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Absolute Time, Length Expansion, Particle Mass Origins, Quantum Entanglement, Pauli Exclusion Principle and Higgs Boson on the 4-D Euclidean Space

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Abstract;
The absolute time and relative time are defined in terms of the 4-D Euclidean space. Our universe is the 3-D $x_1x_2x_3$ quantized photon space which follows the absolute time simultaneity when the universe moves along the absolute time axis of ct. The length expansion of $\Delta x = \Delta\gamma x_0$ is derived under the condition of the absolute time (ct) simultaneity. From the similarity between this length expansion of $\Delta x = \Delta\gamma x_0$ and the energy increasing of $\gamma = EE_0$, it is assumed that the energy is proportional to the particle size of Δx. The extension of this assumption to the 4-D Euclidean space gives the new definition that the particle energy (E) is the 4-D volume. Then, the particle mass energy is defined as $E= mc^2 = c\Delta t\Delta V = \gamma E_0$. The masses of the elementary particles are originated from the 4-D warped volume of the photon space because the particle is the warped photon space with the velocity of $v < c$. Therefore, the Higgs boson concept in the standard model (SM) is not needed in the present 3-D quantized space model (TQSM). The scalar boson with the spin of zero, photon with the spin of 1 and graviton with the spin of 2 are the two-boson states. Therefore, the observed Higgs boson is reinterpreted as the two-boson state of the scalar boson with the spin of zero. The cosmic muon observation and twin paradox are explained by using the absolute time and relative time. The relative time is the observed time in the twin paradox and cosmic muon observation. In the twin paradox, a person who travels the long distance is more aged than a person on the earth in terms of the relative time ages because of the space and time conversion effect (STCE effect) of the moving space distance (x). But twins are in the same ages in terms of the absolute time without STCE effect. The fast-moving cosmic muon has the expanded half-life from the time expansion of the relative time. Also, the quantum entanglement and Pauli exclusion principle are explained. The quantum base of the photon space line connects two entangled particles. Two particles and quantum base system is fluctuated along the absolute time axis by the time clicking when one particle is measured. Another particle is instantly selected by the time clicking. This is called as the quantum entanglement. The photons which are the flat photon space with the constant speed of c along the space axis and absolute time axis have the 4-D photon velocity of $c_{eff} = \sqrt{2}\, c$. Total 10-D Euclidean space including three 3-D quantized spaces and one absolute time axis is required for the electric charges (EC), lepton charges (CC) and color charges (CC) of the elementary particles. The 3-D photon space is very stiff along the absolute time (ct) axis and very soft along the space axes. The Coulomb force through the photons (2EM waves) of the space fluctuations is much stronger than the Gravitational force through the gravitons (G waves) of the time fluctuations between two electrons.

Key words: Absolute time; Length expansion; Absolute time simultaneity; Twin paradox; Quantum entanglement; 4-D Euclidean space; Pauli exclusion principle; Higgs boson; Time clicking; Quantum base

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1. Introduction

In the three-dimensional (3-D) quantized space model (TQSM), the following six conditions are proposed by using the 4-D Euclidean space or total 10-D Euclidean space.

1. Our universe is the 3-D quantized photon space with the quantum time width of $c\Delta t_q$ which consists of the background photons (2EM waves) with the zero electric (E) fields, zero magnetic (M) fields and zero gravitational (G) fields.
2. Our universe has the three 3-D quantized photon spaces and one time axis which means total 10-D Euclidean space. Each 3-D quantized photon space has the EC, LC or CC charge based on the 4-D Euclidean space.
3. The velocity (c) of the massless photon which is the flat photon space is constant and the photon energy (E=hν) is the 4-D flat space volume of $E=c\Delta t\Delta V$ on the 4-D Euclidean space.
4. The velocity of the massive particle which is the warped photon space is $v = \Delta x/\Delta t_l < c$ and the particle mass energy is the 4-D warped space volume of $E = mc^2 = c\Delta t\Delta V$ on the 4-D Euclidean space. The charge (q) of EC, LC or CC for the massive particle is defined as $|q| = c\Delta t$ on each 3-D quantized photon space.
5. Total mass of the massive particle is $m = m_{EC} + m_{LC} + m_{CC}$. Total spin of the massive elementary fermion is $s = ½ = s(m_{EC}) + s(m_{LC}) + s(m_{CC})$. And the corresponding relations are $|EC|: |LC| : |CC| = m_{EC} : m_{LC} : m_{CC} = s(m_{EC}) : s(m_{LC}) : s(m_{CC})$.

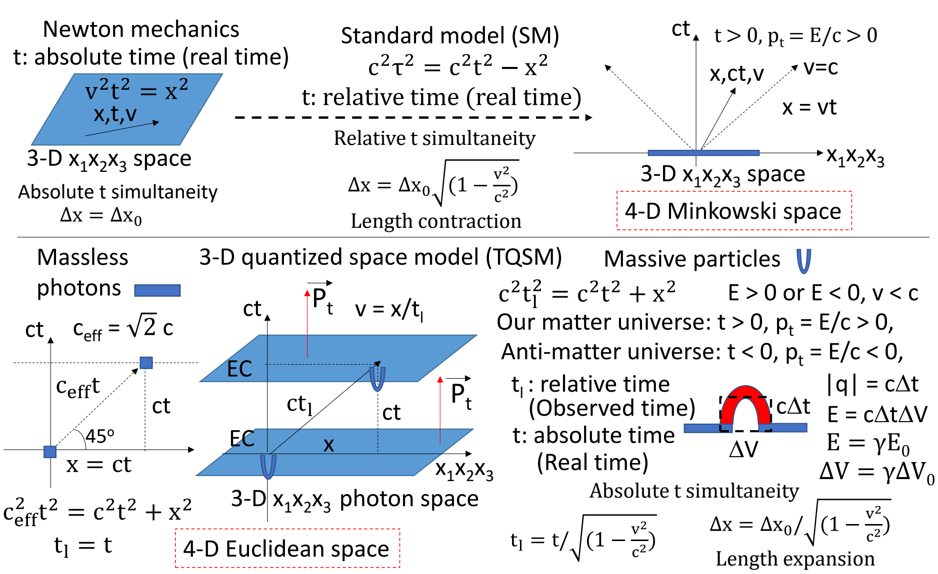

Fig. 1. Absolute time and relative time are compared.

6. For the electric charges (EC), lepton charges (LC) and color charges (CC) of the elementary particles, total 10-D Euclidean spaces of three 3-D quantized spaces and one time axis are required. The 39 elementary fermions (3 dark matters (bastons)(EC), 9 leptons(EC,LC) and 27 quarks(EC,LC,CC)) , 39 elementary bosons (3 dark matter force bosons(EC), 9 weak force bosons(EC,LC) and 27 strong force bosons(EC,LC,CC)), three gravitons (g(0), g(0,0) and g(0,0,0)) and three photons(γ(0), γ(0,0) and γ(0,0,0)) exist in nature in terms of the 3-D quantized space model. For more details of the elementary particles, see ref. [1].

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The concept of the time has been changed [2-17]. The time (t) is absolute in terms of the Newton mechanics in Fig. 1. But in the special/general relative theory and standard model (SM), the time (t) is relatively changing depending on the velocity of the particle or the reference frame. The relative time axis of ct is assigned as the time axis in the 4-D (4-dimensional) Minkowski space in Fig. 1. Then, the photon velocity of c is constant. The Lorentz transformations are derived about the relative time (t_l) and space axes. Also, the length contraction of $\Delta x = \Delta x_0\sqrt{1-\frac{v^2}{c^2}}$ takes place under the condition of the relative time (t_l) simultaneity [18-21]. The size of the moving particle is reduced with the increase of the particle velocity (v). Even the particle size comes close to zero as the particle velocity goes close to the photon velocity. The particle should be converted to the photon when the particle velocity is equal to the photon velocity. But with the condition of the length contraction, the particle should disappear because the particle size is zero when particle velocity of v equals to the photon velocity of c. The photons consist of the electromagnetic (EM) waves with the non-zero sizes. The photon should have the non-zero size. This problem arises because of the condition of the relative time simultaneity when the length contraction formular is derived. This problem is solved in terms of the 3-D quantized space model (TQSM) in Fig. 1.

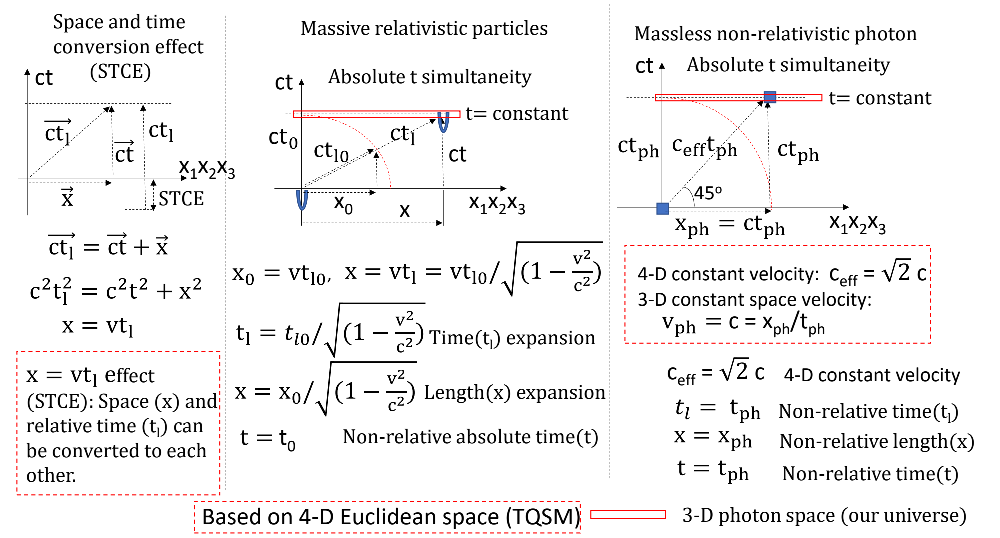

Fig. 2. Length expansion is derived from the absolute time simultaneity. And it is shown that the 4-D photon velocity is $c_{eff} = \sqrt{2}\,c$.

In the TQSM model, two times of the absolute time (t) and relative time coexist in Figs. 1-4. The time (t) is the real time along the time axis of ct in the 4-D Euclidean space. The relative time (t_l) is the observed time along the 4-D moving distance axis of ct_l. The relative time (t_l) in the TQSM model corresponds to the relative time (t) in the SM model and special relative theory. Then in the TQSM model, the condition of the absolute time (t) simultaneity should be used instead of the condition of the relative time (t_l) simultaneity. The length expansion ($\Delta x = \Delta x_0/\sqrt{1-\frac{v^2}{c^2}}$) of the moving particle is derived in the present work. This indicates that when the particle comes close to the photon velocity, the particle size is expanded to very long size by the length expansion. At some point, the warped space volume of the particle is collapsed to the flat photon space with the proper size following the energy conservation in Fig. 5. This means that the total energy of the moving particle is converted to the total energy of the photon by the matter collapse when the

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particle velocity comes close to the photon velocity. The matter collapse of the moving particle takes place when the length expansion force is larger than the resisting force of the 4-D volume of the moving particle. Also, the cosmic muon problem in Fig. 6 and twin paradox problem [22,23] in Figs. 7 and 8 are explained by using the length expansion in the present work.

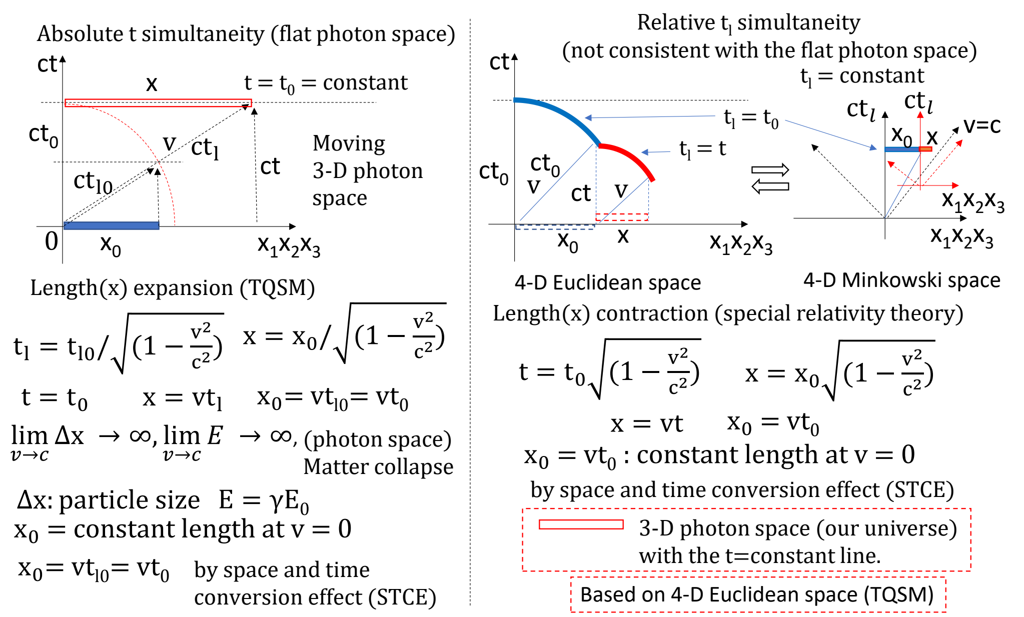

Fig. 3. The length expansion from the absolute time simultaneity and length contraction from the relative time simultaneity are compared.

The particles have the zero masses in terms of the SM model. Then, the non-zero masses of the particles except the neutrinos are explained by the Higgs mechanism in the SM model [24-32]. In the TQSM model, the particle mass ($m=E/c^2$) is originated from the 4-D space volume which is caused by the warped photon space of the particles. This indicates that the observed Higgs boson and corresponding Higgs mechanics are not needed to explain the mass origin of the elementary particles. In the present TQSM model the observed Higgs boson is reinterpreted as the scalar boson which is created by the two-boson states. Then the boson has the spin of 1. And the spin addition rule of two bosons allows the scalar boson (s=0), the photon (s=1) and graviton (s=2). The photon and graviton are the force carrying bosons of the Coulomb force and gravitational force, respectively. The scalar boson is the force carrying boson of the short-range boson force.

The quantum entanglement between two particles is one of the major problems in the quantum mechanics [33-46]. The entangled two photons have been experimentally confirmed. But the how the information between two particles is instantly transmitted needs to be solved. This problem is solved in terms of the present TQSM model. The universe is based on the background photon space which is moving along the absolute time axis. This indicates that all matters and photons are strongly entangled by the background photon space. Also, the quantum entanglement between two particles is explained by using the quantum base of the photon space line which connects two particles. Also, the Pauli exclusion principle is explained along with the quantum entanglement.

In summary, in the present work, the absolute time, relative time and length expansion in section 2, the particle mass origins and Higgs boson in section 3, and the quantum entanglement and Pauli

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exclusion principle in section 4 are discussed by using the 4-D Euclidean space or 10-D Euclidean space.

2. Absolute time (t) and relative time (t_l) on the 4-D Euclidean space

The time has been considered as the absolute time (t) in the Newton mechanics. The absolute time is the real time in the Newton mechanics. Then, the length does not depend on the velocity of the object. In other words, $\Delta x = \Delta x_0$ under the condition of the absolute time (t) simultaneity in Fig. 1. However, in the special relative theory applied to the standard model (SM), the time has been used as the relative time (t) depending on the velocity of the related massive matter. Even the time has been connected to the entropy increase of the universe in terms of the thermal dynamics. The concept of the relative time in the standard model introduces 4-D Minkowski space in Fig. 1. The relative time is the real time in the special relative theory. This indicates that two persons in the two different spaceships are aged differently. Then the simultaneity is arranged about the relative time. The length contraction is defined as $\Delta x = \Delta x_0(1-v^2/c^2)^{0.5}$ under the condition of the relative time (t) simultaneity in Fig. 1. In the standard model, the massless photon has always the constant velocity of c. The massive particles have the velocity of $v = \Delta x/\Delta t < c$.

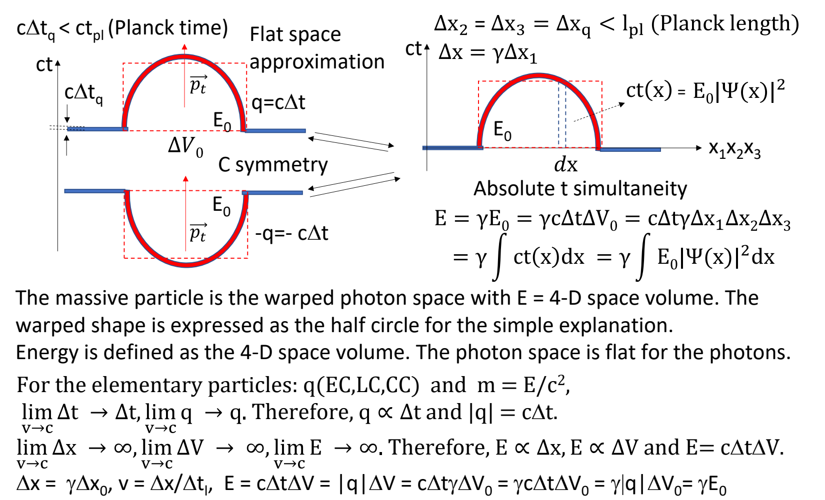

Fig. 4. The particle shape and wave function with the corresponding energy definition are compared.

In the present 3-D qunantized space model (TQSM) in Fig. 1, the 4-D Euclidean space is used. Then the fourh axis is the absolute time axis of ct and the remaining 3-D space is the photon space. The 4-D distance is described as the relative time axis of ct_l. The absolute time (t) in the TQSM model corresponds to the absolute time in terms of the Newton mechanics even though the concept is different. The relative time of ct_l in the TQSM model corrresponds to the relative time of ct in the special relative theory that has been developed on the 4-D Minkowski space in Fig. 1. The 4-D distance axis is varying according to the particle velocity. This is the reason why the time of ct_l along the 4-D distance axis is called as the relative time. The relative time (ct_l) of the particle is the observed time in the TQSM doel. But the time axis of ct is not varying depending on the particle velocity. Because of this reason, the time of ct is called as the absolute time. In the present TQSM model, the absolute time of ct is the real time in Figs. 1 and 2. Therefore, every thing and every

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person within the same photon space of our universe have the same absolute time of ct along the same absolute time axis. This means that our universe has the absolute time (t) simultaneity. The relative time of ct_l gives the relative moving time and relative moving distance. This indicates that two persons in the two different spaceships have the same absolute time but the different relative time. When two twin persons in the two different spaceships meet at the same location, they have the same real times (real ages) of ct but the different relative times (observed relative ages) of ct_l.

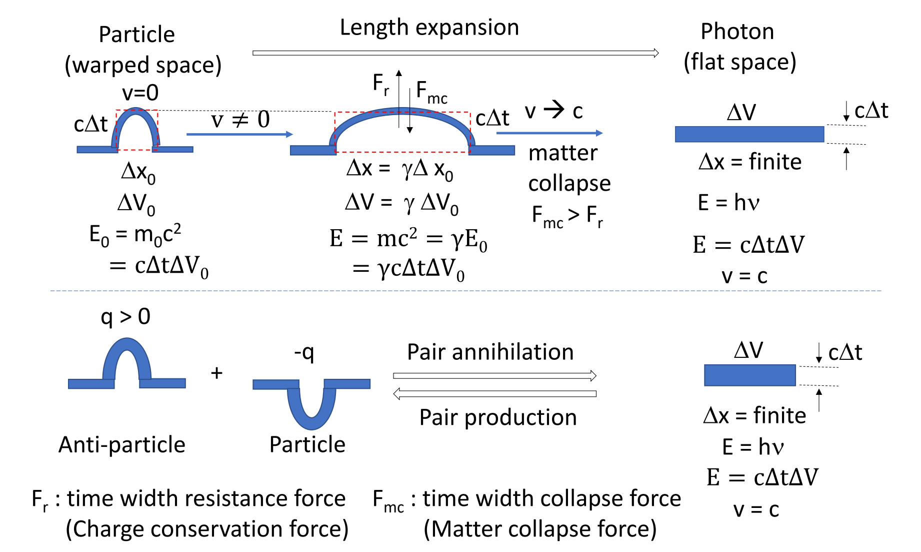

Fig. 5. Length expansion and pair annihilation are compared.

The photon space is called as the $x_1x_2x_3$ 3-D quantized space in Figs. 1 and 2. The massive particles are moving on the 4-D Euclidean space. The observed time is the 4-D relative time of ct_l. The observed space distance is x. Then the observed massive particle velocity is $v = x/t_l$. Then the relative time can be expressed as $t_l = t/(1-v^2/c^2)^{0.5}$. The relative time of the massive particle is changed depending on the particle velocity in Fig. 2. In other words, the particle velocity is changed depending on the relative time. However, the massless photon velocity of c is the constant. The 3-D photon space distance is $x_{ph} = ct_{lph}$ for the massless photon of the flat $x_1x_2x_3$ photon space and the distance along the absolute time axis is ct_{ph} because our universe (3-D quantized space) is the photon space moving with the photon velocity of c along the absolute time axis. This indicates that t_{lph} is equal to t_{ph}. Then, the 4-D space distance axis for the massless photon has always the angle of 45° from the 3-D space axes in Fig. 2. Then, because the 3-D photon space velocity is $v_{ph} = x_{ph}/t_{lph} = c$ = constant, the photon relative time of t_{lph} should be equal to the photon absolute time of t_{ph}. The 4-D distance of the photon is $2^{0.5}ct_{ph} = c_{eff}t_{ph}$. Then the 4-D photon velocity of c_{eff} is $2^{0.5}c$ which is faster than the 3-D space photon velocity of c by the factor of $2^{0.5}$. In summary, the massive particle has the increased 4-D relative time of $t_l = t/(1-v^2/c^2)^{0.5}$ which makes the traveling distance ($x = vt_l$) of the particle longer than the traveling distance ($x = ct_{ph}$) of the photon during the same absolute time of $t = t_{ph}$ for $v > c/2^{0.5}$ in Fig. 2. Our universe is moving along the absolute time axis of ct with the constant photon velocity of c. And the photon velocity along the 3-D space is also c. And it is concluded that the 4-D photon velocity is $c_{eff} = 2^{05}c$. The time expansion is expressed by the equation of $t_l = t/(1-v^2/c^2)^{0.5}$. And the length expansion is expressed by the equation of $x = x_0/(1-v^2/c^2)^{0.5}$ or $\Delta x= \Delta x_0/(1-v^2/c^2)^{0.5}$ in Figs. 1, 2 and 3 based on the absolute time (t) simultaneity of the flat $x_1x_2x_3$ photon space. However, in the special relative theory the length contraction of $x = x_0(1-v^2/c^2)^{0.5}$ or $\Delta x= \Delta x_0(1-v^2/c^2)^{0.5}$ has been derived based on the relative time

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(t_l) simultaneity in Figs. 1 and 3. The lenth contraction is explained by the relative time (t_l) simultaneity in Fig. 3. Our universe is the 3-D quantized space which is the flat photon space. This flat photon space means that our universe follows the condition of the absolute time (t) simultaneoty but not the condition of the relative time (t_l) simultaneity. Because the relative time (t_l) simultaneity is not consistent with the flat photon space, the length contraction of $x = x_0(1-v^2/c^2)^{0.5}$ or $\Delta x= \Delta x_0(1-v^2/c^2)^{0.5}$ cannot happen in terms of the TQSM model. Therefore, the length expansion of $x = x_0/(1-v^2/c^2)^{0.5}$ or $\Delta x= \Delta x_0/(1-v^2/c^2)^{0.5}$ in Figs. 1, 2 and 3 is taken into account in the present TQSM model.

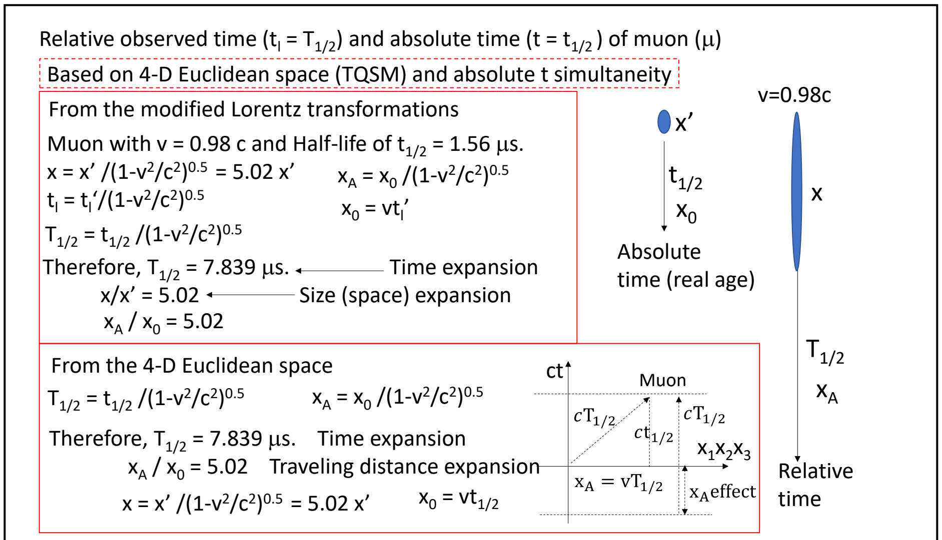

Fig. 6. Cosmic muon observation is explained by the time expansion.

In Fig. 2, the moving 3-D space distance (x) can be converted to the moving 4-D space distance by the equation of $x = vt_l$ for the massive particle. We observe the relative time of t_l and space distance of x for the massive particle. In the 4-D Euclidean space, the relative time axis is actually the 4-D moving distance axis and the space distance axis is actually the 3-D space axis. The relative observed time (t_l) and observed space distance (x) can be converted to each other by using the equation of $x = vt_l$. This is called as the space and time conversion effect (STCE effect) in Fig. 2. In Figs. 1-3, the 3-D space size (Δx or ΔV) of the elementary particle can be expanded by the equation of $\Delta x= \Delta x_0/(1-v^2/c^2)^{0.5}$ or $\Delta V= \Delta V_0/(1-v^2/c^2)^{0.5}$. In Fig. 4, the total energy (E) of the moving particle is $E= mc^2 = E_0/(1-v^2/c^2)^{0.5}$. Therefore, the energy is proportional to the 3-D space volume of the elementary particle. Because the absolute time size ($c\Delta t$) of the elementary is not changed depending on the particle velocity of v, the 4-D space volume is expressed as $c\Delta t\Delta V= c\Delta t\Delta V_0/(1-v^2/c^2)^{0.5}$. Therefore, in the present work, the energy equal to the 4-D volume of the elementary particle is defined. In other words, $E = mc^2 = c\Delta t\Delta V= c\Delta t\Delta V_0/(1-v^2/c^2)^{0.5} = m_0c^2/(1-v^2/c^2)^{0.5} = E_0/(1-v^2/c^2)^{0.5}$. The elementary particles have the conserved charges while they are moving. The absolute time size (width) of the elementary particle is also the conserved quantity while they are moving. In the present work in Fig. 4, the charge |q| of the elementary particle is defined as the absolute time size of $c\Delta t$. The charge is actually q(EC,LC,CC) including three charges of electric charge (EC), lepton charge (LC) and color charge (CC) of the elementary particle. Therefore, the origins of the mass ($m = E/c^2$) and charge (q) are shown for the warped shape of the 3-D quantized photon space in Fig. 4. The warped shape of the 3-D quantized photon space is the elementary particle in Fig. 4. The photons are the flat photon space.

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The relative time (t_I) expansion is proved in the observation of the cosmic muon in Fig. 5. The half -life of the rest muon is taken as the absolute time half-life ($t_{1/2}$) of the muon. The half-life of the fast muon is the relative time half-life ($T_{1/2} = t_{I1/2}$) of the fast muon. The traveling distance can be

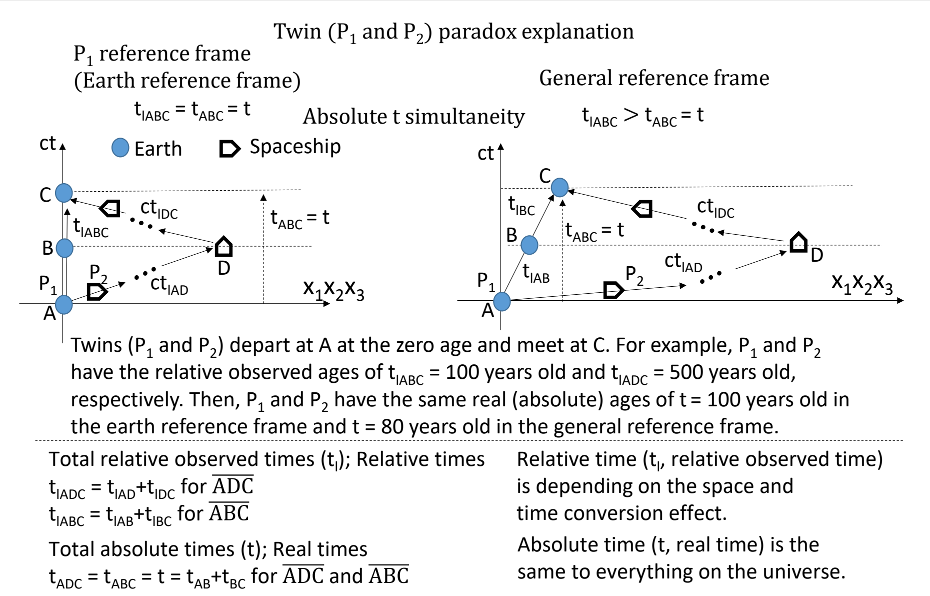

Fig. 7. Twin paradox is explained in terms of the TQSM model.

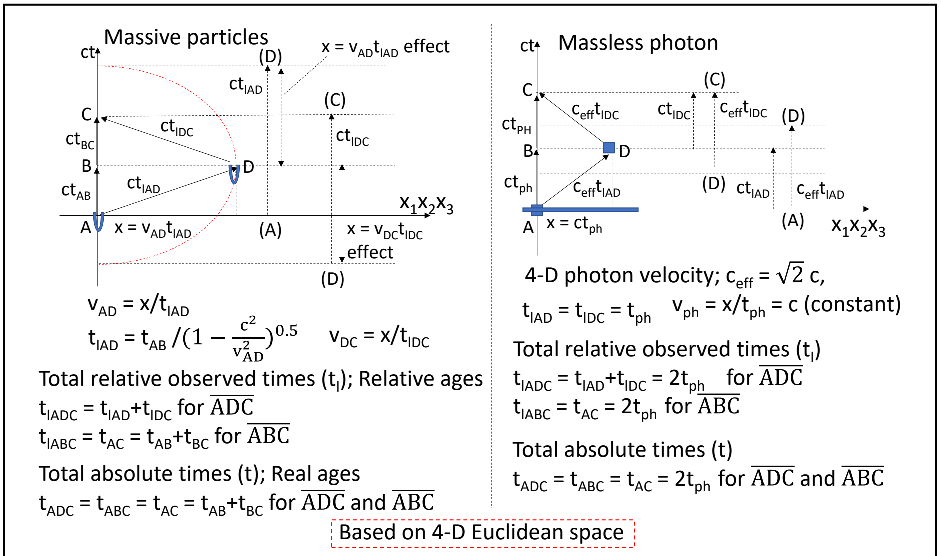

Fig. 8. Massless photon and massive particle are compared.

calculated easily by the equation of $x = vT_{1/2} = vt_{1/2}/(1-v^2/c^2)^{0.5}$. In Fig. 6, the twin paradox is explained [22,23]. Twins (P_1 and P_2) depart at A at the zero age and meet at C. For example, let's assume that P_1 and P_2 have the relative observed ages of t_{IABC} = 100 years old and t_{IADC} = 500 years old, respectively. Then, P_1 and P_2 have the same real (absolute) ages of t = 100 years old in the earth reference frame and t = 80 years old in the general reference frame. Relative time (t_I, observed time) is depending on the space and time conversion effect (STCE effect). Absolute time

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(t, real time) is the same to everything on the universe. The P_2 person has the much older age than the p_1 person because of the STCE effect in the viewpoint of relative time.

In Fig. 7, when the massive particle moves from the A location to the D location, the relative time (t_{lAD}) of the particle has the longer time than the absolute time (t_{AB}) by the space and time conversion effect (STCE effect) of the moving space distance (x). The relative time (t_{lAD}) expanded by the STCE effect is $t_{lAD} = x/v_{AD}$. In Fig. 7, when the massive particle moves from the D location

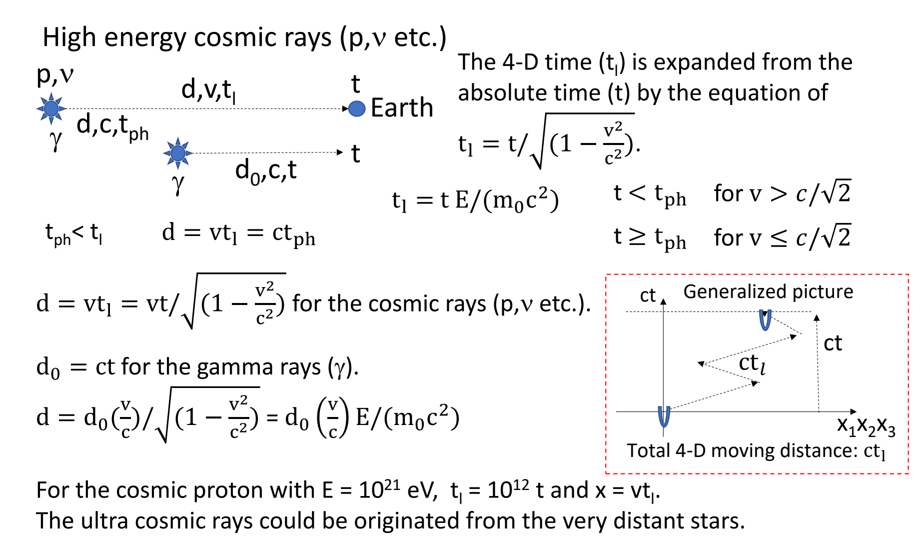

Fig. 9. High energy cosmic rays can be originated from the farther sources than expected.

to the C location, the relative time (t_{lDC}) of the particle has the longer time than the absolute time (t_{BC}) by the space and time conversion effect (STCE effect) of the moving space distance (x). The relative time (t_{lDC}) expanded by the STCE effect is $t_{lDC} = x/v_{DC}$. In Figs. 2 and 7, the massless photon has the constant 3-D space velocity of c. The 3-D photon space distance is $x_{ph} = ct_{lph}$ for the massless photon of the flat $x_1x_2x_3$ photon space and the distance along the absolute time axis is ct_{ph} because our universe (3-D quantized space) is the photon space moving with the photon velocity of c along the absolute time axis. This indicates that t_{lph} is equal to t_{ph}. Then, the 4-D space distance axis for the massless photon has always the angle of 45° from the 3-D space axes in Figs. 2 and 7.

Then, because the 3-D photon space velocity is $v_{ph} = x_{ph}/t_{lph} = c$ = constant, the photon relative time of t_{lph} should be equal to the photon absolute time of t_{ph}. The 4-D distance of the photon is $2^{0.5}ct_{ph} = c_{eff}t_{ph}$. Then the 4-D photon velocity of c_{eff} is $2^{0.5}c$ which is faster than the 3-D space photon velocity of c by the factor of $2^{0.5}$. In the reference frame of the observer, the photon has the observable time equal to t_{ph}. Because the photon velocity is always $v_{ph} = c = x_{ph}/t_{ph}$, the 4-D photon velocity is $c_{eff} = \sqrt{2}\,c$. Note that the photon consists of the photon space fluctuations with the zero-rest mass. In the reference frame of the observer, the particle has the observable relative time, t_l, depending on the particle velocity (v). If the absolute time (t) is the real age of the particle, the traveling relative time (t_l) is the relative observed age of the particle. Particle's traveling space distance(x_p) is expanded by the expanded traveling relative time (t_l) of the particle. If the velocity (v) of the particle is close to the photon speed, the particle can travel the very long space distance (x_p) during the very long relative age (t_l). The high energy cosmic particles of protons and neutrinos can come to the earth from the very far galaxies. x_{po} is the distance calculated with the absolute time. The massive particle has the increased 4-D relative time of $t_l = t/(1-v^2/c^2)^{0.5}$ which makes the traveling distance ($x = vt_l$) of the particle longer than the traveling distance ($x = ct_{ph}$) of the photon during the same absolute time of $t = t_{ph}$ for $v > c/2^{0.5}$ in Fig. 8. Our universe is moving along the absolute time axis of ct with the constant photon velocity of c. And the photon velocity along the

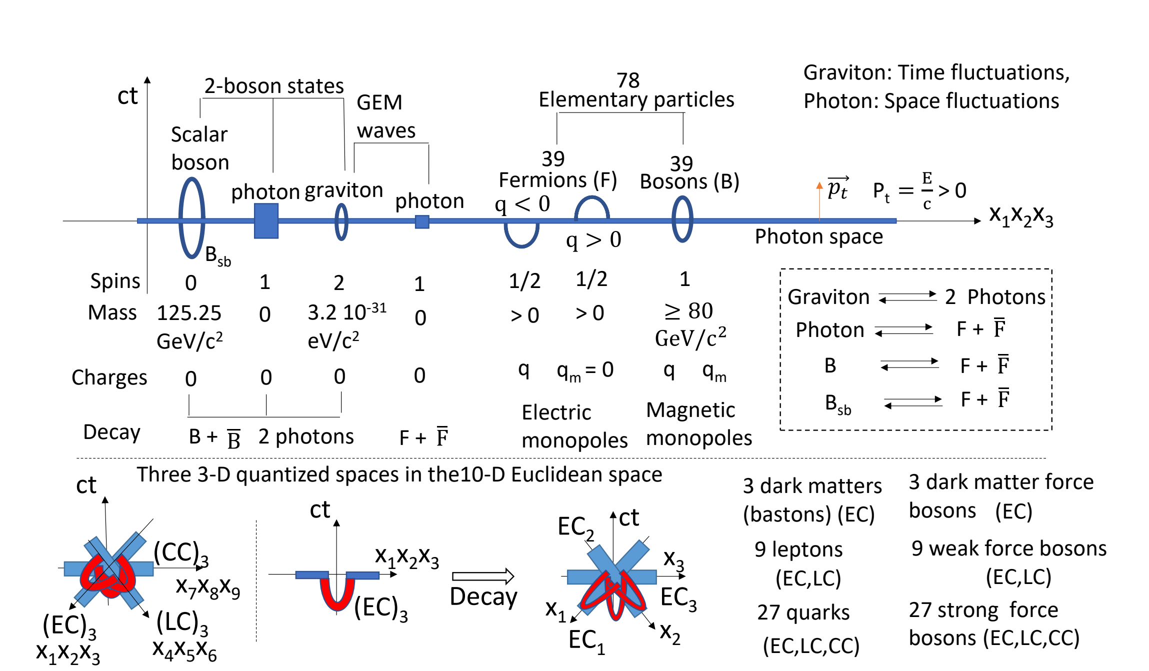

Fig. 10. Particles are compared in the TQSM model. It is shown that the observed Higgs boson can be the two-boson state. Elementary fermions and elementary bosons can be seen from ref. [1].

3-D space is also c. And it is concluded that the 4-D photon velocity is $c_{eff} = 2^{0.5}c$. For the cosmic proton with $E = 10^{21}$ eV, $t_l = 10^{12}$ t and $x = vt_l$. The ultra cosmic rays could be originated from the very distant stars.

3. Particle mass and Higgs boson

The masses of the elementary particles are zero in the standard model [24-32]. The nonzero masses of the elementary particles except the neutrinos have been explained by using the Higgs mechanism. Also, the scalar boson observed at the mass of 125.25 GeV/c^2 are the best candidate of the Higgs boson in the standard model (SM) [24-32]. In the present TQSM model. The particle masses are defined as the 4-D volume of the warped photon space in Fig. 4 by using the length expansion in Fig. 3. The massive particle is the warped photon space, and the massless photon is

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the flat photon space in Figs. 1 and 9. Total 39 elementary fermions and 39 bosons are proposed as shown in ref. [1]. The rest mass of the photon is zero because it is the flat photon space Therefore, in the TQSM model the Higgs mechanism is not needed any more for the explanation of the non-zero masses of the elementary particles. The observed scalar boson is considered as one of three two-boson states in Fig. 9 in terms of the present TQSM model. In Fig. 9, the scalar boson which

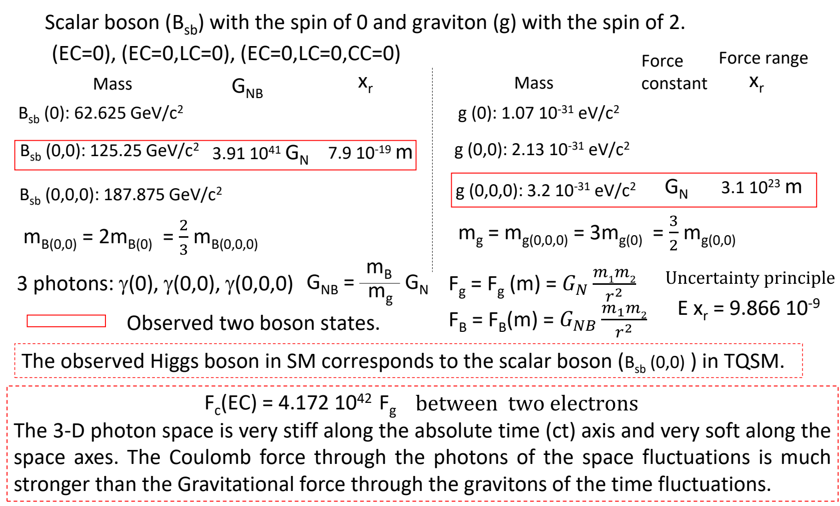

Fig. 11. Two-boson states are gravitons are compared.

is the two-boson state in the TQSM model can explain the observed decay patterns of the so-called Higgs boson in terms of the standard model. Two-boson states are separated as the scalar boson with the spin of 0, the photon with the spin of 1 and graviton with the spin of 2. The two-boson

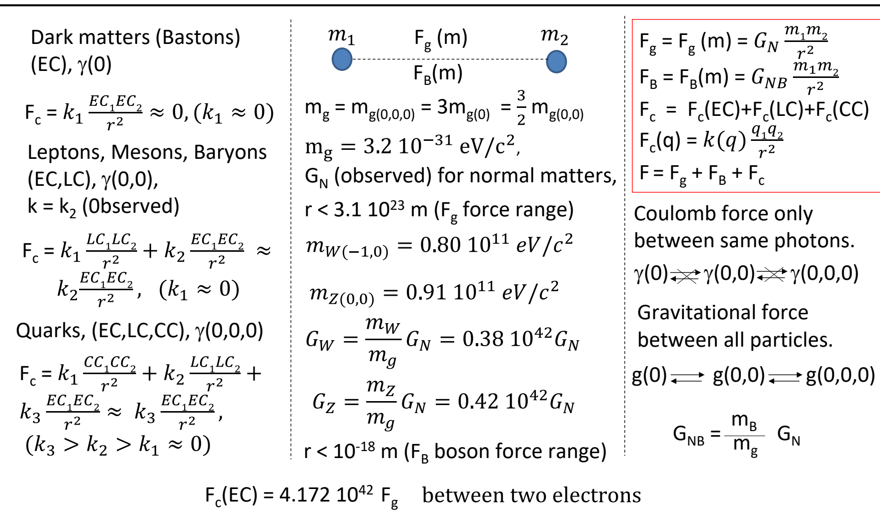

Fig. 12. The forces are compared.

states are the combined states of two bosons with the spin of 1. By the addition rule of two spins, three spins of 0, 1 and 2 are possible. The photon and graviton are the force carrying bosons of the Electromagnetic force (or Coulomb force) and gravitational force, respectively. Therefore, the scalar boson with the mass of 125.25 GeV/c^2 is the force carrying boson of the short-range force. In Fig. 10, the scalar boson and the graviton are compared. There are three kinds of the gravitons

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that are separated as the g(0) with EC = 0 for the dark matters, g(0,0) with EC = 0 and LC = 0 for the leptons and g(0,0,0) with EC = 0, LC = 0 and CC = 0 for the quarks and hadrons. The graviton

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

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

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

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

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

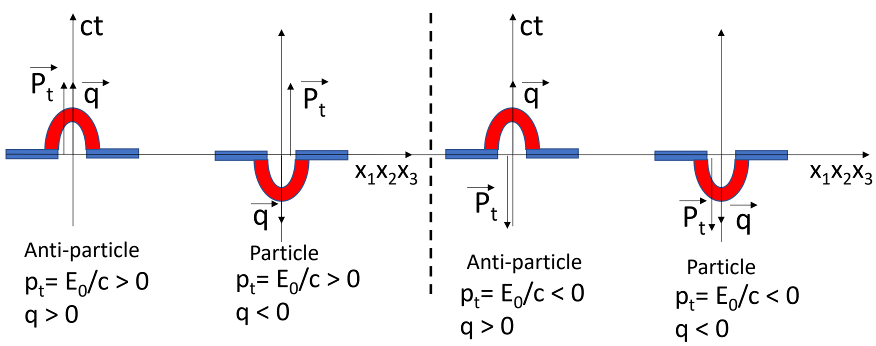
If the rest mass (m) of the elementary fermion is given, partial masses and partial spins can be calculated by using the charge(q) configuration of (EC,LC,CC). Note that the volume (ΔV) and angular velocity (ω) are the same for m, m_{EC}, m_{LC} and m_{CC}. Then the partial spin is proportional to the partial mass.

Fig. 13. Patrial Masses and partial spins are closely related to the ratios of the EC, LC and CC charges. Elementary fermions and elementary bosons can be seen from ref. [1].

Electric charges, energies and masses independent of the space directions

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

Time momentum of $p_t = E_0/c$, rest mass energy of E_0, rest mass of E_0/c^2, and electric charges (q) are vectors along the time axis of ct.



$p_t = E_0/c = (E_0/c^2)c = m_0c$, $c = \Delta x4/\Delta t$, $x4 = ct$. The x4 axis is the time axis of ct.
$V(x1x2x3x4) = |E| = |mc^2| = \Delta(ct)\Delta x1\Delta x2\Delta x3 = c\Delta(t)\Delta V$

Fig. 14. Masses and charges of the particles are defined.

with the mass of 3.2 10^{-31} eV/c^2 observed from the normal matters corresponds to the g(0,0,0) boson. There are three kinds of the scalar bosons that are separated as the $B_{sb}(0)$ with EC = 0 for the dark matters, $B_{sb}(0,0)$ with EC = 0 and LC = 0 for the leptons and hadrons and $B_{sb}(0,0,0)$ with EC = 0, LC = 0 and CC = 0 for the quarks. The scalar boson with the mass of 125.25 GeV/c^2

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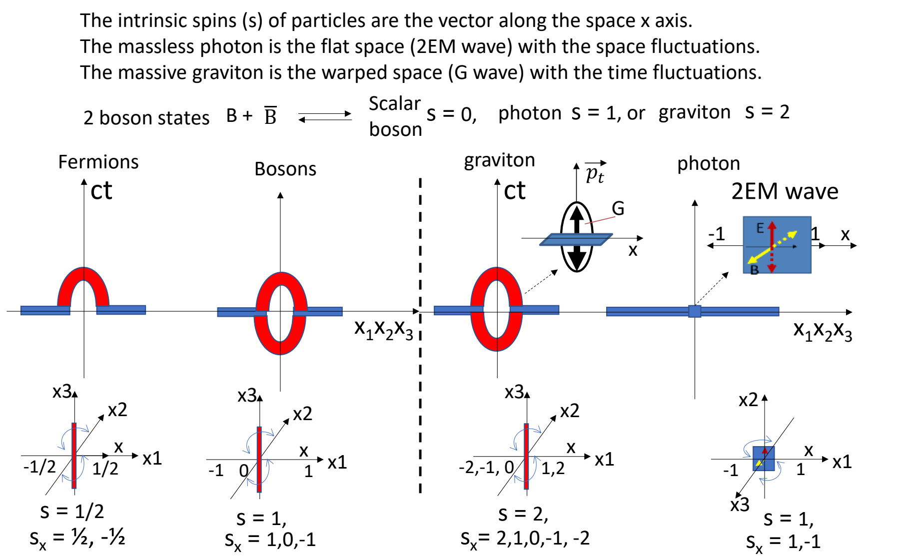

Fig. 15. Fermions and bosons are defined as the warped photon space. The photons are defined as the flat photon spaces.

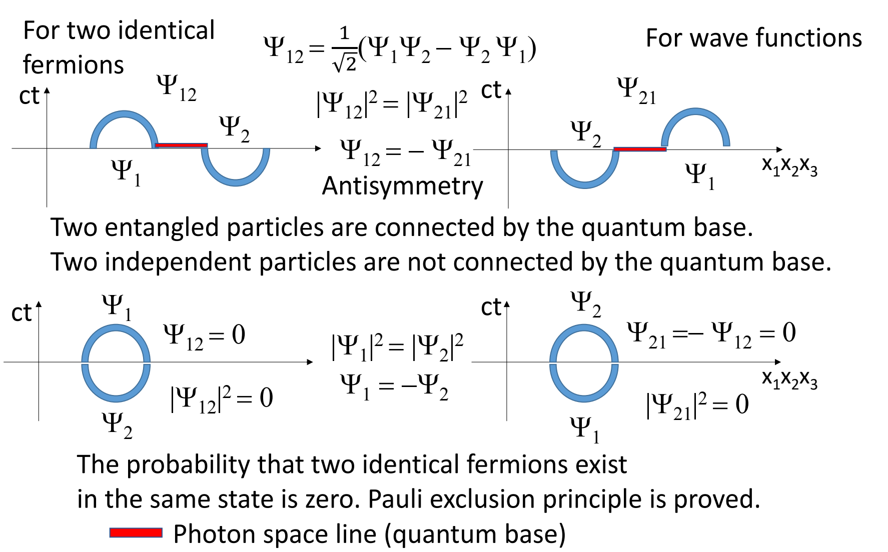

Fig. 16. Two entangled fermions are connected by the quantum base.

observed from the normal matters corresponds to the $B_{sb}(0,0)$ boson. The force ranges and force constants are calculated in Fig. 10. The Coulomb forces, gravitational forces and boson forces applied to the elementary particles are summarized in Fig. 11 for the readers. The 3-D photon space is very stiff along the absolute time (ct) axis and very soft along the space axes. The Coulomb force through the photons (2EM waves) of the space fluctuations is much stronger than the Gravitational force through the gravitons (G waves) of the time fluctuations between two electrons in Figs. 11 and 12.

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4. Quantum entanglement and Pauli exclusion principle

All matters within the universe exist on the photon space. This indicates that all matters and the photons are connected by the background photon space. Therefore, the universe is the strongly entangled system of all matters and the flat background photon space. Whole universe moves with the photon velocity along the absolute time axis of ct. For the particles in the small scale of the

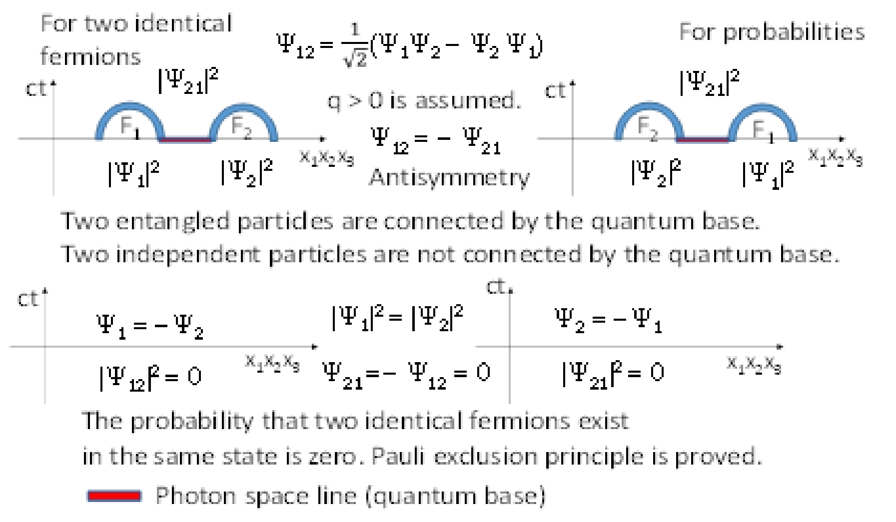

Fig. 17. Two entangled fermions are connected by the quantum base.

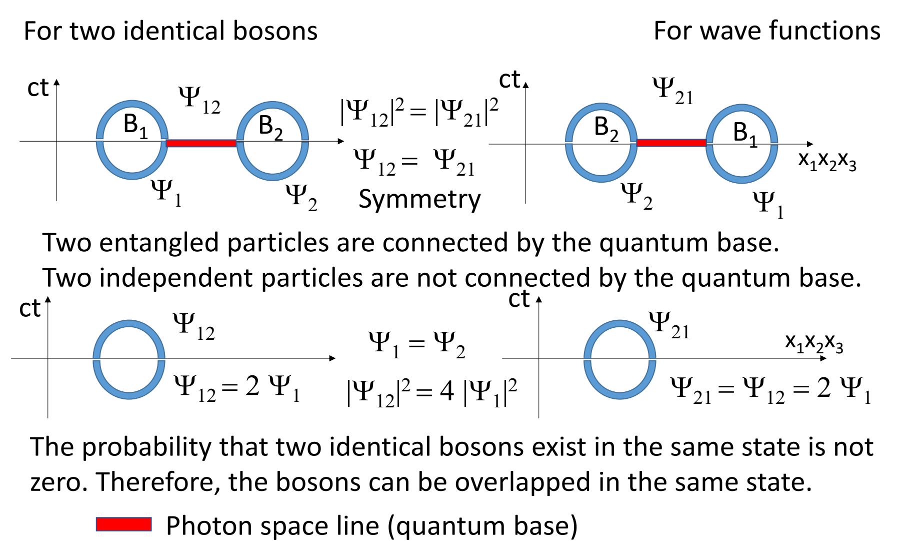

Fig. 18. Two entangled bosons are connected by the quantum base.

local area, the entangled particles are connected by the photon space lines so called as the quantum base (QB) in the present work. Two entangled particles are connected by the quantum base of the photon space line in Figs. 16 and 17 for the fermions and in Figs. 18 and 19 for the bosons. And how the information is instantly transmitted between two entangled particles connected by the quantum base is explained by the time clicking effect of the time fluctuations along the absolute time axis in Fig. 20.

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Quantum entanglement has never been explained successfully even though two entangled photon experiments [33-46] have been carried out. In Figs. 16 and 17, one example of the quantum entanglement is shown for the identical fermions like the electrons. For example, two electrons marked as the 1-particle and 2-particle in Figs. 16 and 17 are entangled in the singlet state (|0,0>). If we detect the 1-electron with the spin up state (|1/2,1/2>), the 2- electron should have the spin down state (|1/2,-1/2>) regardless of the distance between two electrons. Also, if we detect the 1-electron with the spin down state (|1/2,-1/2>), the 2-electron should have the spin up state (|1/2,1/2>) regardless of the distance between two electrons. This is called as the quantum entanglement. In the present work, the quantum entanglement is explained by using the quantum base (QB, the photon space line) in Figs. 16 and 17 for the wave functions and probabilities.

And the gravitational interaction between two elementary fermions is explained by the exchanges of the massive graviton through the graviton base. Quantum entanglement between two elementary fermions is not the interaction caused by the exchange of a boson but means the connection of two elementary fermions. In other words, the 1-electron with the spin up state (|1/2,1/2>) is connected to the 2-electron with the spin down state (|1/2,-1/2>) through the quantum base and the 1-electron with the spin down state (|1/2,-1/2>) is connected to the 2-electron with the spin up state (|1/2,1/2>) through the quantum base as shown in Figs. 16 and 17. The electrons are the xi-xj (or x2-x4) particles and the quantum base between these two electrons is the xi-xj flat space with the time

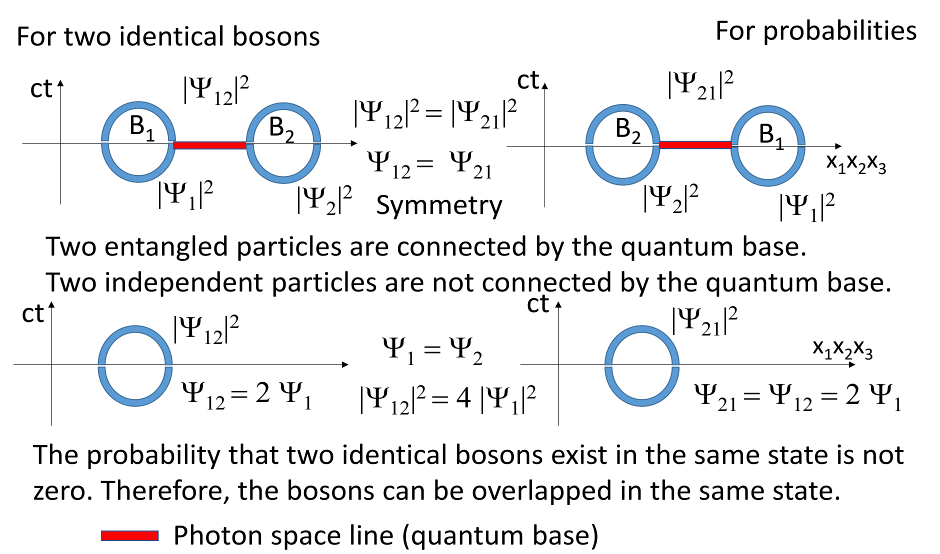

Fig. 19. Two entangled bosons are connected by the quantum base.

width of the quantum time (Δt_q). Whenever we detect the 1-electron with the spin up state (|1/2,1/2>), the 2-electron should have the spin down state (|1/2,-1/2>) regardless of the distance between two electrons because of the quantum base. Also, whenever we detect the 1-electron with the spin down state (|1/2,-1/2>), the2-electron should have the spin up state (|1/2,1/2>) regardless of the distance between two electrons because of the quantum base. Quantum base cannot be observed directly because the time width of the quantum time (Δt_q) is much smaller than the Planck time (t_p) which is the minimum observable time. In summary, the quantum base is introduced successfully in order to explain the quantum entanglement effects at a distance. In Fig. 20, the entangled two particles like the entangled two fermions (F_1 and F_2) form the F_1-QB-F_2 system. The length of the quantum base (QB) can be changed along the $x_1x_2x_3$ space axes. The quantum base is very stiff along the absolute time (ct) axis. The F_1 and F_2 particles move freely along the $x_1x_2x_3$ space axes, but the F_1-QB-F_2 system is fluctuated along the absolute time (ct) axis by the F_1 measurement. When we measure the F_1 particle by clicking the F_1 particle along the absolute time axis, the time fluctuations of the F_1-QB-F_2 system take place along the absolute time axis. Therefore, the F_2 particle entangled to the F_1 particle is instantly chosen regardless of the distance of the quantum base. In Fig. 20, the independent two particles like the independent two fermions (F_1 and F_2) are the F_1 and F_2 particles without the quantum base. When we measure the F_1 particle by clicking the F_1 particle along the

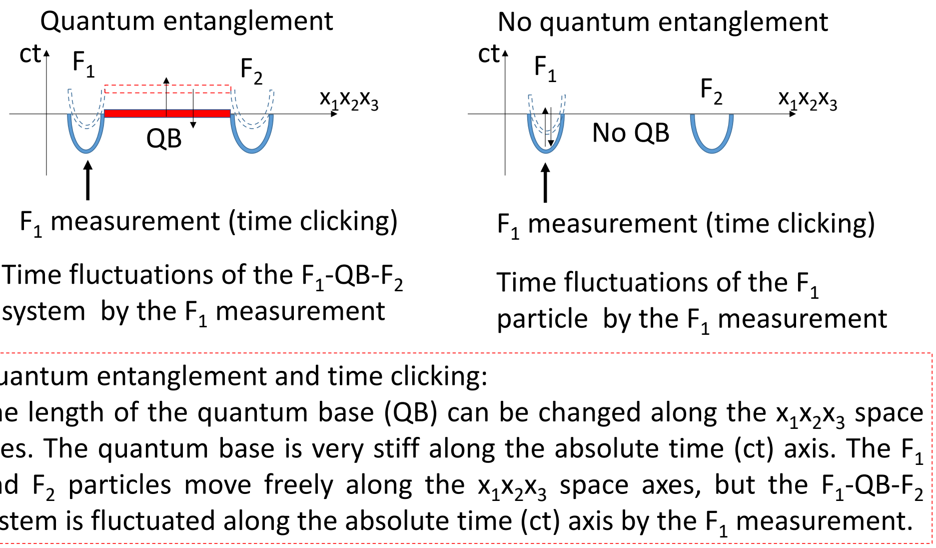

Fig. 20. The F_1 and F_2 particles are instantly affected by the time clicking effect on the F_1 particle because the whole F_1-QB-F_2 system is affected by the time clicking effect of the F_1 measurement.

absolute time axis, the time fluctuations of only the F_1 particle take place along the absolute time axis. Therefore, the F_2 particle without the quantum entanglement to the F_1 particle is not chosen by the measurement of the F_1 particle. The same discussions can be applied to the entangled two bosons in Figs. 18 and 19.

In Figs. 16 and 17, two identical fermions cannot exist in the same space-time locations because the entangled wave function is collapsed to zero. Therefore, the probability that two identical fermions exist on the same state is zero. However, two identical bosons can be overlapped in the same states as shown in Figs. 18 and 19. This is called as the Pauli exclusion principle. Therefore, the Pauli exclusion principle is proved by using the quantum entanglement concept in Figs. 16-19.

5. Summary

In summary, the absolute time, length expansion, particle mass origins, quantum entanglement Pauli exclusion principle and Higgs boson are discussed in terms of the 4-D Euclidean space. For the electric charges (EC), lepton charges (LC) and color charges (CC) of the elementary particles, total 10-D Euclidean spaces of three 3-D quantized spaces and one time axis are required. The 39 elementary fermions (3 dark matters (bastons)(EC), 9 leptons(EC,LC) and 27 quarks(EC,LC,CC)) , 39 elementary bosons (3 dark matter force bosons(EC), 9 weak force bosons(EC,LC) and 27 strong

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force bosons(EC,LC,CC)), three gravitons (g(0), g(0,0) and g(0,0,0)) and three photons(γ(0), γ(0,0) and γ(0,0,0)) exist in nature in terms of the 3-D quantized space model based on the 10-D Euclidean space. For more details of the elementary particles, see ref. [1].

The length expansion of $\Delta x = \gamma \Delta x_0$ and the relative time expansion of $\Delta t_l = \gamma \Delta t_{l0}$ are derived from the relation of the relative time and absolute time in the 4-D Euclidean space in terms of the 3-D quantized space model. Then the moving particle experiences the size expansion of $\Delta x = \gamma \Delta x_0$. The length expansion is derived under the condition of the absolute time simultaneity in terms of the present 3-D quantized space model. Because our universe follows the absolute time simultaneity but not the relative time simultaneity, the length expansion is obtained. The relative time simultaneity gives the length contraction of $\Delta x = \Delta x_0/\gamma$ as expected in the special relative theory. From the similarity between this length expansion of $\Delta x = \gamma \Delta x_0$ and the energy increasing of $E = \gamma E_0$, it is assumed that the energy is proportional to the particle size of Δx. The extension of this assumption to the 4-D Euclidean space gives the new definition that the particle energy (E) is the 4-D space volume. Then, the particle mass energy is defined as $E= mc^2 = c\Delta t\Delta V = \gamma E_0$. The masses of the elementary particles are originated from the 4-D warped volume of the photon space because the particle is the warped photon space with the velocity of $v < c$. Therefore, the Higgs boson concept in the standard model (SM) is not required in the present 3-D quantized space model (TQSM). The scalar boson with the spin of zero, photon with the spin of 1 and graviton with the spin of 2 are the two-boson states. Therefore, the observed Higgs boson is reinterpreted as the two-boson state of the scalar boson with the spin of zero. The photons which are the flat photon space with the constant speed of c along the space axis and absolute time axis have the 4-D photon velocity of $c_{eff} = \sqrt{2}$ c. The 3-D photon space is very stiff along the absolute time (ct) axis and very soft along the space axes. The Coulomb force through the photons (2EM waves) of the space fluctuations is much stronger than the Gravitational force through the gravitons (G waves) of the time fluctuations between two electrons.

The cosmic muon observation and twin paradox are explained by using the absolute time and relative time. The length expansion and relative time expansion are, successfully, applied to the cosmic muon observation and twin paradox. For the twin paradox, two person have the same absolute time ages but the different relative time ages. The relative time age is the observed time age. Therefore, a person who travels the long distance is more aged than a person on the earth in terms of the relative time ages because of the space and time conversion effect (STCE effect) of the moving space distance (x). But twins are in the same ages in terms of the absolute time without the space and time conversion effect (STCE effect) of the moving space distance (x). When the same argument is applied to the fast-moving cosmic muon, the cosmic muon can travel the longer distance from the length expansion and relative time expansion. For the twin paradox, there are three ages when two twins meet at the same location. Two relative time ages (observed relative ages) and one absolute time ages (real ages). For example, when they meet, the A person is 50

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years old and another B person is 100 years old. Two persons have the same absolute time ages of 40 years old. The absolute time ages of 40 years old are the real ages of the twins.

Also, the quantum entanglement and Pauli exclusion principle are explained. The quantum base of the photon space line connects two entangled particles. Two particles and quantum base system is fluctuated along the absolute time axis by the time clicking when one particle is measured. Another particle is instantly selected by the time clicking. This is called as the quantum entanglement. The entangled particles can move freely along the space axes because the length of the quantum base can be easily changed along the space axes. But it is very hard to warp and bend the quantum base along the absolute time axis. This means that the quantum base is very stiff. Therefore, when we click the one particle by the experimental measurement, the two particles and quantum base system is fluctuated together along the absolute time axis. When the one particle is chosen by the time clicking, another particle is instantly chosen by the time fluctuation. This is called as the quantum entanglement. Also, Pauli exclusion principle is explained by using the quantum entanglement and wave functions. The elementary fermions cannot be overlapped at the same states with the same space-time locations. However, the elementary bosons can be overlapped at the same states with the same space-time locations.

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