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Unified explanation of big bang, inflation, charged black hole decay, galaxy formation, proton spin crisis and elementary particle masses

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Abstract;
Space-time evolution is briefly explained by using the 3-dimensional quantized space model (TQSM) based on the 4-dimensional (4-D) Euclidean space. The energy (E=cΔtΔV), charges (|q|= cΔt) and absolute time (ct) are newly defined based on the 4-D Euclidean space. The big bang is understood by the space-time evolution of the 4-D Euclidean space but not by the sudden 4-D Minkowski space-time creation. The big bang process created the matter universe with the positive energy and the partner anti-matter universe with the negative energy from the CPT symmetry. Our universe is the matter universe with the negative charges of electric charge (EC), lepton charge (LC) and color charge (CC). This first universe is made of three dark matter -, lepton -, and quark - primary black holes with the huge negative charges which cause the Coulomb repulsive forces much bigger than the gravitational forces. The huge Coulomb forces induce the inflation of the primary black holes, that decay to the super-massive black holes. The dark matter super-massive black holes surrounded by the normal matters and dark matters make the galaxies and galaxy clusters. The spiral arms of galaxies are closely related to the decay of the 3-D charged normal matter black holes to the 1-D charged normal matter black holes. The elementary leptons and quarks are created by the decay of the normal matter charged black holes, that is caused by the Coulomb forces much stronger than the gravitational forces. The Coulomb forces are very weak with the very small Coulomb constants (k_1(EC) = k_{dd}(EC) ≈ 0) for the dark matters and very strong with the very big Coulomb constants (k_2(EC) = k_{nn}(EC)) for the normal matters because of the non-communication of the photons between the dark matters and normal matters. The photons are charge dependent and mass independent. But the dark matters and normal matters have the similar and very weak gravitational forces because of the communication of the gravitons between the dark matters and normal matters. The gravitons are charge independent and mass dependent. Note that the three kinds of charges (EC, LC and CC) and one kind of mass (m) exist in our matter universe. The dark matters, leptons and quarks have the charge configurations of (EC), (EC,LC) and (EC,LC,CC), respectively. Partial masses of elementary fermions are calculated, and the proton spin crisis is explained. The charged black holes are not the singularities.

Key words; Elementary particles; Galaxy structures; Charged black hole decay; Big bang and inflation; Super-massive black holes; Coulomb forces; Universe evolution; 4-D Euclidean space.

1. Introduction

The space-time geometry research is closely related to the special and general relativities, quantum mechanics, manifold mathematical physics, cosmology, and standard model [1-42]. The present model is based on the Euclidean space-time, but not on the Minkowski space-time. The time axis that is defined on the Minkowski space-time is relatively changing with the particle velocity in the Lorentz transformations of the relativity theory. But the time axis (called as the absolute time of ct) that is defined on the Euclidean space-time does not change with the particle velocity in Fig. 1.

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Only the space-time distance (called as the relative time of ct_l) is changing with the particle velocity as shown in Fig. 1. This relative time (ct_l) corresponds to the time (t) of the Minkowski space-time even though the concept is very different. The modified Lorentz transformations are introduced in terms of the Euclidean space-time in Ref. 43. Therefore, there are two times of the absolute time and relative time based on the Euclidean space-time. All physical concepts in the present work are discussed based on the Euclidean space-time. In Fig, 1, the massive particle and photon are defined as the warped space and flat space on the 4-D Euclidean space-time. When the particle does not move, only the absolute time is ticking on. Then the observed relative time is the

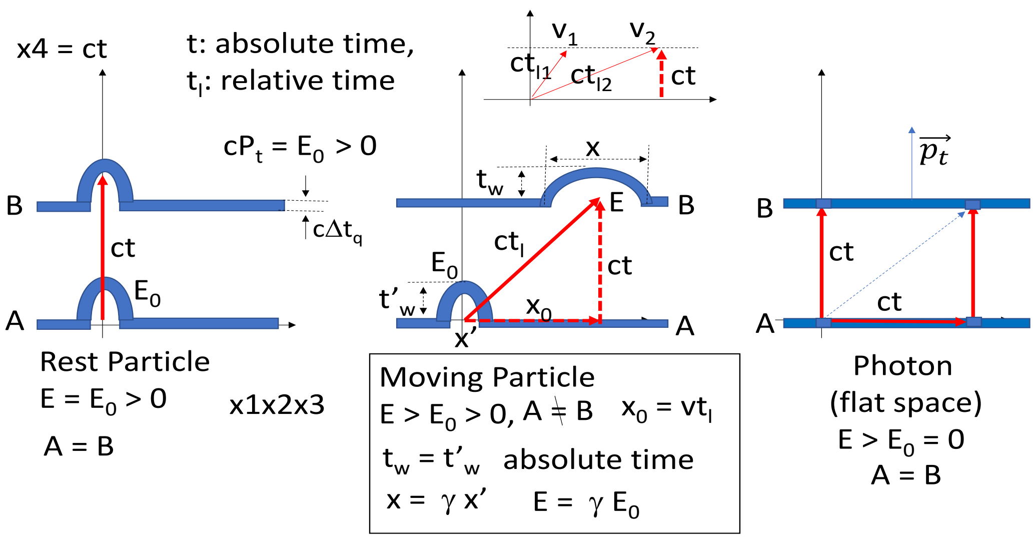


Fig. 1. The particle and matter with the non-zero rest mass are described as the warped space. The photon with the zero-rest mass are described as the flat space.

same as the absolute time. And if the particle moves with the velocity of $v = \Delta x/\Delta t_l$, the observed relative time of $c\Delta t_l$ is different from the absolute time of $c\Delta t$. The relative time axis is varying following the particle velocity. Therefore, the relative time can be related with the velocity and moving space distance of the particle in the modified Lorentz-transformations [43]. The absolute time axis is fixed always as the fourth dimensional axis in the 4-D Euclidean space-time. The photon is the flat space in Fig. 1. The photon moves with the light velocity of c. The whole photon space (or whole 3-D quantized space) in Fig. 1 is moving with the light velocity of $c = \Delta x4/t$ along the x4 axis. The internal photons inside the flat space move with the light velocity of $c = \Delta x/t_l$ on the flat space. In Fig. 1, the rest particle, moving particle and photon are compared. The photon has the zero rest mass. Therefore, even though the internal photon is moving along the x space direction with the constant speed of c, the photon space is not changed. It is expressed as A=B in Fig. 1. In other words, the electromagnetic wave does not change the space. But the moving massive particle changes the space as shown in Fig. 1. It indicates that the electromagnetic wave is the space fluctuations which does not change the photon space itself. Also, the photon moves along the time axis of ct like the rest particle does. Therefore, ct is equal to ct_l for the photon in Fig. 1. This means that the photon has both properties of the particle (photon) and wave (electromagnetic wave). This explains the particle-wave duality of the photon.

The present work is entirely based on the 4 dimension Euclidean space but not on the 4 dimension Minkowski space. Fourth dimension axis is the absolute time axis of ct. The ideas proposed by the present model are graphically explained for the readers who want to understand the basic physical concepts. In the present model, the photon is the flat space with the zero rest mass. The particles and matters with non-zero rest masses (m_0) including the gravitons are considered as the warped spaces. Here, the graviton has the non-zero rest mass. This tells that all the particles including the gravitons with the non-zero rest masses are the warped spaces which are created from the flat photon space. Only the photon has the zero rest mass which indicates the flat space. The rest mass energy of $E = mc^2$ is defined as the four-dimension space volume of cΔtΔx1Δx2Δx3 = cΔtΔV.

	Bastons (EC), $\gamma(0)$				Leptons(EC,LC), $\gamma(0,0)$				Quarks(EC,LC,CC), $\gamma(0,0,0)$			
	EC				EC				EC			
X1	-2/3	B1			0	ν_e	ν_μ	ν_τ	2/3	u	c	t
X2	-5/3	B2			-1	e	μ	τ	-1/3	d	s	b
X3	-8/3	B3			-2	Le	Lμ	Lτ	-4/3	Q1	Q2	Q3
Total	-5				-3				-1			
	Dark matters				LC				LC			
X4	-1 = 2/3 -1/3 -4/3				-2/3	ν_e	e	Le	0	u	d	Q1
X5	-3 = 0 -1 -2				-5/3	ν_μ	μ	Lμ	-1	c	s	Q2
X6	-5 = -2/3 -5/3 -8/3				-8/3	ν_τ	τ	Lτ	-2	t	b	Q3
Total					-5				-3			
									CC			
X7									-2/3(r)			
X8									-5/3(g)			
X9									-8/3(b)			
Total									-5			

Each flavor (charge) corresponds to each dimensional axis.

Force carrying bosons: EC, LC, CC = 0, -1, -2
EC, LC, CC Conservations in reactions and decays of particles

$J(-5)_3$ $P(-3,-5)_3$ $B(-1,-3,-5)_3$: 3-D particles

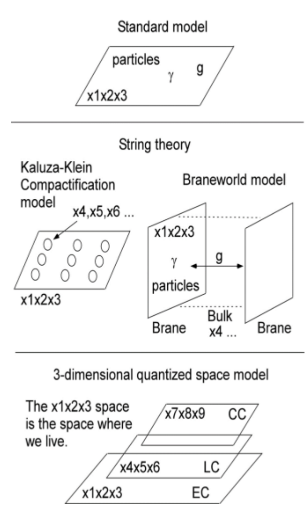


Fig. 2. Elementary fermions are shown in terms of TQSM [11].

Because the 4-D volume is the only factor to define the different particles, it is reasonable to say that the 4-D volume is the rest mass energy of the corresponding particle. This four-dimension space volume of cΔtΔx1Δx2Δx3 is connected to the wave function of the quantum mechanics. This could be the origin of the quantum mechanics. The wave function is formed along the absolute time axis of ct but not along the relative time axis of ct_l. It will be interesting to research the relation between the four-dimension space volume of Δ(ct)Δx1Δx2Δx3 and the particle energy in quantum mechanics. The relation between the four-dimension space volume and wave function in the quantum mechanics will be discussed in the following paper.

The definition of E = cΔtΔx1Δx2Δx3 = cΔtΔV is very important in the physical point of view. The particle is the warped space, and the particle energy is the warped space volume on the 4-D Euclidean space. The time momentum is p_t = mc = E/c = ΔtΔx1Δx2Δx3 = cΔtΔV. From the definition of the energy, we just can observe the space volume because we live on the 3-D space. The energy and mass cannot be directly observed because it is the 4-D Euclidean volume. We observe the energy and mass as the effect on the 3-D space when the particle is moving. The inertia mass of m = F/a is one example. The black holes have the huge energy (or mass) and very small space volume. This indicates that the cΔt is huge for the black holes. The singularity is expected for the black holes because of the huge gravitational force in terms of the general relativity. Therefore, the black holes are very stable and could be evaporated through the Hawking radiation from the quantum vacuum fluctuations [44 – 50]. Now I propose the radical charge assumption of

|q| = cΔt. In this definition, the negative charge is the space-time shape warped toward the negative time direction and the positive charge is the space-time shape warped toward the positive time axis. Under this charge definition, the black holes have the huge charge and very small space volume.

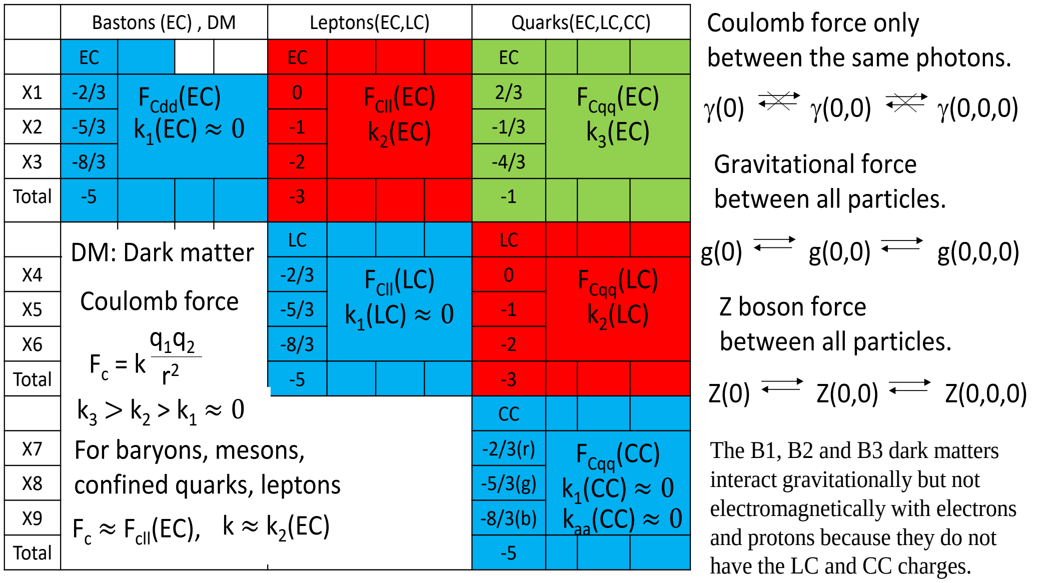
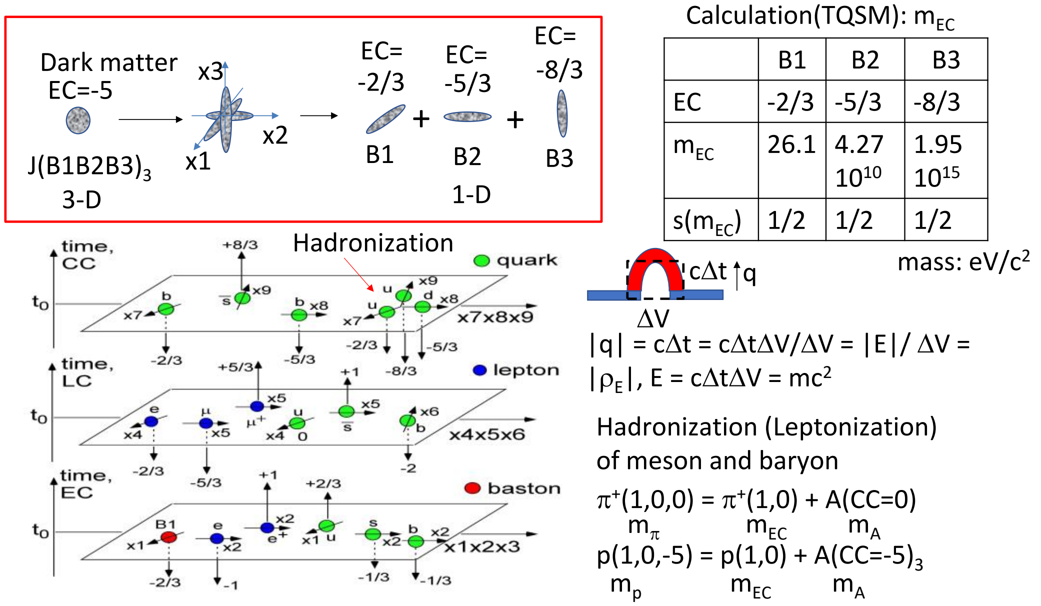


Fig. 3. Coulomb forces and Coulomb constants of the elementary fermions are compared. $k_1(EC) = k_{dd}(EC)$, $k_2(EC) = k_{ll}(EC)$, and $k_3(EC) = k_{qq}(EC)$. The present table is modified from the Coulomb force table (Fig. 2) in Ref. [45].

This means that the black holes (BH) have the stable space-time warped shape under the condition of $F_c = F_g + F_B$. Here, F_c, F_g and F_B are the Coulomb force, gravitational force, and boson force, respectively. If the extremely large black holes are created at the big bang, these primary black holes have the huge Coulomb force to meet the condition of $Fc >> Fg + F_B$. Because of the huge Coulomb force with the huge BH surface fluctuations, these primary black holes experience the rapid space expansion and rapid time (charge) contraction that are called as the inflation. Finally, these primary black holes are charged to the stable black holes with the condition of $F_c = F_g + F_B$. The black holes are not the singularities. The big bang, inflation, charged black hole decay, galaxy formation, proton crisis and elementary particle masses are explained in the following sections. Elementary fermions, Coulomb forces and charged black holes are discussed in section 2. Space-time evolution and big bang in terms of TQSM is explained section 3. Decay of the charged black holes and origin of the galaxy formation is the tile of the section 4. Calculated elementary particle masses, Gravitational forces, and boson forces is the tile of section 5. Partial mass calculations of elementary fermions and proton spin crisis is the title of section 6.

2. Elementary fermions, Coulomb forces and charged black holes

In Fig. 2, the elementary fermions are listed. The elementary fermions are the warped space in Fig. 1. The 3-D dark matter of $J(B1B2B3)_3 = J(-5)_3$ decays to the 1-D B1, B2 and B3 dark matters in Fig. 2. And the 3-D lepton of $P(-3,-5)_3$ decays to the 9 1-D leptons in Fig. 2. Also, the 3-D quark of B(-1,-3,-5)3 decays to the 27 1-D quarks in Fig. 2. The elementary fermions are made of the three bastons (dark matters) with the charge configuration of (EC), 9 leptons with the charge



	B1	B2	B3
EC	-2/3	-5/3	-8/3
m_{EC}	26.1	4.27 10^{10}	1.95 10^{15}
$s(m_{EC})$	1/2	1/2	1/2

Fig. 4. Energy and charges are defined in terms of the 3-D quantized space model. The 3-D dark matter decays to the 1-D dark matters with the calculated masses [11,45].

configuration of (EC,LC) and 27 quarks with the charge configuration of (EC,LC,CC). Then, there are three kinds of photons of γ(EC=0) for the dark matters, γ(EC=0,LC=0) for the leptons and γ(EC=0.LC=0,CC=0) for the quarks connected with the Coulomb forces. This is called as the three-dimensional quantized space model (TQSM). The Coulomb interactions do not work between dark matters, leptons and quarks because of the different charge configurations in Fig. 3. The Coulomb interactions are charge dependent. The baryons and mesons with the color charges (CC) separated from the EC and LC charges act like the leptons for the Coulomb interaction. The color Coulomb forces (F_c(CC)) are very weak and nearly zero for the quarks, baryons and mesons in Fig. 3. The Coulomb forces work between the hadrons and leptons. The hadronization is called as the leptonization in the present work in Fig. 4. The gravitational force is applied for all particles because the gravitational force has the mass dependence but not the charge dependence. The gravitational force strength of G (gravitational constant) is similar for the dark matters, leptons and quarks because of the communication between all particles. But the Coulomb force strength of k (Coulomb constant) should be different for the dark matters, leptons and quarks because of the non-communication between the dark matters, leptons and quarks. We know that the Coulomb forces are much stronger than the gravitational forces for the normal matters like the electron and proton. This means that the lepton Coulomb constant of k_2(EC) = k_{ll}(EC) acting between the leptons and baryons is large as observed. The localized dark matter distribution around the galaxy tells that the gravitational forces are stronger than the Coulomb repulsive forces for the EC charged dark matters. From this information, the Coulomb force for the dark matters is very weak compared with the Coulomb force for the electron and proton. The observed Coulomb force for the electron and proton is the electric charge Coulomb force (F_c(EC)). It is thought that the lepton charge Coulomb force (F_c(LC)) for the electron and proton is very weak compared with the electric charge

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Coulomb force (F_c(EC)). The total Coulomb force for the electron and proton is Fc = Fc(EC) + Fc(LC). And for the Coulomb force, the neutrino has $F_c = F_c$(LC) = very weak. The Coulomb force effect for the neutrinos has never been observed. Therefore, it is proposed that the very weak LC Coulomb constant for the leptons is the same to the very weak EC Coulomb constant for the dark matters. This concept is extended for the quarks. The weak EC Coulomb constant for the dark matters is the same to the weak CC Coulomb constant for the quarks. The CC Coulomb force for the quarks is $F_c = F_c$(CC) = very weak. Actually, the Coulomb force between neutrons is the CC Coulomb force because the neutrons have the color charge of CC=-5. Then the CC Coulomb forces between the neutrons are not observed. This means that the CC Coulomb forces between the neutrons are very weak and close to zero. In other words, the CC Coulomb constant between the baryons are very weak and close to zero. Also, the CC Coulomb constant between the quarks are also very weak and close to zero as shown in Fig. 3. The EC Coulomb constant between the dark matters, LC Coulomb constant between the leptons, the LC Coulomb constant between the baryons, and CC Coulomb constant for the baryons and quarks are the same. The strong EC Coulomb constant for the leptons and strong EC Coulomb constant for the hadrons (baryons and mesons) are the same to the strong LC Coulomb constant for the quarks. It is thought that the EC Coulomb force for the quarks is very strong. This very strong EC Coulomb force is strong enough to allow only the 2 quark system (meson) and 3 quark system (baryon). The very strong EC Coulomb constant is the reason why it is very difficult to discover the multi-quark system with more than 4 quarks. It will be interesting to study on which one of the EC Coulomb force and gauge boson force between quarks is stronger in section 5. The Coulomb forces are summarized in Fig. 3. In summary, The Coulomb constants are different for the dark matters, leptons and quarks because of the non-communications between the dark matters, leptons and quarks. The Coulomb force (or Coulomb constant, k) is charge dependent. And the photons are charge dependent, too. The photons cannot be interchanged between the dark matters, leptons and quarks. The photons cannot be interchanged between the dark matters and normal matters. This means that the EC Coulomb constants are very weak (or very small) for the dark matters, strong for the leptons and hadrons and very strong for the quarks. The observed strong EC Coulomb constant for the normal matters and the expected very weak EC Coulomb constant for the dark matters are explained by the non-communications between the dark matters and normal matters for the Coulomb interactions. The gravitational force (gravitational constant, G) is charge independent and mass dependent in section 5. And the gravitons are charge independent and mass dependent, too. The gravitons can be interchanged between the dark matters, leptons and quarks. The gravitons can be interchanged between the dark matters and normal matters. The gravitational forces can be communicated between massive particles. The gravitational constants (G) are very weak (or very small) for the massive particles. The gravitational constants for the normal matters and dark matters are observed to be very weak and similar in section 5. The observed weakness of the gravitational forces between the elementary particles are explained by the communications between the elementary particles for the gravitational interactions. Therefore, it is assumed that the Coulomb force (or Coulomb constant) between the dark matters is relatively much weaker than the gravitational force (or gravitational constant) between the dark matters. The Coulomb force (or Coulomb constant) between the normal matters (or leptons and hardrons) is relatively much stronger than the gravitational force (or gravitational constant) between the normal matters (or leptons and hadrons). These results are required to explain the observed phenomena of the dark matters and normal matters. The competition between the Coulomb forces and gravitational forces plays the very important role for the evolution of the universe which are explained by the evolution of the charged

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black holes. In Fig. 4, the energy, and charges (EC, LC and CC) are defined in the TQSM. The energy (E) of the particle is E=cΔtΔV. And the charge is defined as the cΔt value which is positive along the positive ct time axis and negative along the negative ct time axis. The elementary

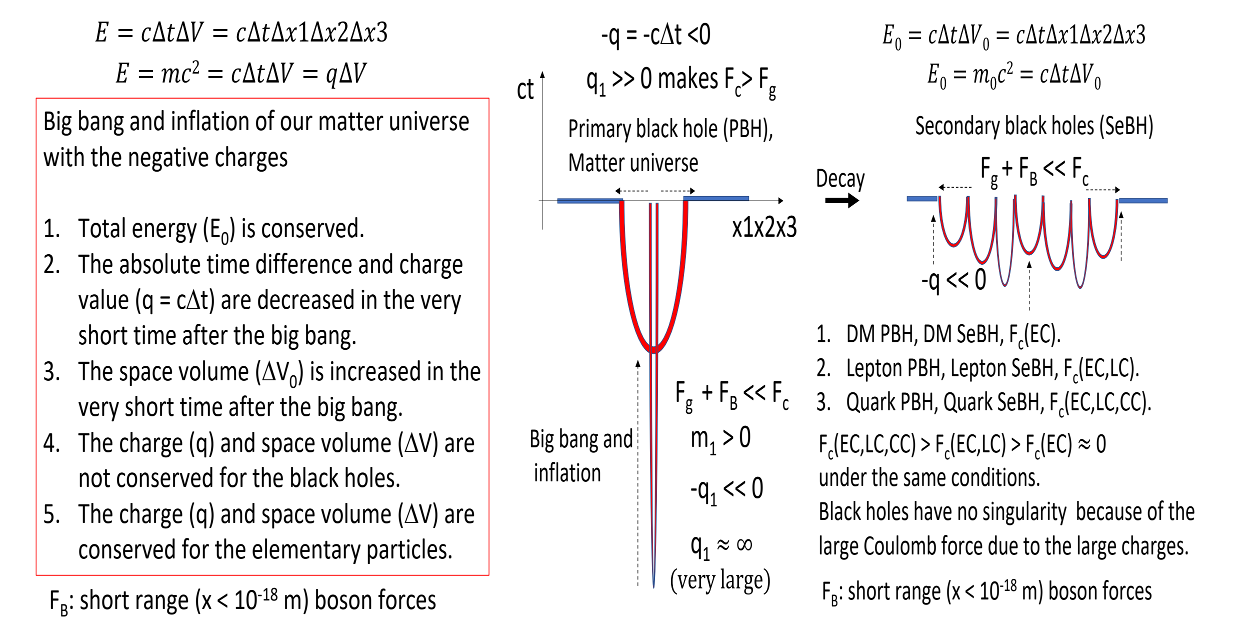

Fig. 5. The big bang and inflation take place because of the huge Coulomb forces.

fermions have the fixed spin of s=1/2, constant charges, constant space volume and the constant energy (or constant rest mass). However, the black holes without the internal structures have the varying physical quantities of the spins, charges, and space volumes except the total energy. The three kinds of black holes exist as the dark matter black hole with the EC charge, lepton black hole with the EC and LC charges and quark black hole with the EC, LC and CC charges. These charged black holes are the totally merged space-time states without the internal structures. These black holes have the charges and masses. The dark matter black hole, lepton black hole and quark black hole are expressed as the charge configurations of (EC), (EC,LC) and (EC,LC,CC), respectively. The black holes with the very small space volume are hugely warped along the time axis of ct. The huge time size (cΔt) means the huge charge of q = cΔt. These charged black holes have the surface fluctuations from the competition of the attractive gravitational force (F_g), attractive boson force (F_B) and repulsive Coulomb force (F_c). The short range (gauge) boson force (F_B) should be generally added as the attractive force for the black holes because many black holes have the very small space sizes. The first black hole created at the big bang is developed from the primary black hole to our present matter universe. This primary black hole should experience the space expansion (inflation) and time contraction because the energy conservation equation of E = cΔtΔV. The black hole and particle with the non-zero rest masses are defined as the warped space-time in Figs. 1 and 4-7. The 4-dimensional space-time volume of E= cΔtΔV is defined as the energy of the black hole and particle. From this definition, the inflation means the huge space expansion (inflation) and huge time contraction from the energy conservation equation of E = cΔtΔV.

The black hole is the particle with the very small space volume and very large mass. The typical definition of this black hole leads to the very large time of cΔt because of the very large energy (E) and very small space volume (ΔV) in the equation of E = cΔtΔV. In the general relativity, it is

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thought that the black hole does not experience the surface fluctuations and is very stable attracting everything including the photons. Eventually, the black hole leads to the singularity at its center. The black hole does not decay and emits only Hawking radiation from the quantum vacuum fluctuation. Therefore, we need the very radical and new physical concept in order to explain the inflation of the primary black hole after big bang. The answer to this question can come out from the possibility that the black hole can be hugely charged as proposed in the present 3-dimensional quantized space model (TQSM) as shown in Figs. 5 - 7. The present TQSM model is the extended standard model. If the black hole has the huge charge that can give the huge repulsive Coulomb

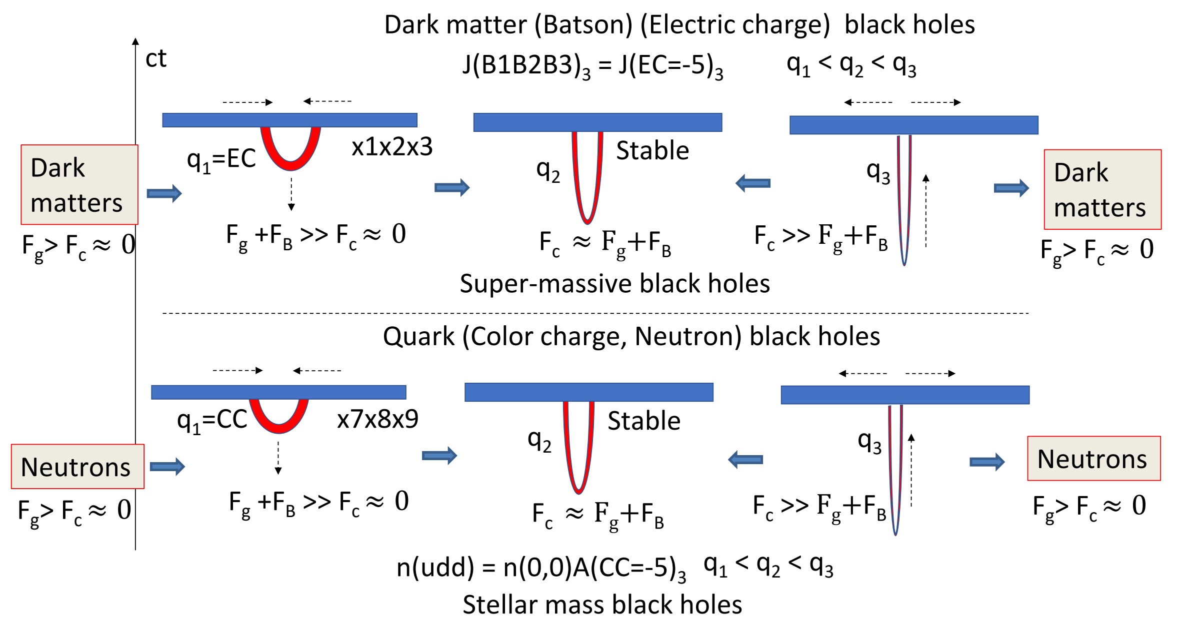

Fig. 6. The stable black holes are shown for the dark matter super-massive black holes and the stellar mass black holes.

force large enough to overcome the attractive gravitational force and boson force, the inflation of the primary black hole created at the big bang can be explained. Now the charge is defined as $q = c\Delta t$. This charge definition is used for the black hole evolution including the inflation in the present work. The inflation and decay of the primary black hole continue until the Coulomb force is similar to the sum of the gravitational force and bosons force for the black hole as shown in Figs. 5-7. The Coulomb forces for the leptons and quarks are much stronger than the gravitational forces in Fig. 3. This means that the lepton black holes and quark black holes can be destroyed because of the strong Coulomb forces greater than the sum of the long-range gravitational force and short-range boson force. In the inflation process of the primary black hole, after the moment at which the space sizes of the secondary black holes become bigger than the boson force range of about $< 10^{-18}$ m, the black holes are rapidly destroyed before the crossing point of $F_c \approx F_g + F_B$, because the Coulomb forces are much stronger than the gravitational forces for the leptons and quarks and the Coulomb forces are still much stronger than the gravitational forces for the charged black holes. Therefore, the charged particles like electrons and protons are emitted as the aftermath of the inflation of the lepton black holes and quark black holes in Fig. 7. These electrons and protons are distributed as the normal matters in the galaxies. These normal matters are locally distributed by the gravitational force between the normal matters and dark matters (including the dark matter black holes). Now

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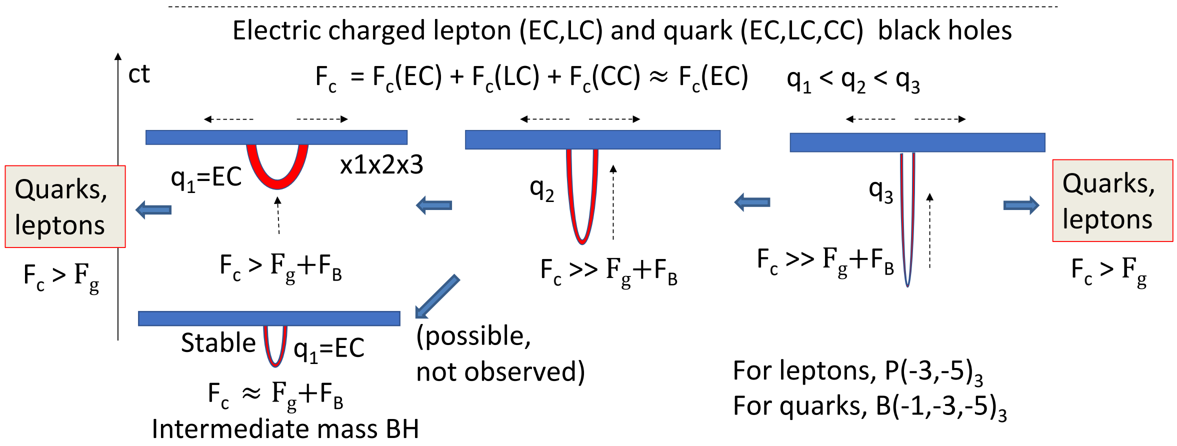
dark matter primary black hole experiences the inflation after the big bang like the lepton primary black hole and quark primary black hole. The Coulomb force between the dark matters is very



The charge (q) and space volume (ΔV) are not conserved for the black holes. In the present work, $F_c > F_g + F_B$ from the large EC charge (large cΔt) and small space volume is always assumed for the EC charged lepton and quark black holes, which decay to the quarks (or baryons and mesons) and leptons.

Fig. 7. Lepton and quark black holes are destroyed and decay to leptons and quarks.

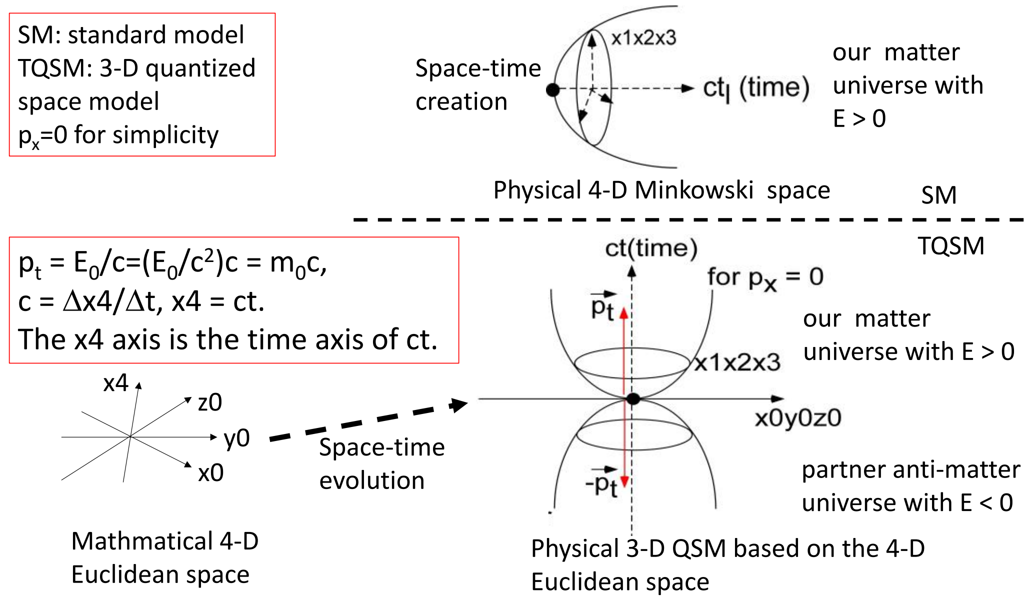


Fig. 8. The big bang process is compared for the space-time evolution in TQSM and space-time creation in SM. The x1x2x3 space coordinates and x0y0z0 space coordinates can be always overlapped with the corresponding time gap of cΔt.

weak to be neglected in the most cases. But the very weak Coulomb force of the charged dark matters play the major role for the inflation of the dark matter primary black hole and secondary black holes with the huge EC charges. The Coulomb force of the dark matter black holes with the huge EC charges is bigger than the sum of the gravitational force and short-range boson force of the dark matter black holes. In other words, $F_c > F_g + F_B$. In the inflation process, after the moment

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at which the space sizes of the secondary black holes become bigger than the boson force range of about < 10^{-18} m, the black holes are slowly destroyed because the Coulomb forces are much weaker than the gravitational forces for the charged elementary dark matters and the Coulomb forces are still stronger than the gravitational forces for the charged black holes. The dark matters are emitted from the host black holes. The emitted dark matters are locally distributed around the left-over dark matter black holes. At the crossing point of $F_C \approx F_g+F_B$, the dark matter black hole stops to decay. The dark matter black hole with the large EC charge enough to meet the condition of $F_C \approx F_g+F_B$ remains as the super-massive black holes at the center of the galaxies in Fig. 6. Therefore, the emitted normal matters, emitted dark matters and left-over dark matter black hole form the galaxies.

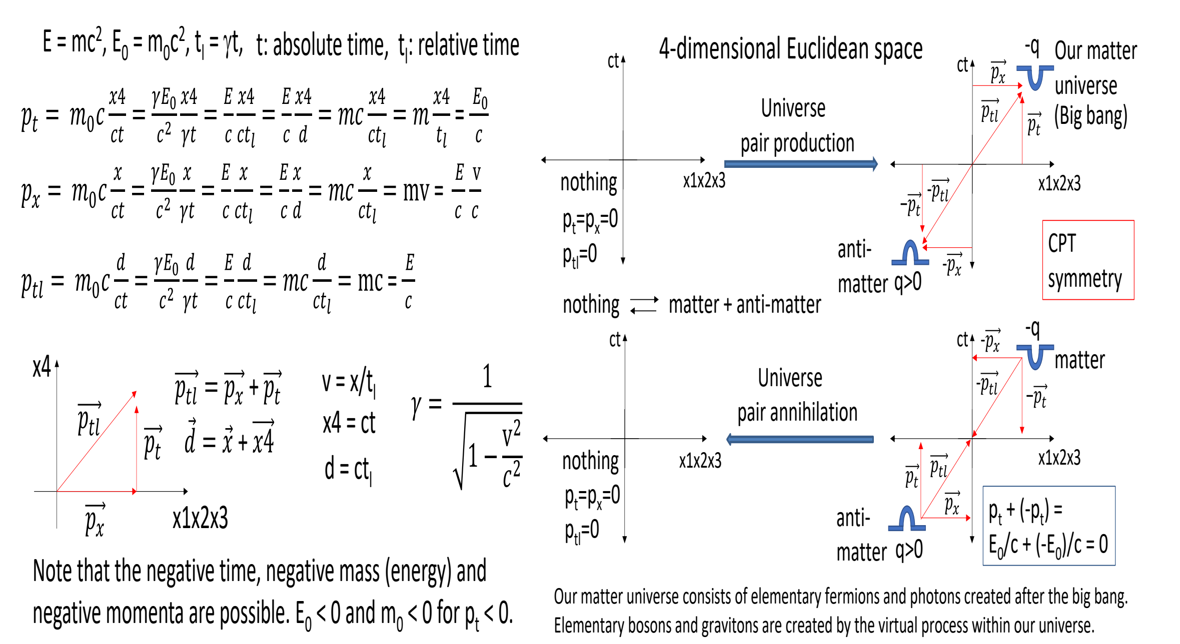

Fig. 9. 4-dimensional momenta are defined for the absolute time (t) along the x4 axis. Here, the big bang is explained as the universe pair production (see Fig. 1). The x1x2x3 space coordinates can be always replaced with the x0y0z0 space coordinates if needed.

In the inflation process, the black hole is decayed to the smaller black holes. These small black holes decay to the galaxy black holes (galaxy particles) which are the seed black holes of the galaxies. In order for the black hole to decay, the Coulomb force (Fc) should be larger than the sum of the gravitational force (Fg) and the short-range boson force (F_B). The first black hole followed by the big bang should be electrically charged with the huge charges of EC, LC and CC which have the very small space volume (ΔV) and very big absolute time (cΔt). In order for the big bang and inflation to take place, the first condition is that the Coulomb force, Fc is much bigger than the sum (F_A) of the gravitational force (Fg) and bosons force (F_B). Because $Fc>>F_A$, the big bang and inflation mean the sudden increasing of the space volume and the sudden decreasing of the absolute time (cΔt). After these processes, a lot of smaller super-massive black holes are created. These super-massive black holes decays slowly to form the galaxy clusters and each galaxy. The black holes are not the singularities because of the huge repulsive Coulomb forces due to the huge charges of the black holes in Figs. 5-7.

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The big bang process is the sudden space-time creation from the nothing in the standard model as shown in Fig. 8. There have been many efforts to explain this sudden 4-D space-time creation. The sudden 4-D space and time creation does not look like the natural process in terms of the CPT symmetry. It is because the partner universe is not proposed in the well-known big bang theory.

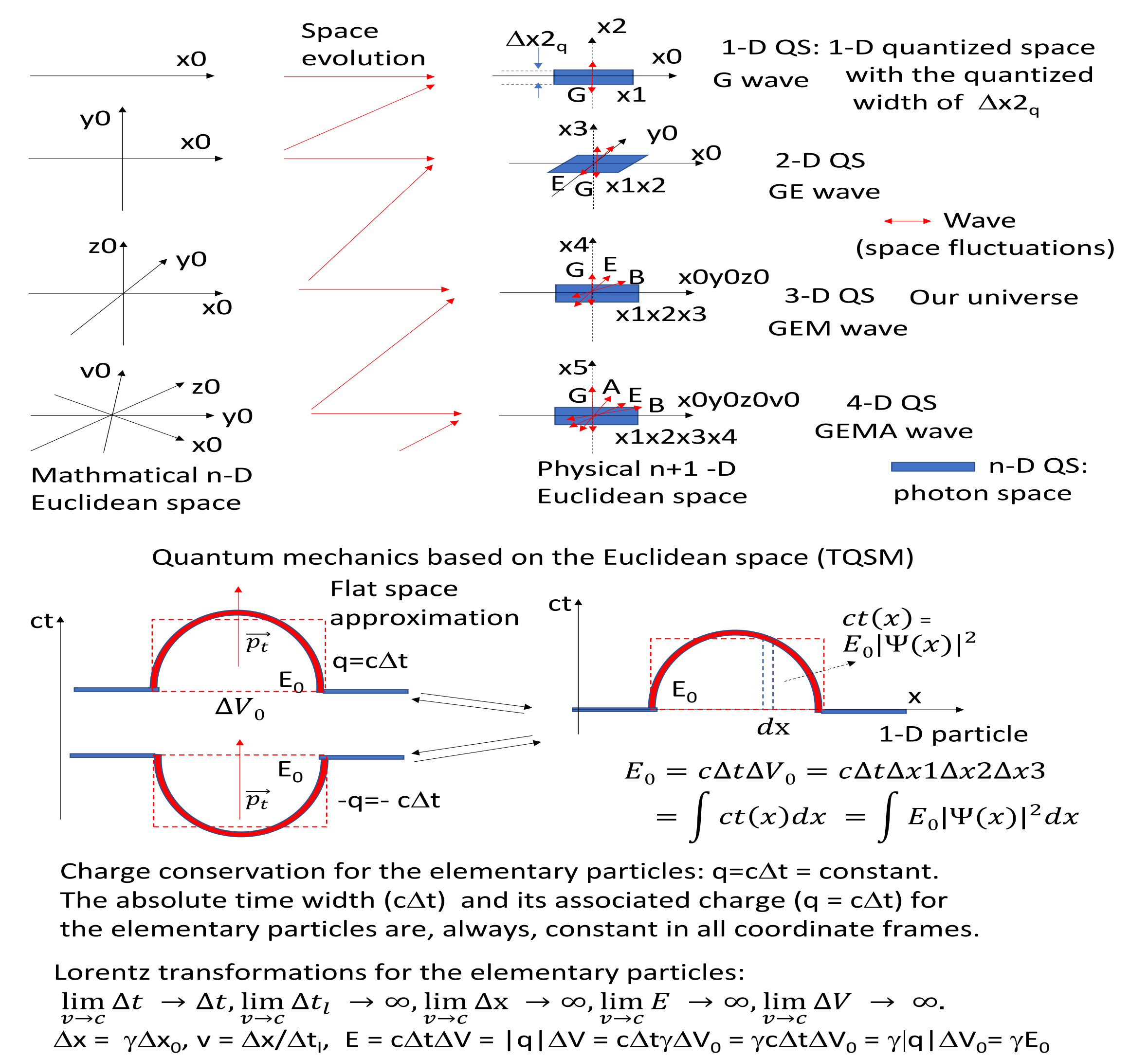

Fig. 10. The mathematical n-D Euclidean spaces are developed to the physical n+1 -D Euclidean spaces with the energy (photon space). The warped space-time shape can be explained as the wave function of the quantum mechanics.

The corresponding space-time is based on the 4-D Minkowski space where the observed time of t_l is changing with changing of the particle velocity. In this well-known big bang theory, the observed time and energy (mass) are positive in Fig. 8. This means that the time momentum of $p_{tl}=E/c$ is positive along the time axis of ct_l, and our universe is moving toward the positive (forward) time direction since the birth of the universe. This explains the fact that our universe cannot be moving to the backward time direction and the observed mass (energy) are positive. At least this is true in our universe where we live. The standard model including the big bang process has been successfully established to explain many properties of the elementary particles, for a long time.

In the present work, our space-time matter universe is explained by the extension from the 4-D x0y0z0x4 Euclidean space to the 3-D x1x2x3 Euclidean space on the 4-D x0y0z0x4 Euclidean space in Figs. 8-10. This x1x2x3 space is called as the 3-D quantized space with the quantized time width of $c\Delta t_q$ (3-D QS) or the 4-D quantized space and time (4-D QST) in Figs. 8-10. Then the time axis of ct is the fourth dimension x4 axis. The quantized time width of $c\Delta t_q$ could be the Planck size scale or smaller quantum size. Our matter universe corresponds to the x1x2x3 quantized space in Figs. 8-10 because only the three space dimensions and one time dimension are observed in the real macroscopic world. Also, two E and M space fluctuations in the EM wave indicates that we live in the 3-D quantized x1x2x3 space in Fig. 10. This is called as the space-time evolution which looks like the natural process in terms of the CPT symmetry because our matter x1x2x3 universe and the partner anti-matter x1x2x3 universe are created at the big bang by the CPT symmetry. In the president 3-D quantized space model, the universe can move toward the positive time direction or negative time direction. It is because the time momentum of p_t is positive or negative. Because the time momentum is $p_t = E_0/c$ in Figs. 8-10, the energy of the universe with the positive time momentum is positive and the energy of the partner universe with the negative time momentum is negative. Of course, the zero time momentum of $p_t = E_0/c = 0$ means the nothing with the zero energy. Therefore, the universe with the positive time momentum and the partner universe with the negative time momentum are created from the nothing with the zero time momentum of $p_t = E_0/c = 0$ as shown in Figs. 8-9. The created universe is called as the x1x2x3 space with the very small time width of $c\Delta t_q$ which could be the Planck time scale or smaller quantum size. The present big bang theory in terms of the 3-D quantized space model (TQSM) is called as the space-time evolution theory while the well-known big bang theory in terms of the standard model (SM) is called as the space-time creation theory in Fig. 8.

The 3-dimensional quantized flat space is the photon space. The particle is the warped space with the velocity (v) slower than the photon velocity of c. Under this definition of the particle mass, it is proposed that the electric charge is positive for the positive warped space and negative charge for the negative warped space in the x1x2x3 space. Based on these concepts, the 3-dimensional quantized space model is developed for the elementary fermions and bosons [11]. It is surprising that several new particles including three fermionic dark matters exist in terms of the 3-dimensional quantized space model [11].

The fermion with the intrinsic spin of 1/2 is the open warped photon space along the positive or negative direction of the time axis. The boson with the intrinsic spin of 1 is the closed warped photon space along both positive and negative directions of the time axis. And the graviton with the intrinsic spin of 2 is the closed warped photon space along both positive and negative directions of the time axis and the photon with the intrinsic spin of 1 is just the flat space.

3. Space-time evolution and big bang in terms of TQSM

The big bang theory has been developed to show the beginning moment of our matter universe. The 4-D space and time were created at one moment (big bang) in the past as shown in Figs. 8-9. This space and time creation means there was nothing before the big bang. Even the time did not exist before the big bang moment. It seems to me that the god created everything of the space and time at the big bang moment. The CPT symmetry does not exist because there is nothing before the big bang. Because our universe is the matter dominated universe, the CP symmetry problem is unsolved. Also, the time (T) symmetry before and after the big bang cannot be applied to our universe. I think that these CP and T symmetry problems are the serious problems. For the explanation of the geometrical structure of our universe, the 4-D Minkowski space was introduced in the special and general relative theories. Then the introduced time should be varied depending on the relative velocity of two space-time frames. This is called as the relative time of t which corresponds to the relative time of t_l in the present 3-D quantized space model (TQSM). We know in the real life that the massive particles and matters are made of the 3-D space volume at the instant time of t. It means that the instant time of t has the very small-time gap of $c\Delta t_q$ when we observe the 3-D space volume at the time of t. This is the 3-D quantized x1x2x3 space in Fig. 10. The well-known big bang theory assumes that this 3-D quantized space is flowing along the relative time axis of ct_l. In this case the time and space are warped together. There is nothing else except our universe of 3-D quantized space. The well-known big bang theory, special and general relativity theories and standard model are developed based on this single 3-D quantized space on the 4-D Minkowski space.

Therefore, I have thought of the origin of the big bang based on the 4-D Euclidean space rather than the 4-D Minkowski space. Let us think of the 3-D Euclidean quantized space which is overlapped on the 4-D Euclidean quantized space in Figs. 2 and 4. Then the 3-D quantized x1x2x3 space is moving along the 4th dimension axis in the 4-D Euclidean space. The 4th dimension axis is the absolute time axis of ct. This 3-D quantized space is assigned as the x1x2x3 space and the 4-D Euclidean space is assigned as the x0y0z0ct space and time. It is assumed that the 3-D quantized x1x2x3 space is moving along the x4 axis with the constant speed of c because the 3-D quantized x1x2x3 space is the photon space. Then, from $c = \Delta x4/\Delta t$, $x4 = ct$, the x4 axis is the absolute time axis of ct. Under this assumption, the mathematical 4-D Euclidean space is evolved to the physical 3-D quantized space based on the 4-D Euclidean space as shown in Fig. 10. From this physical concept, the 4-D momenta in Fig. 10 is defined for the x1x2x3 space. Then, Note that, in Fig. 9, the 4-D momenta can be expressed as $p_t = m_0 c \frac{x4}{ct}$, $p_x = m_0 c \frac{x}{ct}$ and $p_{tl} = m_0 c \frac{d}{ct}$. The 4th dimension axis is the absolute time axis of ct. Note that the negative time, negative mass (energy) and negative momenta are possible. $E_0 < 0$ and $m_0 < 0$ for $p_t < 0$ in Fig. 9. And the C, P and T symmetry are defined for our universe based on the 4-D Euclidean space. The T symmetry is defined from the absolute time axis of ct not from the relative time of ct_l. The negative time momentum means negative mass and negative energy. Our matter universe with the positive time momentum and anti-matter partner universe with the negative time momentum should be created following the CPT symmetry as shown in Figs. 8 and 9. Therefore, there is only the 4-D Euclidean space before the big bang and there is the 3-D quantized space based on the 4-D Euclidean space after the big bang. Because our universe has the positive time momentum and positive energy (mass) and the partner universe has the negative time momentum and negative energy (mass), these two universes are created from the nothing with the zero time momentum and zero energy (mass). Therefore, in Figs. 8 and 9, the CPT symmetry explains why our universe is the matter universe and where the energy of our universe comes from. Now we have the complete birth history of our universe in terms of the present 3-D quantized space model (TQSM).

Note that the time, t in the Lorentz transformations corresponds to t_l in the present work. In other words, the time axis of ct in the present work is the fourth dimension axis in the 4-dimensional Euclidean space in Figs. 8-10. And the time axis of ct in the Lorentz transformations of the

Minkowski space is the distance axis of ct_l in the present 4-dimensional Euclidean space. Therefore, the direction of the ct_l time axis depends on the corresponding particle velocity of $v = x/t_l$. This means that the observed time of t_l depends on the corresponding velocity of v as shown in the Lorentz transformations of the special relativity. Therefore, the time of t_l is called as the relative time in the present work. The relation between the relative time of t_l and the observed space distance of x is described as a function of v in the Lorentz transformations of the special relativity. But the time axis direction of ct does not depend on the particle velocity. It is just the fourth dimension axis in the 4-dimensional Euclidean space. Therefore, the time of t is called as the absolute time in the present work. It is clear from the definition of the time momentum ($p_t = E_0/c = m_0c$). Then from $c = \Delta x4/\Delta t$, x4 = ct, the x4 axis is the absolute time axis of ct. The photon with the constant speed (c) is the flat space with the zero charge in Fig. 1. It is defined that our x1x2x3 universe is the photon space which moves along the positive x4 axis with the constant speed of c in the 4-dimensional Euclidean space of x0y0z0x4. In this definition, the x4 axis becomes the absolute time axis of ct in the 4-dimensional Euclidean space of x0y0z0x4 in Figs. 8-10. Then, this photon space has the microscopic time width of $c\Delta t_q$ which could be the Planck length size. But the time width of the local photon space can be changed depending on the photon energy. This photon space is called as the x1x2x3 space in Figs. 8-10.

The photon consists of many internal photons. These internal photons form the photon wave of the electromagnetic wave by the interferences. And the x4 axis is the ct time axis. The photon has the constant velocity of $c= \Delta x4/\Delta t$ along the x4 axis. And the internal photons have the constant velocity of $c= \Delta x/\Delta t_l$ along the x axis on the x1x2x3 space. So, the moving distance ($\Delta x = c\Delta t_l$) of the internal photon on the x1x2x3 space is the same to the moving distance ($\Delta x4 = c\Delta t$) of the whole photon space along the ct axis in Fig. 1. This means that the whole photon space can be treated as the rest particle with the velocity of c along the ct axis. This axis is the absolute time axis. Also, each internal photon can be considered as the moving particle on the x1x2x3 space with the velocity of c. This internal photon is the electromagnetic wave which is closely related to the electric and magnetic fields. It is thought that each photon and electromagnetic wave can consist of several internal photons with the less energies. Therefore, the x1x2x3 space corresponding to each photon can be always defined based on the 4-dimensional Euclidean space as shown for our universe. Here our universe is the warped space of the x1x2x3 photon (flat) space.

Therefore, our universe is the x1x2x3 photon space positioned on the mother x0y0z0x4 space. This is the 3-dimensional quantized x1x2x3 space. Everything in the present work is based on the 4-dimension Euclidean space. Then, our universe is moving with the photon velocity of c along the x4 axis which is called as the time axis of ct. Please note that the absolute time lapse is defined as the $\Delta t = \Delta x4/c$. This is the absolute time which is not dependent on the particle velocity. The relative time of t_l is dependent on the particle velocity as shown in the special relativity theory. The time of t in the special relativity theory corresponds to the relative time of t_l in the present work. The relative time of t_l is defined as $\Delta t_l = \Delta l/c = \Delta x/v$. Our universe can be locally warped to create the particles in Figs. 2, 4 and 10. Then the rest mass energy and electric charge (EC) are introduced as the warped space of our x1x2x3 universe. The 3-dimensional quantized space is the photon space. The particle is the warped space with the velocity (v) slower than the photon velocity of c. Then the rest mass of the particle is defined as the 4-dimensional volume of the warped space. Under this definition of the particle mass, it is proposed that the electric charge is positive for the positively warped space and negative for the negatively warped space in the x1x2x3 space. Because other lepton charges (LC) and color charges (CC) exist in the real world, we need two

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more 3-D quantized spaces of the x4x5x6 and x7x8x9 spaces [11]. The x4x5x6 and x7x8x9 spaces are for the LC and CC charges, respectively. The present work including only the EC x1x2x3 space

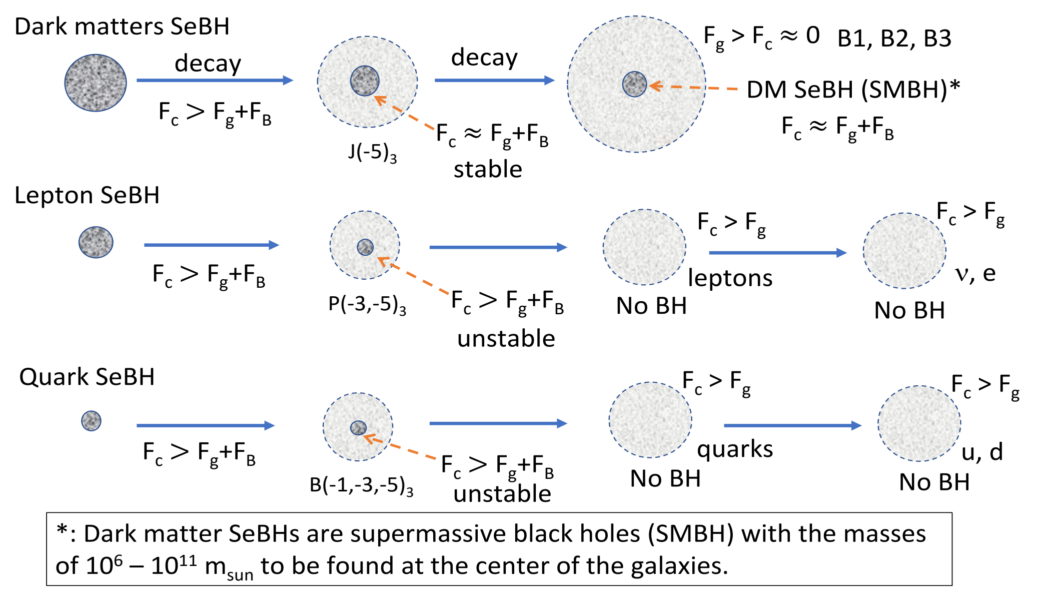

Fig. 11. Dark matter, lepton and quark secondary black holes decay to the dark matters, leptons and quarks.

for simplicity can be easily extended to the research including all three spaces of the x1x2x3 space, LC x4x5x6 space and CC x7x8x9 space. In the extended case, the charge (q) of (EC) can be, easily, replaced with the charges (q) of (EC,LC) and (EC, LC, CC).

4. Decay of the charged black holes and origin of the galaxy formation

In Figs. 6, 7 and 11, the secondary black holes decay to the smaller black holes and emit the particles because of the huge Coulomb force of $F_c > F_g + F_B$. The lepton black holes and quark black holes have the Coulomb forces that are still greater than the sum of the gravitational force and boson force. The remaining lepton black holes and quark black holes decay to the leptons and quarks. The emitted quarks become the hadrons from the quark confinement. However, dark matter black holes have the much weaker Coulomb forces than the Coulomb forces of the lepton black holes and quark black holes under the same conditions. Because of the weaker Coulomb forces for the dark matters, the dark matter black hole becomes stable at the moment when the Coulomb force is equal to the sum of the gravitational force and boson force. The emitted dark matters are located around the stable dark matter black hole. Also, the electrons and hadrons are located around the stable dark matter black hole by the gravitational force. The stable dark matter black hole, dark matters and normal matters (electrons and hadrons) forms the galaxy. This stable dark matter can be called as the super-massive black hole at the center of the galaxy.

In Fig. 12, the elementary fermions are created from the decays of the 3-D particles of J(-5)3, P(-3,-5)3 and B(-1,-3,-5). The 3 dark matters of B1, B2 and B3 in Fig. 2 are created from the decay of the 3-D $J(-5)_3$ dark matter particle. The 9 leptons in Fig. 2 are created from the decay of the 3-D $P(-3,-5)_3$ lepton particle. And the 27 quarks in Fig. 2 are created from the decay of the 3-D $B(-1,-3,-5)_3$ quark particle. The 27 quarks make the baryons by the balanced color charges of -2/3 (red), -5/3(green) and -8/3(blue) that are merged to the 3-D color charge of $(CC=-5)_3$. For example,

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the proton can be described as the charge configuration of (1,0,-5) = (1,0)(-5)3. The more details are shown in Figs. 13 and 14 from the big bang to the galaxy.

Now I will discuss about the origin of the galaxy shape in Fig. 15. The structure of the galaxy with the dark matter super-massive black hole, dark natters and normal matters (electrons and hadrons) are shown in Figs. 11-14. Four kinds of the galaxies have ben discovered. There are spiral galaxies with the four arms, barred spiral galaxies with two arms, elliptical galaxies and irregular galaxies in Fig. 15. Because the normal matters have the spiral arms, the normal matters rotates around the dark matter super-massive black hole. And the dark matters are distributed around the dark matters, The dark matters do not rotate and have the spherical shape around the dark matter super-massive black hole in Fig. 15. The spherical distribution of the dark matters can give the observed rotational velocity curve of the normal matters. First, the lepton and quark primary black holes have the three-dimensional shapes. Also, the lepton and quark secondary black holes have the three-dimensional shapes. The 3-D lepton and quark black holes decay to the three 1-D black holes in Fig. 15. The rotational plane is assumed as the x1-x2 plane. The rotational axis is the x3 axis. Two 1-D black holes along the x1 and x2 axes make the observed four shapes of galaxies. Two 1-D black holes elongated along the x1 and x2 axes make the four bars of the emitted normal matters on the rotational plane by the attractive gravitational force connected to the dark matters

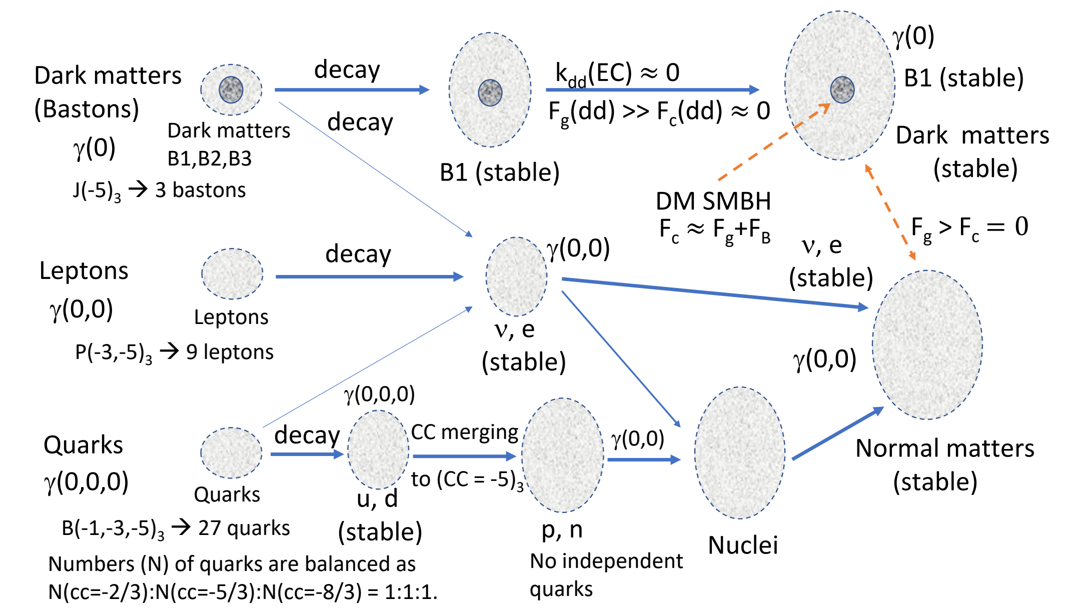

Fig. 12. How the dark matters and normal matters are created is shown.

and dark matter super-massive black hole. The four bars of the emitted normal matters becomes the four arms of the galaxies. The barred spiral galaxies are made when one 1-D black hole builds

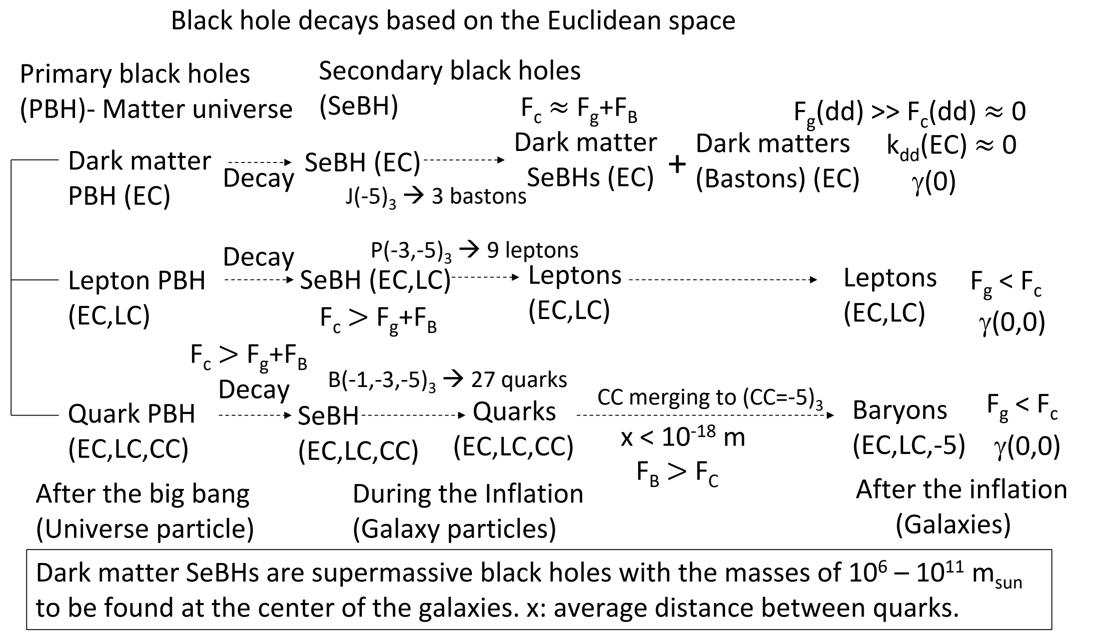

Fig. 13. How the primary black holes decay to the dark matters, leptons and baryons is explained.

the two arms of the normal matters, and another 1-D black hole forms the undeveloped bar of the normal matters on the rotational plane. The elliptical galaxies are made when two 1-D black holes

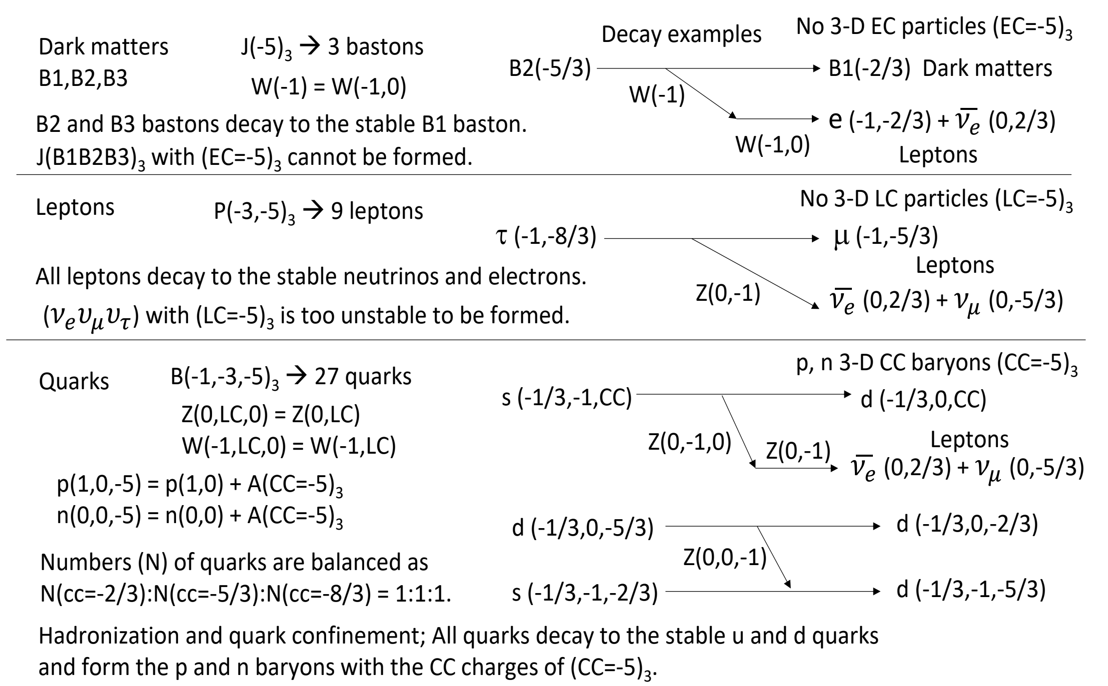

Fig. 14. The decay schemes of the dark matters, leptons and quarks are shown.

are not developed to the arms of the normal matters and remain as the undeveloped bar shapes of the normal matters. These two bar-shaped normal matters are merged to form the elliptical shape.

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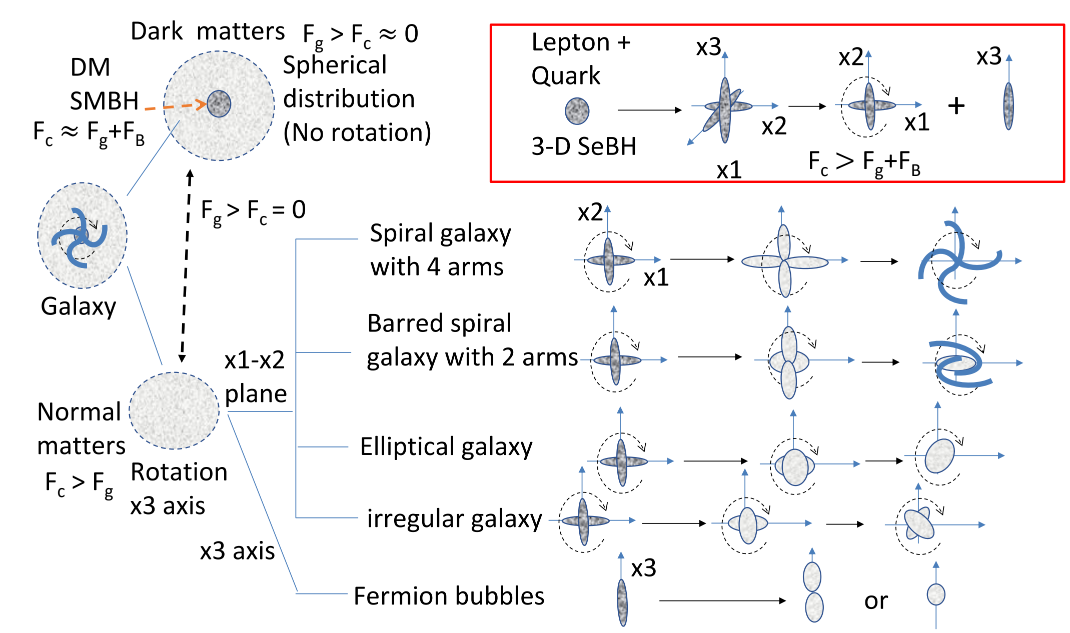

Fig. 15. How the galaxies are formed is explained for the four kinds of galaxies.

The irregular galaxies have the irregular distribution of the normal matters different from other three shapes of the galaxies in Fig. 15. Some galaxies like the Milky way galaxy have the fermion

$k_{nn}(CC) = k_{dd}(EC) \approx 0$, The black hole has the huge charge (q).

$F_c(CC)_{nn}$ Neutron (Quark) BH – Merging

q(0,0,CC)	Merging n number (N)	Mass (m_{BH}) Unit: m_{sun}
White dwarf		< 1
NS	1	1 - 3
SBH	2	5 - 15
SBH	3	32 – 96
IMBH	4	352 - 1056
IMBH	5	0.72 – 2.15 10^4
IMBH	6	2.79 - 8.36 10^5

CC; $F_c \approx F_g+F_B$; $F_c > F_g+F_B$

BH mass gap: 3 – 5 m_{sun}
BH mass gap (Intermediate mass BH): $10^2 – 10^5$ m_{sun},
$J(B1B2B3)_3$ decays to B1+B2+B3 forming the dark matter cloud (DMC).
$m(NJ) = m(J)\, 2^{N(N-1)/2}$,
$m_{BH} = 2.08 – 6.23\ 10^6\ 2^{N(N-1)/2}\ m_{sun}$

Dark matter (Baston) BH – Decaying $F_c(EC)_{dd}$

q(EC)	Merging J particle number (N)	Mass (m_{BH}) Unit: m_{sun}
DMC		< 10^6
SMBH	1	2.08 - 6.23 10^6
	2	4.15 – 12.5 10^6
(Observed)	3	1.66 – 4.98 10^7
	4	1.33 – 3.98 10^8
	5	2.12 - 6.37 10^9
SMBH	6	0.68 – 2.04 10^{11}
Galaxy SeBH	7	0.44 – 1.31 10^{13}
Galaxy SeBH	8	0.56 – 1.67 10^{15}
(Inflation)	9	1.43 – 4.28 10^{17}
	10	0.73 – 2.19 10^{20}
Universe PBH	15	0.84 – 2.53 10^{38}
(Big bang)	16	2.76 – 8.27 10^{42}

EC; $F_c \approx F_g+F_B$; $F_c > F_g+F_B$; $F_c \gg F_g+F_B$

Fig. 16. Dark matter super-massive black holes and stellar mass black holes are compared.

bubbles along the rotational x3 axis. The fermion bubbles are explained by the development of the 1-D black hole along the rotational axis to the two bubbles of the normal matters. I think that the 1-D black hole along the rotational axis can be developed to the dense normal matters located at the center of the galaxy. Or the two fermion bubbles and dense normal matter can coexist. Or the two fermion bubbles and dense normal matters can make the oscillations. In this oscillation, the

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two fermion bubbles can be observed as the particle jets and cosmic ray emissions along the rotational x3 axis. The gravitational forces between the normal matters and dark matters (including the dark matter super-massive black hole) are one of the major contributions to build the galaxies.

The neutron and J particle have the same properties to form the black holes.

n_{3q} = n(udd) = n(0,0,-5) = n(0,0) A(CC=-5)$_3$

m(n) = 939.6 MeV/c^2,

m_{NS} = 1-3 m_{sun} m_{sun} = 1.115 10^{66} eV/c^2

k_{qq}(CC) ≈ 0 F_c ≈ 0 F_g : Very large

SBH: Stellar mass BH
IMBH: Intermediate mass BH
SMBH: Super-massive BH
SeBH: Secondary BH
PBH: Primary BH

SBH has the very large CC charge from the merging of neutrons.

J_{3B} = J(B1B2B3)$_3$ = J(EC=-5)$_3$

m(J) = 1.95 10^{15} eV/c^2 = 2.075 10^6 m(n),

m_{SMBH} = 2.075 – 6.225 10^6 m_{sun}

k_{dd}(EC) ≈ 0 F_c ≈ 0 F_g : Very large

Bastons (DM) mass: eV/c^2

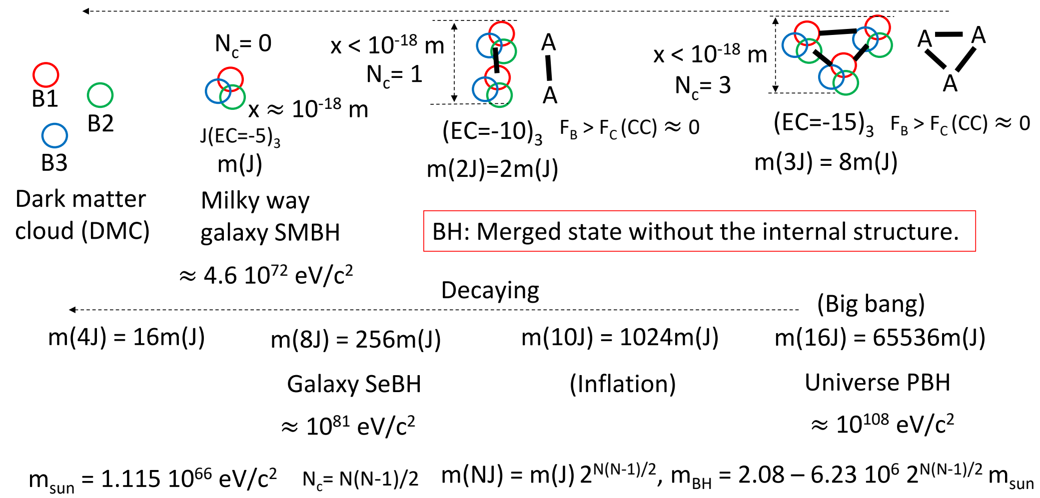
	B1	B2	B3
m_{EC}	26.1	4.27 10^{10}	1.95 10^{15}
EC	-2/3	-5/3	-8/3

Calculation(TQSM): m_{EC}

SMBH has the very large EC charge from the merging of J particles.

P(EC=-3,LC=-5)$_3$ for leptons and B(EC=-1,LC=-3,CC=-5)$_3$ for quarks form the fast-decaying BHs because of the strong Coulomb forces since the big bang.

Fig. 17. The dark matter black holes and stellar mass black holes are compared.



P(EC=-3,LC=-5)$_3$ for leptons and B(EC=-1,LC=-3,CC=-5)$_3$ for quarks forms the fast-decaying BHs because of the strong Coulomb forces unlike J(EC=-5) for bastons since the big bang.

Fig. 18. The universe evolution is explained by using the decaying processes of the dark matter black holes since the big bang.

In Figs. 16-18, the masses of the stellar mass black holes and super-massive black holes are calculated as the function of merging particle number (N). The more details can be found in ref. [48]. There are two kinds of black holes. One is the neutron black hole which are the stellar mass black hole. These stellar mass black holes are made by the merging of the neutrons from the supernova explosion. Other black holes are the dark matters super-massive black holes. The dark

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matter super-massive black holes are developed from the primary black hole created at the big bang. The neutron and dark matters have the similarity in Figs. 6 and 16-18. The neutron has the zero EC and zero LC charges. The neutron has the 3-D CC charge of $(CC=-5)_3$. The Coulomb force between neutrons is nearly zero. In other words, k_{nn}(CC) is nearly zero in Figs. 2, 6 and 16-18. The stellar mass black holes made with the merged neutrons have the huge CC charges. Because of these huge CC charges, the stable neutron black holes become the stable stellar mass black holes in Figs. 6 and 16-18. Another one is the dark matter black hole which are the super-massive black hole. These super-massive black holes are made by the merging of the 3-D dark matter $(J(-5)_3)$ particles. The dark matter super-massive black holes are developed from the primary black hole created at the big bang. The $J(-5)_3$ dark matter has the zero LC and zero CC charges. This dark matter has the 3-D EC charge of $(EC=-5)_3$. The Coulomb force between dark matters is nearly zero. In other words, k_{dd}(EC) is nearly zero in Figs. 2, 6 and 16-18. The dark matter super-massive black holes made with the merged dark matters have the huge EC charges. Because of these huge EC charges, the stable dark matter super-massive black holes become the stable dark matter super-massive black holes in Figs. 6, 15 and 16-18.

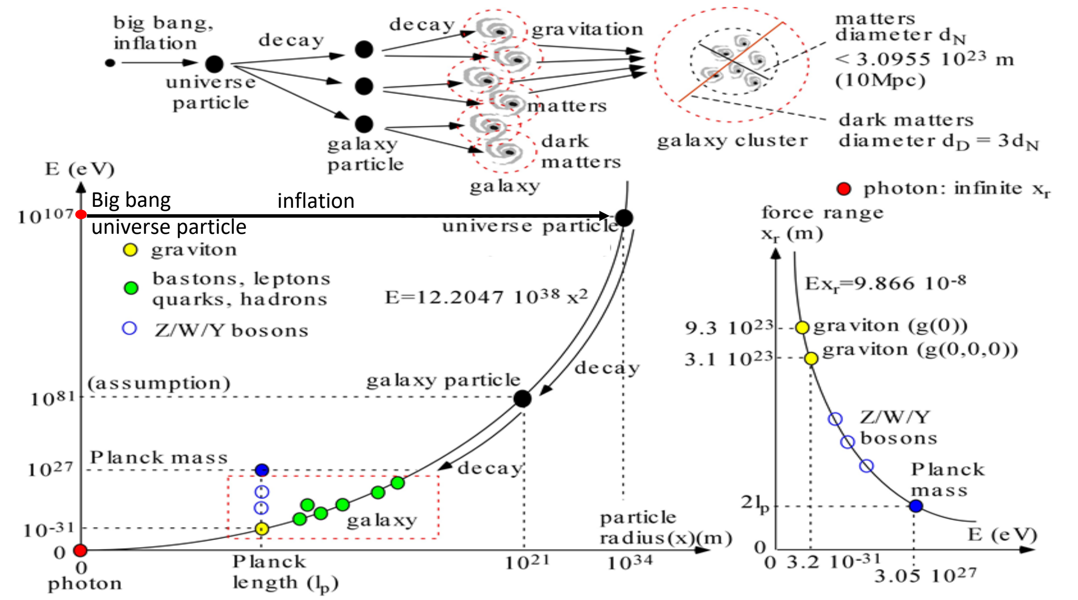

Fig. 19. The universe evolution from the big bang to the galaxies is explained.

5. Calculated elementary particle masses, Gravitational forces, and boson forces

In this section, gravitational interactions and boson interactions are discussed. These two forces are dependent on the masses in Figs. 20-24. The dark matters in Fig. 2 have only the EC charges. The related masses are expressed as the m_{EC} masses in Fig. 20 [45]. The leptons have the EC and LC charges in Fig. 2. This indicates that the masses of the leptons can be separated as the m_{EC} and m_{LC} masses in Fig. 20 [45]. This means that the neutrinos have the non-zero masses of m_{LC}. The charged leptons have the non-zero masses of m_{EC} and m_{LC}. The quarks, baryons and mesons have the EC, LC and CC charges. This indicates that the masses of quarks, baryons and mesons are separated as the m_{EC}, m_{LC} and m_{CC} masses [45]. Partial masses of all elementary fermions are calculated in Ref. [45].

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$E = c\Delta t\Delta V = |q|\Delta V = mc^2$

For the elementary fermion with the charge (q) configuration of (EC,LC,CC),

$E = mc^2 = (|EC| + |LC| + |CC|)\Delta V = (m_{EC} + m_{LC} + m_{CC})\, c^2$

$s = ½ = s(m_{EC}) + s(m_{LC}) + s(m_{CC}) \propto m\omega$

$|EC| : |LC| : |CC| = m_{EC} : m_{LC} : m_{CC} = s(m_{EC}) : s(m_{LC}) : s(m_{CC})$

If the rest mass (m) of the elementary fermion is given, partial masses and partial spins can be calculated by using the charge(q) configuration of (EC,LC,CC). The calculated tables are shown for all elementary fermions of the 3 dark matters (3 bastons), 9 leptons and 27 quarks in the present work. Note that the volume (ΔV) and angular velocity (ω) are the same for m, m_{EC}, m_{LC} and m_{CC}. Then the partial spin is proportional to the partial mass.

Fig. 20. The masses, spins and charges are closely related to each other. By using these relations, the partial masses used in the gravitational forces and boson forces in Figs. 22-24 can be calculated. The partial masses are tabulated in Ref. [45]. See Figs. 26-30.

In Fig. 20, the partial spins and partial masses are closely related to the EC, LC and CC charges of the elementary fermions. In Fig. 21, the partial masses of the proton are calculated by using the

$p(1,0,-5) = p(1,0) + A(CC=-5)_3$ $m(u) = 2.2$ MeV/c^2, $m(d) = 4.7$ MeV/c^2,

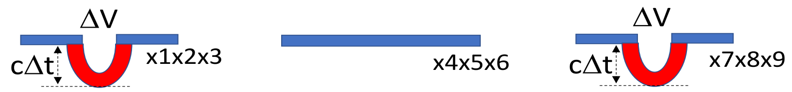
m_p m_{EC} m_A $s(p(1,0)) = 0.33$ (6): proton spin puzzle

$m_p = m_{EC} + m_A = 938.27$ MeV/c^2 CC=-5 merging energy (m_A) : 934.47 MeV /c^2

$m_A = 934.47$ MeV/c^2 $m_{EC} = 2m(u(m_{EC})) + m(d(m_{EC})) = 3.8$ MeV/c^2 $m_{LC} = 0$

$|q| = c\Delta t = c\Delta t\Delta V/\Delta V = |E|/\Delta V = |\rho_E|$ $E = c\Delta t\Delta V = mc^2$

d quark



EC= $c\Delta t$ = -1/3 LC = 0 CC = $c\Delta t$ = -2/3, -5/3 or -8/3

$m(d) = m_{EC} + m_{CC}$ m_{EC} $m_{LC} = 0$ m_{CC}

$s(d) = ½ = s(m_{EC}) + s(m_{CC})$ $s(m_{EC})$ $s(m_{LC}) = 0$ $s(m_{CC})$

Constant ΔV is assumed for each quark. Spin is proportional to the mass and charge for each quark. Note that p(1,0) is the lepton-like particle.

Fig. 21. The partial masses of the proton and neutron can be calculated [45].

partial masses of the u and d quarks [45]. Then the CC partial mass (m_A(CC)) of the proton is 934.47 MeV/c^2 [45]. The m_{EC} and m_{LC} partial masses of the proton are 3.8 MeV/c^2 and zero, respectively [45]. Therefore, the gravitational interactions between the normal matters come mostly from the m_A(CC) partial masses of the protons and neutrons. The observed Newton gravitational constant is nearly the same to the gravitational constant of the m_A(CC) masses. The

A parts of the baryons are the 3-D color charge states (so called as the hadronization) in Fig. 4. If the graviton related to the gravitational interactions of the normal matters has the mass of m_g, the 1-D particles of the elementary fermions in Fig. 2 will have the graviton mass of $m_g/3$. Because the gravitational constant is proportional to the graviton mass, if the gravitational constants of the normal matters are the Newton gravitational constant of G_N, the gravitational constant of the 1-D particles of the elementary fermions in Fig. 2 is $G_N/3$. Because of the communications between the dark matters, leptons and quarks, the gravitational constants of all interactions between elementary fermions in Fig. are the same to $G_N/3$ in Fig. 22. In Fig. 3, the Coulomb interactions between the normal matters are much stronger than the negligible Coulomb interactions between the dark matters because of the non-communications between normal matters and dark matters. Of course, the non-communications between the normal matters and dark matters mean the zero Coulomb

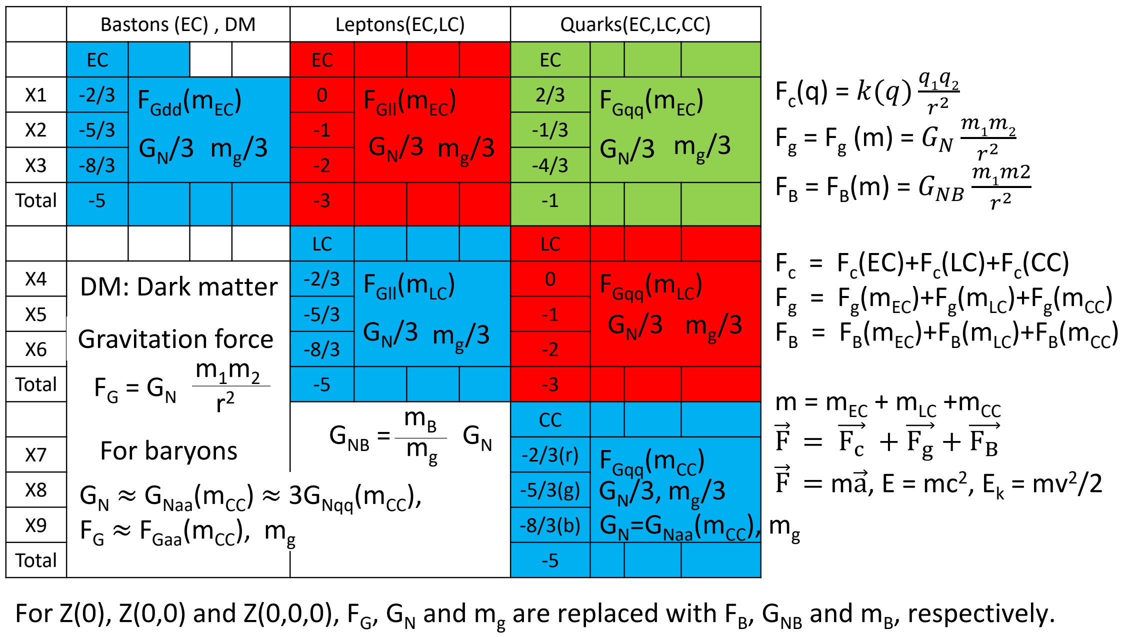


Fig. 22. The Gravitational forces and Z bosons are compared. The masses of the normal matters (p and n) come mostly from $m_A = m_{cc}$ in Fig. 4 [45]. The present table is modified from the gravitational force table (Fig. 4) in Ref. [45].

interactions between the dark matters and normal matters. The gravitational interactions between the elementary fermions are relatively much weaker than the Coulomb interactions between the elementary fermions under the similar conditions. The relatively much weaker gravitational interactions compared with the Coulomb interactions for the normal matters are caused by the communication of the gravitational interactions and non-communication of the Coulomb interactions. Also, the relatively weaker Coulomb interactions compared with the gravitational interactions for the dark matters are caused by the communication of the gravitational interactions and non-communication of the Coulomb interactions, too. In Fig. 23, the gravitational forces and Coulomb forces are compared for several cases.

 doi:10.20944/preprints202109.0467.v1

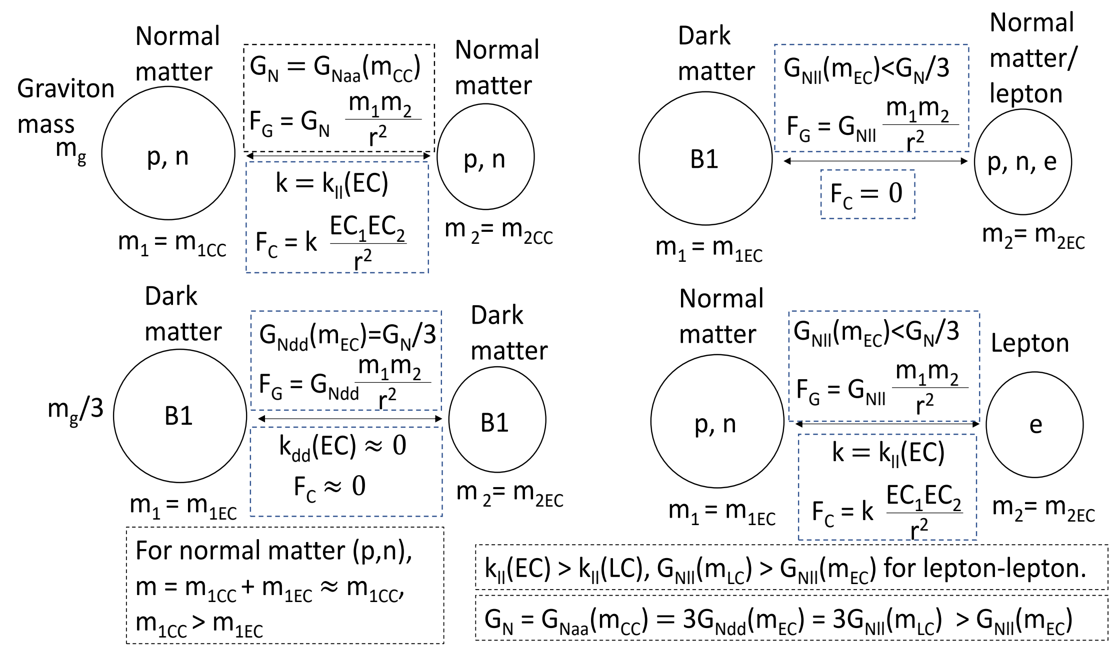


Fig. 23. The Gravitational forces and Coulomb forces are compared. The masses of the normal matters (p and n) come mostly from $m_A = m_{cc}$ in Fig. 4. The mass of $m_A = m_{cc}$ has the 3-D space volume completed by the three color charges (r, g, b) for the baryons like p and n in Fig. 4. The dark matters of B1, B2 and B3 in Fig. 2 occupy the 1-D space volumes. The graviton mass and gravitational constant related to the 3-D m_A mass are three times larger than the graviton mass and gravitational constant of the 1-D dark matter mass. The graviton mass and gravitational constant related to the normal matters are the graviton mass and gravitational constant related to the 3-D m_A mass. The present figure is modified from Fig. 1 in Ref. [45].

In Fig. 24, the boson forces are given. The elementary bosons are tabulated in Fig. 25 [11]. The boson interactions are charge independent and mass dependent. The measured Z, W^-, W^+ boson masses in the high energy experiments are the Z(0,0), W(-1,0) and W(1,0) masses in the present work. The dark matters, leptons and quarks have the communication of the bosons interactions by the Z(0), Z(0,0) and Z(0,0,0) bosons which can be treated like the g(0), g(0,0) and g(0,0,0) gravitons. But in general, the bosons forces in Fig. 24 depend on the different boson masses in Fig. 25. This means that the boson force constants (G_{NB}) depend on the boson masses from the equation of $G_{NB}(m_1)/G_{NB}(m_2) = m_1/m_2$.

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	Bastons (EC) , DM		Leptons(EC,LC)		Quarks(EC,LC,CC)	
	EC		EC		EC	
X1	-2/3	$F_{Bdd}(m_{EC})$ $G_{NBdd}(m_{EC})$	0	$F_{Bll}(m_{EC})$ $G_{NBll}(m_{EC})$	2/3	$F_{Bqq}(m_{EC})$ $G_{NBqq}(m_{EC})$
X2	-5/3		-1		-1/3	
X3	-8/3		-2		-4/3	
Total	-5		-3		-1	
			LC		LC	
X4			-2/3	$F_{Bll}(m_{LC})$ $G_{NBll}(m_{LC})$	0	$F_{Bqq}(m_{LC})$ $G_{NBqq}(m_{LC})$
X5			-5/3		-1	
X6			-8/3		-2	
Total			-5		-3	
					CC	
X7					-2/3(r)	$F_{Bqq}(m_{CC})$ $G_{NBqq}(m_{CC})$ $G_{NBaa}(m_{CC})$
X8					-5/3(g)	
X9					-8/3(b)	
Total					-5	

Boson force

$$G_{NB} = \frac{m_B}{m_g} G_N$$

$$F_B = G_{NB} \frac{m_1 m_2}{r^2}$$

at $r < 10^{-18}$ m

$G_{NBll}(m_{LC}) > G_{NBll}(m_{EC})$ $F_B > F_C$ (EC)

$G_{NBqq}(m_{CC}) > G_{NBqq}(m_{LC}) > G_{NBqq}(m_{EC})$

$G_{NBaa}(m_{CC}) = G_{NBll}(m_{LC}) = G_{NBdd}(m_{EC})$

$G_{NBqq}(m_{LC}) = G_{NBll}(m_{EC}) > G_{NBqq}(m_{EC})$

$F_B \approx F_{Baa}(m_{CC}), G_{NB} \approx G_{NBaa}(m_{CC}) \approx G_{NBqq}(m_{CC})$ for baryons

Asymptotic freedom (AF):
F_C (EC) > F_B=0 (Free quarks)
at 10^{-18} m < $x_{EC} \lesssim 10^{-15}$ m

Mesons(EC,LC)
with A(CC=0):
Color charge (CC) merging energy (m_A) of a quark and anti-quark is 132.8 MeV for a π^0 meson.

Baryons(EC,LC)
with $A(CC=-5)_3$:
Color charge (CC) merging energy (m_A) of three quarks is 935.3 MeV for a neutron.

$G_{NB}(m_1)/G_{NB}(m_2) = m_1/m_2$.

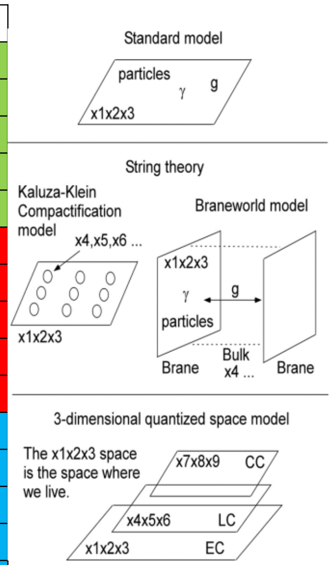
Fig. 24. The boson forces are compared. The masses of the normal matters (p and n) come mostly from $m_A = m_{cc}$ in Fig. 4 [45]. The present table is not modified from the boson force table (Fig. 3) in Ref. [45].

	Dark matter force		Weak force (EC,LC)				Strong force (EC,LC,CC)			
	EC		EC				EC			
X1	0	Z(0)	0	Z(0,0)	Z(0,–1)	Z(0,–2)	0	Z(0,0)	Z(0,–1)	Z(0,–2)
X2	-1	W(-1)	-1	W(-1,0)	W(-1,-1)	W(-1,-2)	-1	W(-1,0)	W(-1,-1)	W(-1,-2)
X3	-2	Y(-2)	-2	Y(-2,0)	Y(-2,-1)	Y(-2,-2)	-2	Y(-2,0)	Y(-2,-1)	Y(-2,-2)
Total	-3		-3				-3			
			LC				LC			
X4			0	Z(0,0)	W(–1,0)	Y(–2,0)	0	Z(0,0)	W(–1,0)	Y(–2,0)
X5			-1	Z(0,-1)	W(-1,-1)	Y(-1,-1)	-1	Z(0,-1)	W(-1,-1)	Y(-1,-1)
X6			-2	Z(0,-2)	W(-1,-2)	Y(-2,-2)	-2	Z(0,-2)	W(-1,-2)	Y(-2,-2)
Total			-3				-3			
							CC			
X7							0			
X8							-1			
X9							-2			
Total							-3			

Each flavor (charge) corresponds to each dimensional axis.

Z, W⁻, gluons (SM) → Z(0,LC),W(-1,LC), Z(0,0,CC) (ESM)

Z/W/Y(EC,LC,0) ⟷ Z/W/Y(EC,LC)
Z/W/Y(EC,0) ⟷ Z/W/Y(EC)



Z/W/Y(-1,0)CC(-2) = Z/W/Y(-1,0,-2)

Fig. 25. The elementary bosons are shown [11]. The elementary fermions are tabulated in Fig. 2.

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6. Partial mass calculations of elementary fermions and proton spin crisis

The elementary particles have the intrinsic spin. The elementary particles have the spin of ½ and the elementary bosons have the spin of 1. The spin value is the very fundamental physical constant that does not charge. Then one experiment raised the question of this fundamental spin value of

u quark	mass: MeV/c²		
EC	2/3	2/3	2/3
CC	-2/3	-5/3	-8/3
m_{EC}	1.1	1.1	1.1
m_{CC}	1.1	2.8	4.4
m(u)	2.2	3.9	5.5
$s(m_{EC})$	1/4	2/14	1/10
$s(m_{CC})$	1/4	5/14	4/10
s(u)	1/2	1/2	1/2

LC=0

d quark	mass: MeV/c²		
EC	-1/3	-1/3	-1/3
CC	-2/3	-5/3	-8/3
m_{EC}	1.6	1.6	1.6
m_{CC}	3.1	8.0	12.8
m(d)	4.7	9.6	14.4
$s(m_{EC})$	1/6	1/12	1/18
$s(m_{CC})$	2/6	5/12	8/18
s(d)	1/2	1/2	1/2

LC=0

Proton	Spin	$s(m_{EC})$
u(2/3,0,-2/3)	↑	+1/4
u(2/3,0,-5/3)	↓	-2/14
d(-1/3,0,-8/3)	↑	+1/18
s(p(1,0))		0.163
s(p(1,0,-5))		1/2
a_0		0.326

$m(A(CC=-5)_3) = 1.1 + 2.8 + 12.8 + m(E_{mer}) = 934.47$

$m(E_{mer}) = 917.77$ MeV/c²

$m(A(CC=-5)_3) = m_A = m_{cc} + m(E_{mer})$

E_{mer}: Merging energy

Calculation(QCD): m(u) = 2.2 MeV/c², m(d) = 4.7 MeV/c²,

Observation: s(p(1,0)) = s(p(1,0,-5))*0.33 = 0.165

$m_p = m(p(1,0)) + m(A(CC=-5)_3) = 938.27$ MeV/c²

$m(p(1,0)) = 2m(u(m_{EC})) + m(d(m_{EC})) = 3.8$ MeV/c²,

$s(p(1,0)) = a_0\, s(p(1,0,-5)) = a_0/2$, $a_0 = 0.33 \pm 0.06$ (HERMES), 0.26 - 0.36 (COMPASS)

Fig. 26. Proton spin is calculated. The proton spin crisis is explained.

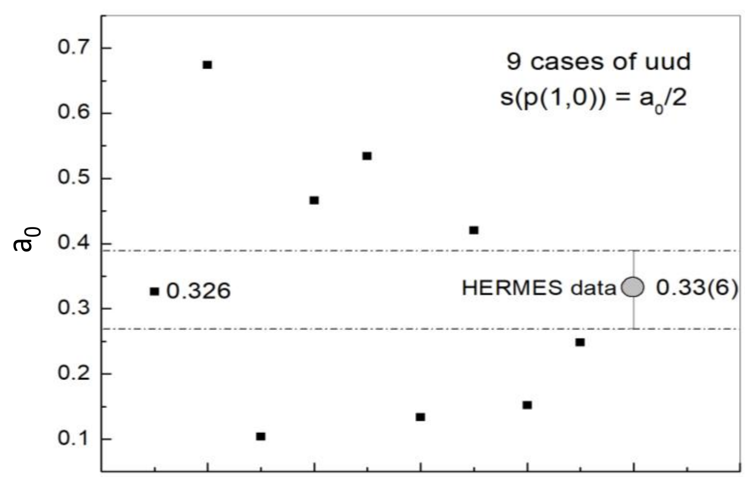

Fig. 27. Calculated proton spins are compared with the experimental proton spin. Proton spin crisis is explained.

the proton. The European muon collaboration (EMC) performed the deep inelastic scattering by muon to search for the spin effect from the inside quarks. The observe spin from the quarks was nearly zero. And then the following experiments like HERMES and COMPASS [52] reports the quark effect of only 33(6) % and 26 – 36 % to the spin (1/2)of the proton. The missing spin of the proton is about 67 % which requires other explanations like the gluon effect or quark orbital angular momentum effect in terms of the quantum chromodynamics (QCD). But still the origin of the proton spin requires more studies experimentally and theoretically.

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The proton spin of the proton is connected to the quark confinement that means the CC charge merging to $A(CC=-5)_3$ state. The proton of p(1,0,-5) has two parts of p(1,0) and $A(CC=-5)_3$ in Fig. 20 and 21 [51]. The CC charge space correspond to the CC=-5 state of $A(CC=-5)_3$ and EC charge space corresponds to the p(1,0) state with only the EC charge. A proton has the lepton charge of LC=0. In the inelastic scattering by the lepton like muon and electron, the lepton has the Coulomb and weak interactions with the proton on the EC charge space. This indicates that the lepton interacts with the quarks in p(1,0) on the EC charge space. The observed spin should be the spin of the three quarks in p(1,0) but not in p(1,0,-5). The CC charge part of $A(CC=-5)_3$ should be excluded because the CC charge part of $A(CC=-5)_3$ does not interact with the leptons like muon and electron with the EC and LC charges. The p(1,0) and $A(CC=-5)_3$ states have the different masses and different spins. The spins of p(1,0) and $A(CC=-5)_3$ depend on the spin contribution of three quarks.

Now one condition is assumed to calculate the proton spin. The assumption is that the intrinsic spin values of m_{EC}, m_{LC} and m_{CC} for each fermion are proportional to the charge values of EC, LC and CC for each fermion in Figs. 20 and 21 [51]. Note that p(1,0) is the lepton -like particle with the charge configuration of (EC=1,LC=0). Based on this assumption, the spins of p(1,0) and $A(CC=-5)_3$ are calculated from the spins of the three quarks. First of all, the spins of u and d quarks are calculated in Fig. 26. The intrinsic spin of ½ in the u and d quarks are separated to the spin ($s(m_{EC})$) of the CC charge mass and spin ($s(m_{CC})$) of the EC charge mass. From the condition that the intrinsic spin values of m_{EC}, m_{LC} and m_{CC} for each fermion are proportional to the charge values of EC, LC and CC for each fermion, the spin tables of the u and d quarks are completed in Fig. 26. The 9 groups of three uud quarks are obtained under the condition of CC=-5. Total 9 cases gives total 9 spins of p(1,0) as shown in Fig. 27. Only one case corresponds to the the experimental value of HERMES that is the quark effect of only 33(6) % and 26 – 36 % to the spin (1/2) of the proton. Three quarks are u(2/3,0,-2/3) with the up-spin of 1/4, u(2/3,0,-5/3) with the down-spin of -2/14 and d(-1/3,0,-8/3) with up-spin of 1/18. These quarks gibe the p(1,0) spin of 0.163 which corresponds to 32.6% of the total p(1,0,-5) spin of ½. This calculated value of 32.6 % consists with the experimental value of 33(6) %. The $A(CC=-5)_3$ state has the 67.4 % of the proton spin.

The quark mass cannot be obtained experimentally. Therefore, the quark mass has been calculated in terms of QCD. This calculated quark mass corresponds to the total mass of each quark. This mass cannot be seriously considered because it could depend on the applied model. But in the table of Fig. 26, the QCD mass is applied to calculate the EC mass and CC mass of each quark. When the EC mass and CC mass of u and d quarks are calculated, the condition that the mass values of m_{EC}, m_{LC} and m_{CC} for each fermion are proportional to the charge values of EC, LC and CC for each fermion is used. Then the mass of $A(CC=-5)_3$ is obtained for the proton. And the CC=-5 merging energy (917.17 MeV) of Emer is calculated for the proton. $A(CC=-5)_3$ takes 934.47 MeV/c^2 from the proton mass of 938.27 MeV/c^2. The total m_{EC} mass of three quarks is only 3.8 MeV/c^2. Therefore, the $A(CC=-5)_3$ state has the 99.6 % of the proton mass (938.27 MeV/c^2). For the neutron of n(udd), n(0,0,-5) = n(0,0) + $A(CC=-5)_3$. $A(CC=-5)_3$ takes 935.3 MeV/c^2 from the neutron mass of 939.6 MeV/c^2. The total m_{EC} mass of three quarks is only 4.3 MeV/c^2. Therefore, the $A(CC=-5)_3$ state has the 99.5 % of the neutron mass (939.6 MeV/c^2). The EC and CC masses of the leptons and the spins of the EC charge masses and LC charge masses are calculated in Fig. 28. The masses of the leptons are obtained experimentally. By using the experimental masses of the leptons like e, muon and tau, the EC mass and LC mass are calculated, and the spin of the EC

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mass and spin of the LC mass are calculated in Fig. 28. The neutrino masses (m_{LC}) are not zero because the lepton charges (LC) are not zero.

Leptons (l) mass: MeV/c²

	ν_e	ν_μ	ν_τ
EC	0	0	0
LC	-2/3	-5/3	-8/3
m_{EC}	0	0	0
m_{LC}	$m(\nu_e)$	$m(\nu_\mu)$	$m(\nu_\tau)$
m(l)	$m(\nu_e)$	$m(\nu_\mu)$	$m(\nu_\tau)$
$s(m_{EC})$	0	0	0
$s(m_{LC})$	1/2	1/2	1/2
s(l)	1/2	1/2	1/2

Leptons (l) mass: MeV/c²

	e	μ	τ
EC	-1	-1	-1
LC	-2/3	-5/3	-8/3
m_{EC}	0.307	39.62	484.6
m_{LC}	0.204	66.04	1292.2
m(l)	0.511	105.66	1776.8
$s(m_{EC})$	3/10	3/16	3/22
$s(m_{LC})$	2/10	5/16	8/22
s(l)	1/2	1/2	1/2

From the lepton (e(-1,-2/3)/μ(-1,-5/3)) - p(1,0) deep inelastic scattering, spins ($s(m_{EC})$) of the u and d quarks are determined. Total spins (s = ½) of the u and d quarks should include the CC charge effect of $A(CC=-5)_3$. Note that p(1,0) is the lepton-like particle. The neutrino masses (m_{LC}) are not zero because the lepton charges (LC) are not zero.

Fig. 28. Lepton spins are calculated for the EC and LC charge masses.

The quark masses are dependent on the CC charges. The quark masses could be indirectly extracted from the meson masses and baryon masses [12]. As shown in Fig. 26, the u quark has three different masses corresponding to three different CC charges. In other words, u(2/3,0,-2/3),

c quark mass: MeV/c²

EC	2/3	2/3	2/3
LC	-1	-1	-1
CC	-2/3	-5/3	-8/3
m_{EC}	366	366	366
m_{LC}	549	549	549
m_{CC}	366	915	1464
m(c)	1280	1830	2379
$s(m_{EC})$	2/14	2/20	2/26
$s(m_{LC})$	3/14	3/20	3/26
$s(m_{CC})$	2/14	5/20	8/26
s(c)	1/2	1/2	1/2

s quark mass: MeV/c²

EC	-1/3	-1/3	-1/3
LC	-1	-1	-1
CC	-2/3	-5/3	-8/3
m_{EC}	16	16	16
m_{LC}	48	48	48
m_{CC}	32	80	128
m(s)	96	144	192
$s(m_{EC})$	1/12	1/18	1/24
$s(m_{LC})$	3/12	3/18	3/24
$s(m_{CC})$	2/12	5/18	8/24
s(s)	1/2	1/2	1/2

Calculation(QCD): m(c) = 1280 MeV/c², m(s) = 96 MeV/c²,

Fig. 29. Spins and masses of the c and s quarks are calculated for the EC, LC and CC charge masses.

u(2/3,0,-5/3) and u(2/3,0,-8/3) have the masses of 2.2 MeV/c², 3.9 MeV/c² and 5.5 MeV/c² if the QCD mass value (2.2 MeV/c²) of the u quark is the right mass of u(2/3,0,-2/3). And, d(-1/3,0,-2/3), d(-1/3,0,-5/3) and d(-1/3,0,-8/3) have the masses of 4.7 MeV/c², 9.6 MeV/c² and 14.4 MeV/c² if the QCD mass value (4.7 MeV/c²) of the u quark is the right mass of d(-1/3,0,-2/3). Therefore, it

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will be interesting to look for the mesons and baryons with the different combinations of the CC charges. From the data of mesons and baryons, it will be interesting to find the quark masses with the different CC charges. For the proton, p(1,0,-5) = p(1,0) + A(CC=-5)$_3$. The m_{EC} masses of the u quark and d quark are 1.1 MeV/c^2 and 1.6 MeV/c^2, respectively.

In the quantum chromodynamics (QCD), the quark masses have been calculated by considering the gluon effects. I am using these masses as the total masses of the quarks in the present work. In the present work, because the gluons are not considered, the quark masses need to be recalculated in terms of the 3-D quantized space model. At this moment, how to calculate the partial masses and partial spins of the EC charge masses, LC charge masses and CC charge masses from the total masses of the quarks are shown in Figs. 20, 21 and 26 - 30. In the deep inelastic scattering experiments, the total masses of the mesons and baryons have been obtained following their decay modes. Also, the partial spin of the EC + LC charge mass for the mesons and baryons can be measured by the inelastic scattering experiments. For example, the partial spin of the EC charge mass in the proton was measured by the lepton inelastic scattering. This partial spin of the EC mass in the proton is about 33(6) % of the total spin (1/2) of the proton. The calculated partial spin of

t quark mass: GeV/c^2

EC	2/3	2/3	2/3
LC	-2	-2	-2
CC	-2/3	-5/3	-8/3
m_{EC}	34.6	34.6	34.6
m_{LC}	103.9	103.9	103.9
m_{CC}	34.6	86.5	138.4
m(t)	173.1	224.9	276.8
s(m_{EC})	2/20	2/26	2/32
s(m_{LC})	6/20	6/26	6/32
s(m_{CC})	2/20	5/26	8/32
s(t)	1/2	1/2	1/2

b quark mass: GeV/c^2

EC	-1/3	-1/3	-1/3
LC	-2	-2	-2
CC	-2/3	-5/3	-8/3
m_{EC}	0.46	0.46	0.46
m_{LC}	2.79	2.79	2.79
m_{CC}	0.93	2.33	3.72
m(b)	4.18	5.58	6.98
s(m_{EC})	1/18	1/24	1/30
s(m_{LC})	6/18	6/24	6/30
s(m_{CC})	2/18	5/24	8/30
s(b)	1/2	1/2	1/2

Calculation(QCD): m(t) = 173.1 GeV/c^2, m(b) = 4.18 GeV/c^2,

Bastons (DM) mass: eV/c^2

	B1	B2	B3
EC	-2/3	-5/3	-8/3
m_{EC}	26.1	4.27 10^{10}	1.95 10^{15}
s(m_{EC})	1/2	1/2	1/2

Calculation(TQSM): m_{EC}

Fig. 30. Spins and masses of the t and s quarks are calculated for the EC, LC and CC charge masses. Spins and masses of the bastons (DM, dark matters) are shown [11].

the EC mass in the proton is 32.6 % of the total spin (1/2) of the proton. From this observation, the partial spins and partial masses of the EC charge mass and CC charge mass of the proton can be calculated as shown in Fig. 26. The partial spins and partial masses of the EC charge masses and LC charge masses of the leptons can be calculated as shown in Fig. 28. For the information, the partial spins and partial masses of the EC charge mass, LC charge masses and CC charge mass of the c, t, s and b quarks can be calculated as shown in Figs. 29 and 30

7. Summary and conclusions

In the present paper, the universe evolution is discussed by the decay of the charged black holes. The massive elementary fermions are defined as the warped spaces toward the positive time axis

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for the positive charges and toward the negative time axis for the negative charges. The photons are the flat space on the 4-D Euclidean space-time. First the energy ($E=c\Delta t\Delta V$), charges ($|q|= c\Delta t$) and absolute time (ct) are newly defined based on the 4-D Euclidean space. The big bang is understood by the space-time evolution of the 4-D Euclidean space but not by the sudden 4-D Minkowski space-time creation. The charged black holes are treated like the elementary fermions. The first matter universe created at the big bang is made of the negatively charged black holes with the huge energy (mass) and very small space volume (maybe smaller than the Planck scale). The origins of the inflation and big bang for our matter universe has not been discovered. In the present work, the origins of the big bang and inflation are briefly explained by using the evolution of the charged black holes in terms of the 3-dimensional quantized space model (TQSM) based on the 4-dimensional (4-D) Euclidean space. Note that the black holes are not the singularities because of the huge Coulomb repulsive forces with the huge BH surface fluctuations. The first primary black holes created at the big bang moment are closest to the singularities in the physical concept. This first primary black holes with the huge charges are inflated to the huge space volume with the much smaller charges.

The big bang process created the matter universe with the positive energy and the partner anti-matter universe with the negative energy from the CPT symmetry. Our universe is the matter universe with the negative charges of electric charge (EC), lepton charge (LC) and color charge (CC). This first universe is made of three dark matter -, lepton -, and quark - primary black holes with the huge negative charges which cause the Coulomb repulsive forces much bigger than the gravitational forces. The huge Coulomb forces induce the inflation of the primary black holes, that decay to the super-massive black holes. The dark matter super-massive black holes surrounded by the normal matters and dark matters make the galaxies and galaxy clusters. The spiral arms of galaxies are closely related to the decay of the 3-D charged normal matter black holes to the 1-D charged normal matter black holes. The elementary leptons and quarks are created by the decay of the normal matter charged black holes, that is caused by the Coulomb forces much stronger than the gravitational forces. The Coulomb forces are very weak with the very small Coulomb constants ($k_1(EC) = k_{dd}(EC) \approx 0$) for the dark matters and very strong with the very big Coulomb constants ($k_2(EC) = k_{nn}(EC)$) for the normal matters because of the non-communication of the photons between the dark matters and normal matters in Fig. 3. The photons are charge dependent and mass independent. But the dark matters and normal matters have the similar and very weak gravitational forces because of the communication of the gravitons between the dark matters and normal matters in Figs. 22-23. The gravitons are charge independent and mass dependent. Note that the three kinds of charges (EC, LC and CC) and one kind of mass (m) exist in our matter universe. The dark matters, leptons and quarks have the charge configurations of (EC), (EC,LC) and (EC,LC,CC), respectively. In Fig. 23, the gravitational forces and Coulomb forces are compared for the readers.

The partial spins and partial masses of the EC charge mass and CC charge mass of the proton can be calculated as shown. The partial spins and partial masses of the EC charge masses and LC charge masses of the leptons can be calculated. For the information, the partial spins and partial masses of the EC charge mass, LC charge masses and CC charge mass of the c, t, s and b quarks are calculated.

We do not observe the rest mass of the photon. We observe the massive particles with the 3-D volumes. The massive particles and massless photons occupy the 3-D volume on the 3-D Euclidean space. Then, what is the difference between the massless photon and massive particles? The answer to this question comes from the 4-D Euclidean space. It is thought that the massive particles take the 4-D warped space that is the warped version of the flat photon space along the time axis of ct. The 4-D volume of the 4-D warped space is the rest mass energy of the massive particle. Under this new idea, the flat photon space has the zero-rest mass energy. The flat photon space has the 3-D quantized space of the physical x1x2x3 space with the very small-time width of $c\Delta t_q$. Therefore, the mathematical 4-D Euclidean space is the unquantized space without the photons (space fluctuations). And the physical 4-D Euclidean space is the 4-D quantized space-time that is the 3-D quantized space of the physical x1x2x3 space with the very small-time width of $c\Delta t_q$. This is called as the space-time evolution in the present work from the mathematical space to the physical space.

In the 4-D Euclidean space, all axes have the positive and negative directions. However, the space momenta along the 3-D space axes have been studied in the physical world. For the time axis, only the positive axis in the 4-D Minkowski space has been taken into consideration because we observe only the positive time direction. From the viewpoint of the 4-D momenta on the 4-D Euclidean space, the time axis should have the positive and negative time directions. If the negative time direction is allowed in the physical point of view, the well-known big bang theory should be changed to include the negative time direction. In this case, the partner universe with the negative time momentum is allowed. Note that the negative energy and negative mass are allowed from the negative time momentum. This means that the big bang is the pair creation of our matter universe and partner anti-matter universe which are the 3-D quantized spaces. This new interpretation completes the big bang theory in terms of the conserved CPT symmetry. It explains why our universe is the matter universe. It is concluded that three unsolved questions of big bang, inflation, charged black hole decay, galaxy formation and elementary particles are solved by using the charged black hole decay in terms of the 3-D quantized space model (TQSM). I wish the present results can inspire people to study on the present topics with their own new ideas.

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