be calculated by formula (4f), $\tau_o \approx 10^{-27}M_o^{3}{}_{(s)}$. For example, if $M_o = M_u \approx 10^{23}M_\theta \approx 10^{56}$g, $\tau_{ou} \approx 10^{130}$ yrs.

(G) Several years ago, some astrophysicists proposed that our universe is accelerating its expansion according to observations from remote supernova 1a, and pointed out that over 60% dark energy of exclusive force exists in universe[1]. Since our universe as a gigantic BH should inevitably possess the essential quality of any

BH, the expansion of our universe only depends upon absorbed energy-matters which did not belong to our original universe. More energy-matters were taken in, faster its expansion would be. Of course, if absorbed energy possesses exclusive force, the expansion of universe should be much faster or accelerated.

8. The further explanations

The new concepts in this article show that GTR cannot be applied to describe the state of quantum field at Plank's Era (-10^{-43}s) $\Rightarrow 0 \Rightarrow (+10^{-43}$ s) in the primordial universal evolution, just as Newton's mechanics cannot describe the motion of any matter which speed is close to the light speed (C). Without exception, the mathematical equations of all theories including GTR would always have its applied conditions and limits.

The four difficult and complicated problems (Singularity, flatness, Event Horizon and magnetic monopole) at the genesis of universe had troubled scientists for several decades. After existence of Singularity has been negated by new concepts in this article, the other three problems may be easily solved. Moreover, the new concepts in this article have given the better explanation to the origin of "Inflation" and "inflationary cosmological model".

If the new concepts in this article exclude the occurrence and existence of Singularity at the genesis of our universe, for which scientists will not need to beg the marvels or any new theories or to provide some special original conditions.

All numerical values calculated in this article are precisely consistent with the current classical theories and its formulas, the observational results and the real evolutionary process of our universe. Probably, the new concepts in this article may not be accepted and convinced by the most scientists because of no abstruse theory, no complicated mathematical equations, no exact demonstrations as well as the old conventions broken down.

9. Demonstration to formulas (1a) and (1b)

To prove the Formulas (1a, 1b) as below, Suppose R is the radius of a sphere in the universe. R's dimension should be large enough.

The potential energy (P.E.) on the spherical surface is:

P.E. = (mMG)/R,

m – Mass of a particle on the surface,

M – Total masses in the sphere of radius R

G – Gravitational Constant,

R – Characteristic scale factor (dimension)

The kinetic energy (K.E.) of m on the surface is

K.E. = $0.5\ mV^2$.

V–Radical Velocity, expanding or escaping velocity are corresponding to the end-point of R.

According to the "Cosmological Principle", the universe, which is both isotropic and homogeneous, looks the same in any direction and at every point. Therefore, the whole sphere should be considered an isolated system and no energy exchange with the other system. Based on the principle's of Newton Mechanics, the real space with three dimensions can be treated in one dimension R in the process of the universe's evolution.

P.E. = K.E.

$0.5V^2=(MG)/R$ (B)

(1) In the process of the universe's evolution from Big Bang to the end of Radiation Era, to particles or radiations (photons), from (2a), (2b), (1a)

$E=mc^2$ $E=\kappa T$ $E=ch/\lambda$ (2a)

$m = \kappa T/C^2$, $R \propto \lambda$, and $T \propto 1/R$, (2b)

Formulas (2a), (2b) show that, in the early process of universe's expansion, the increase in wavelength of the radiations λ is proportional to increase of R, and **as temperature T slow down, mass m of a particle would decrease, and then the gravity between particles would weaken. That is the important reason for that, pre-universe quickened its contraction to Big Crunch and the present universe accelerated its expansion in the earlier period after its birth.**

Because in Formula (B), $\Sigma m_i = M$ (B1)

Therefore, M's increasing is proportional every m_i's increasing,

From Formula (B)(B1) (2b),

So $M \propto 1/R$ **$M \neq$ Constant** (B2)

From Formula (B)(B2), $V^2 \propto 1/R^2$, $V \propto 1/R$, VR=Constant

So RV = Constant i.e. $R(dR/dt)$ = Constant (B3)

From (B)(B1)(B2)(B3) , dR^2/dt = constant

$Tt^{1/2} = k_1$, $R=k_2t^{1/2}$, $RT = k_3$, $R = k_4\lambda$, $RV = k_5$ (1a)

Formula (1a) is proven correctly.

(2). In The Matter-Dominated Era

Because in Formula (B), **M = Constant**

So $R^{1/2}V$=Constant i.e. $R^{1/2}(dR/dt)$ = Constant, So $R^{1/2}V$=Constant

Therefore, $R^{3/2} = t \times$(Constant), $R = k_7 t^{2/3}$ (B4)

In this era, to radiation, Formula (B1) is still right

So from Formulas (B1)(B4)

$Tt^{2/3} = k_6$, $R = k_7t^{2/3}$, $RT = k_8$, $R=k_9\lambda$, $R^{1/2}V = k_{10}$ (1b)

Formula (1b) is proved correctly.

10. Appendix A

Chart 1. Values Compared Between Figure 1 And Formulas (1a) (1b)

10. Appendix A

Chart 1 Values Compared Between Figure 1 And Formulas (1a) (1b)

	I Matter-Dominated Era		II Radiation Era					III Lepton Era	
Time (t) yrs,min,sec Figure 1	13.0×10^{9} yrs	4×10^{5} yrs	***F*** 34 m 40 s	***E*** 3 m 46 s	***E*** 3 m 2 s	***D*** 13.82 s	***C*** 1.09 s	***B*** 0.11 s	***A*** 2×10^{-2} s
Temperature (T) K Figure 1	3 K	3000 K	3×10^{8} K	9×10^{8} K	10^{9} K	3×10^{9} K	10^{10} K	3×10^{10} K	10^{11} K
	Formula (1-b)		***Formula (1-a)***					***Formula (1-a)***	
Temperature (T) Kelvin	3 K	3000 K	2.3×10^{8}	7.1×10^{8}	0.8×10^{9}	2.9×10^{9}	1.02×10^{10}	3.2×10^{10}	0.75×10^{11}
R cm	12×10^{27}	12×10^{24}	1.5×10^{20}	0.5×10^{20}	4.6×10^{19}	1.5×10^{19}	3.5×10^{18}	1.1×10^{18}	4.8×10^{17}
Wavelength (λ) cm	0.1	10^{-4}	1.25×10^{-9}	4.2×10^{-10}	3.8×10^{-10}	1.25×10^{-10}	2.9×10^{-11}	9×10^{-12}	4×10^{-12}
ρ_c g / Cm ^{3}	10.6×10^{-30}	1.12×10^{-20}	0.4	35	54	9.4×10^{3}	1.5×10^{6}	1.48×10^{8}	4.5×10^{9}

IV Hadron Era				V Plank Era
10^{-4} s	10^{-6} s	10^{-35} s	10^{-43}	
10^{12} K	10^{13} K	10^{27} K	10^{32} K	
Formula (1-a)				
1.07×10^{12}	1.07×10^{13}	3.38×10^{27}	0.338×10^{32}	
3.4×10^{16}	3.4×10^{15}	10.7	10.7×10^{-4}	
2.8×10^{-13}	2.8×10^{-14}	8.85×10^{-29}	8.85×10^{-33}	
1.8×10^{14}	1.8×10^{18}	1.8×10^{76}	1.8×10^{92}	

Take the initial numerical values below, which are at present universe time:
All other values on the above chart can be calculated out according to Formulas (1a, 1b)
Suppose the Hubble's Constant H = 75 Km/(sxMP_{sc})

So $t_0 = 1/H = 13 \times 10^{9}$yr

$R = t_0 c = (13 \times 10^{9}\text{yr}) \times c = 12 \times 10^{27}$cm $\quad \lambda = 0.1$ cm $\quad \rho_c = 10.6 \times 10^{-30}$ g/cm^3 $\quad T = 3$k

References of Part One

1. Micheal D. Lemonick; How The Universe Will End. TIME, June 25, 2001.
2. Giancoli, Douglas C. Physics, Principles With Applications. 5th Ed. Upper Saddle River, NJ: Prentice Hall, 1998. 999-1034.
3. Su, Yi. New Instruction to Astronomy. Wuhan, People's Republic Of China: Publishing House of Central China University, 2000. 374-413.
4. Weinburg, Steven. The First Three Minutes. Chinese Edition, Beijing, People's Republic of China: Chinese Foreign Language Translation and Publishers, 1999.
5. Wang, Yong-jiu. Physics of Black Holes. Publishing House of Hunan Normal University. Hunan, China. 2002.
6. He, Xiang-tao. Observational Cosmology. Science Publishing House. Beijing, China. 2002.
7. Gribbin, John. In Search of the Big Bang: Quantum Physics and Cosmology. Chinese Edition, Shanghai Science-Techno-Education Publishing House. China. 2000.

****

Author: Dongsheng Zhang, graduated in 1957 from Beijing University of Aeronautics and Astronautics of China, retired now. Permanent Address: Seventeen Pontiac Road, West Hartford, CT 06117-2129. Email: zhangds12@hotmail.com.

This article had gotten number of Certificate of Registration TXu1-156-325, from UNITED STATE COPYRIGHT OFFICE.

Chinese edition of this article was published on "Aeronautical Education" magazine, June 2004, Beijing University of Aeronautics and Astronautics, China. Publication Number: ISSN1005-8176 | CN11-2548/G4.