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Physical properties of elementary particles, photon space and quantum wave functions

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Abstract;
The time symmetry of $T_c = CT$ is redefined based on the 4-D Euclidean space. The time inversion symmetry of $T_c = CT$ changes the signs of the charge (q) and absolute time (ct) of the particle. The P symmetry changes the signs of the space momenta and handedness of the particle. The T_c symmetry changes the signs of the time momentum (P_t=E/c) and charges. The handedness are classified as the left-handedness and right-handedness on the 3-D space. The charges ($|q| = c\Delta t$) and energies ($E= c\Delta t\Delta V$) of the particles are originated from the upward warping ($q>0$) and downward warping ($q<0$) of the particles along the time axis. The evolution of our matter universe with $P_t > 0$ since the big bang can be interpreted based on the CTP symmetry with the partner antimatter universe with $p_t < 0$. The photon space is called as the vacuum space. Then the E and M waves are the space fluctuations, and the gravitational G wave is the time fluctuations. And the E, M and G fields are newly explained. The zero E and M fields of the photon space indicates that the photon space and gamma ray are the 2EM waves. The rest mass energy of the particle is the 4-D space volume of the warped photon space. In the present work, the quantum wave function is considered as the 4-D vector with the space wave function and time axis wave function in the 4-D Euclidean space. The warped photon space corresponds to the squared wave function which is the probability density. It is concluded that, in the quantum mechanics, the imaginary number concept is introduced in the quantum wave functions instead of the time axis component of the 4-D wave function vector. The left-handed neutrino puzzle is explained from the handedness partner relation with the right-handed dark matters. Finally, the modified Lorentz transformations derived in the 4-D Euclidean space are compared with the Lorentz transformations of the special and general relativity theories in the 4-D Minkowski space.

Key words; T_c symmetry; CTP symmetry; Photon space; Elementary particles; Quantum wave functions; Modified Lorenz transformations; Left-handed neutrinos; Right-handed dark matters.

Contents

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1. Introduction

The origins of the masses (energies) and electric charges (EC) are uncertain in terms of the standard model (SM) based on the 4 - D Minkowski space. The masses (energies) are positive and electric charges have the positive and negative values. The relative time of ct (ct_l in the present work) is only increasing to the positive direction in standard model. Under the T symmetry, t is changed to -t and the energy (mass) is always positive in terms of SM. Therefore, the time momentum of p_t = E/c is always positive. And the space momenta of p_x, p_y and p_z are changed to the space momenta of $-p_x$, $-p_y$ and $-p_z$ because t is changed to -t and m is always positive. But under the P symmetry, the energy and time momentum are positive and the space momenta of p_x, p_y and p_z are changed to the space momenta of $-p_x$, $-p_y$ and $-p_z$ because the space position values of x, y and z are changed to the space position values of -x, -y and -z. Then, under the TP symmetry, the four momenta are not changed. This result comes from presumptions that the energy and mass are always positive and the time of ct is always increasing to the positive direction in our present universe since the creation of the space-time by the big bang. This presumption is true from the observations in our matter universe. However, in terms of the standard model (SM) based on the 4 - D Minkowski space, the condition that the time momentum (p_t=E/c) is not changed under the T symmetry is strange because the space momenta are changed under the P symmetry.

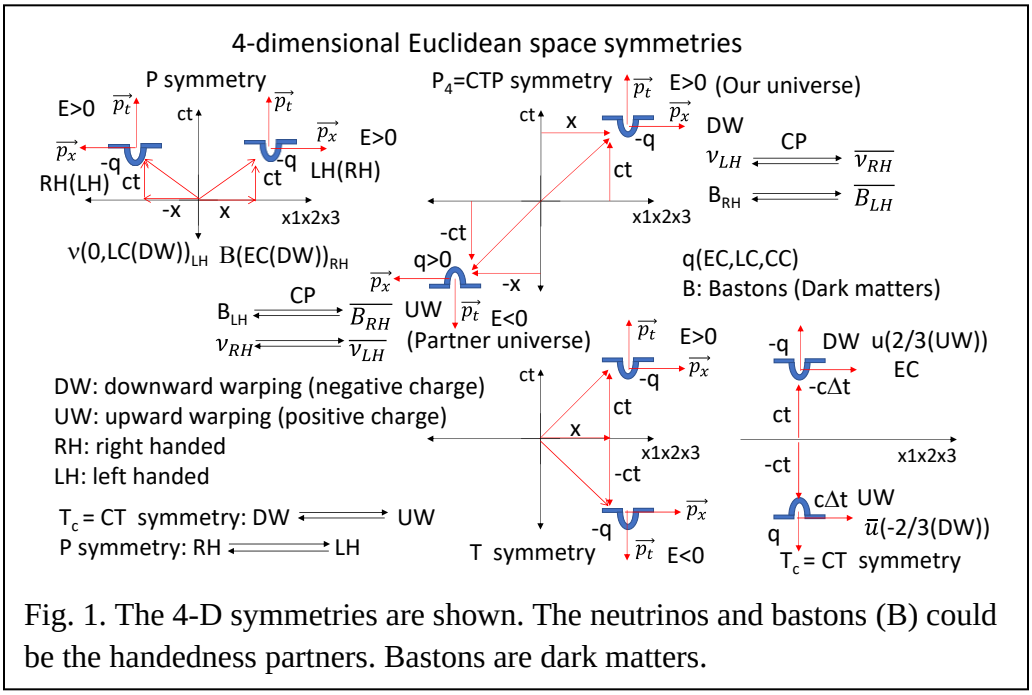

Fig. 1. The 4-D symmetries are shown. The neutrinos and bastons (B) could be the handedness partners. Bastons are dark matters.

The masses (energies) and electric charges independent of the 3 - D space directions are quantized for elementary particles in the standard model [1-11]. The particles are massless in the standard model. The electrically charged particles with the left and right handedness get the masses by the Higgs mechanics including the Higgs bosons in SM. The left-handed neutrinos have the zero masses in the standard model. The observed non-zero neutrino masses could be explained by introducing the Majorana particles following the Seesaw mechanics. In standard model, the total energy is conserved for the most physical processes. However, the energy conservation can be broken for the quantum fluctuations under the uncertainty principle of $\Delta t \Delta E > \hbar/2$ with the very short time gap of Δt. First case of the energy non-conservation is the big bang event that took place

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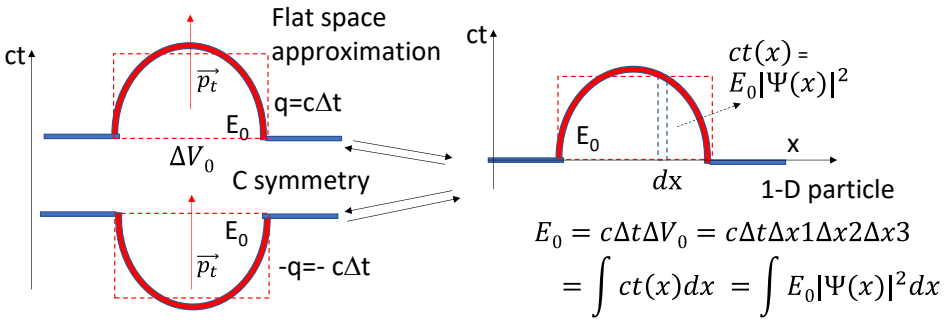
from the quantum fluctuations. The singularity of the space and time with the huge positive energy was created from the nothing with the zero energy by the quantum fluctuations. This singularity was evolved to our universe by the big bang and inflation without giving the charge information. Because the positive energy was created from the nothing, the energy conservation is broken. This physical process is allowed only by the uncertainty principle. The second case of the energy non-conservation is the quantum fluctuation making the pair production and annihilation of virtual particle and virtual anti-particle from the nothing. The electric charges are conserved because total electric charge is zero in the quantum fluctuation. But the energy conservation is instantly broken under the uncertainty principle because the positive energy is created from the nothing with the zero energy. To explain the quark confinements in the mesons and baryons, the quantum



Charge conservation for the elementary particles: q=cΔt = constant.
The absolute time width (cΔt) and its associated charge (q = cΔt) for the elementary particles are, always, constant in all coordinate frames.

Lorentz transformations for the elementary particles:

$\lim_{v\to c} \Delta t \to \Delta t, \lim_{v\to c} \Delta t_l \to \infty, \lim_{v\to c} \Delta x \to \infty, \lim_{v\to c} E \to \infty, \lim_{v\to c} \Delta V \to \infty.$

$\Delta x = \gamma\Delta x_0$, $v = \Delta x/\Delta t_l$, $E = c\Delta t\Delta V = |q|\Delta V = c\Delta t\gamma\Delta V_0 = \gamma c\Delta t\Delta V_0 = \gamma|q|\Delta V_0 = \gamma E_0$

Fig. 2. The warped photon space of the particle is connected to the wave function in the quantum mechanics.

chromodynamics (QCD) is introduced in the standard model. The three color-charges and gluons in the strong interaction corresponding to the photon in the Coulomb interaction are proposed. But how the quarks are strongly confined in the hadrons and why the independent quarks are not found are the interesting and unsolved questions.

Now I will explain the photons and particles in our universe with the positive energy in the 4-D Euclidean space in Figs. 2 and 3. The photon space is the flat space with the time width of $c\Delta t_q$. This flat space moves along the positive time axis of ct with the constant light velocity of c = x4/t. This means that the time of t is the absolute time but not the relative time. The time axis of ct is fixed for our universe. The observed time of t_l is the relative time corresponding to the 4 - D distance of the space and time. This time axis of ct_l is changed according to the velocity of $v = \Delta x/\Delta t_l$ of the particle. The relation of ct_l and v is shown in the modified Lorentz transformations of the TQSM which are modified from those of the special relativity. In other words, the special and general relativity theories are built based on the 4-D distance concept of the 3 - D space and 1 - D time. However, the quantum mechanics are based on the 4-D volume of the 3 - D space and 1-D time. This means that the absolute time of t is used for the wave functions of the quantum

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mechanics and the relative time of t_l is used for the special and general relative theories. In the present work, the particles are defined as the warped shape of the photon space and the flat shape of the photon space is called as the photon or gamma ray. These warped shapes have the 4 - D volumes which are defined as the (rest mass) energy. Therefore, the 4 - D volumes of the particles can be expressed by using the wave functions of the quantum mechanics. The special and general relative theories to see the 4 - D distance and the quantum mechanics to see the 4 - D volume deal with the same warped shape of the photon space from the different perspectives.

The E (electric) waves have the E fields and the M(magnetic) waves have the B fields. Therefore, the EM waves have the E fields and B fields. The photons of the background photon space do not have the E and M fields. The zero E and zero B fields of the photon space indicate that the photons of the background photon space are the 2EM waves which are made of one EM wave with the E and B fields and another EM wave with the opposite E and B fields. This means that the gamma rays with the zero E and zero B fields are the 2EM waves in Fig. 3. All forces between particles are transmitted through the photon spaces with the 2EM waves.

2. CTP symmetry and 4-D momenta in terms of the 3-D quantized space model

The 3 - D quantized space model (TQSM) based on the 4 - D Euclidean space is newly reviewed and introduced in the present work. In terms of the TQSM, the time momentum (p_t=E/c) is changed under the T symmetry and the space momenta are changed under the P symmetry in Fig. 1. The sign of the charge is changed under the effective time symmetry of T_c = TC in Fig. 1. Therefore,

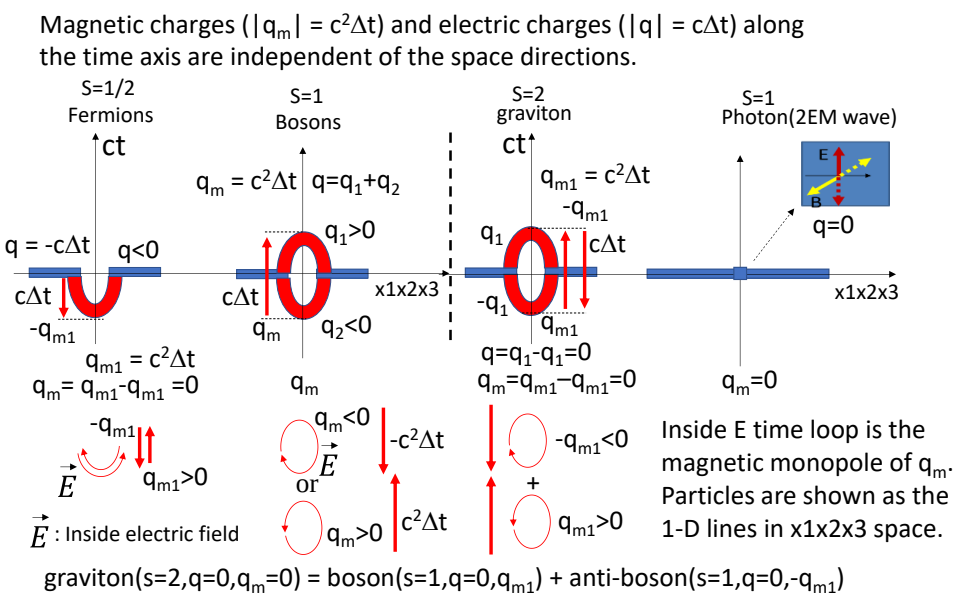

Fig. 3. The elementary particles including the photon and graviton are defined based on the warped photon space. The magnetic charges are defined for the bosons.

the effective time symmetry of T_c is the TC symmetry in Fig. 1. This means that the 4 – D space symmetry of P_4 = = T_cP = CTP can be defined. In the TQSM, the time axis of ct along the 4th axis is the absolute time axis and the relative time is defined as the 4-D distance axis of ct_l. The time

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and space values of ct, x, y and z are changed to the time and space values of -ct, -x, -y and -z under the $P_4 = CTP = T_cP$ symmetry. Therefore, the four momenta of p_t, p_x, p_y and p_z are changed to the four momenta of $-p_t$, $-p_x$, $-p_y$ and $-p_z$ under the TP symmetry. And the charge (q) of the particle is changed in the sign. Therefore, the energy can have the positive (positive time momentum) and negative (negative time momentum) values. The matter or photon space with the negative time momentum (negative energy) moves along the negative direction of the time (ct) axis. Our matter universe with the negative charges and positive energy has the partner anti-matter universe with the positive charges and negative energy under the $P_4 = CTP$ symmetry. The C and P symmetries do not change the energy and time momentum. Therefore, the C and P symmetries are applied on the same universe with the same signs of the energy and time momentum. However, the T symmetry connects the universe with the positive energy and positive time momentum and the partner universe with the negative energy and negative time momentum. The CTP symmetry can give the answers to the unsolved problems of the big bang event, the missing dark energy question, the missing dark matter question, elementary particle production and universe evolution etc. in terms of TQSM. The 4-D momenta can be defined based on the 4-D Euclidean space as shown in Fig. 1. The absolute time is the time along the time axis of ct. The relative time is the 4-D space distance of the 4-D Euclidean space which means the 4-D space-time. This 4-D space distance of $d=ct_l$ is changed depending on the velocity of the particle. This is what is described in the special and general relativity theories.

In the three dimensional (3 - D) quantized space model (TQSM) based on the 4 - D Euclidean space, the origins of the energies (masses) and charges are proposed and defined as shown in Figs. 1, 2 and 3. Then, the energy is positive or negative like the electric charge is negative or positive. First, the energy should be always conserved. In other words, the positive energy cannot be created

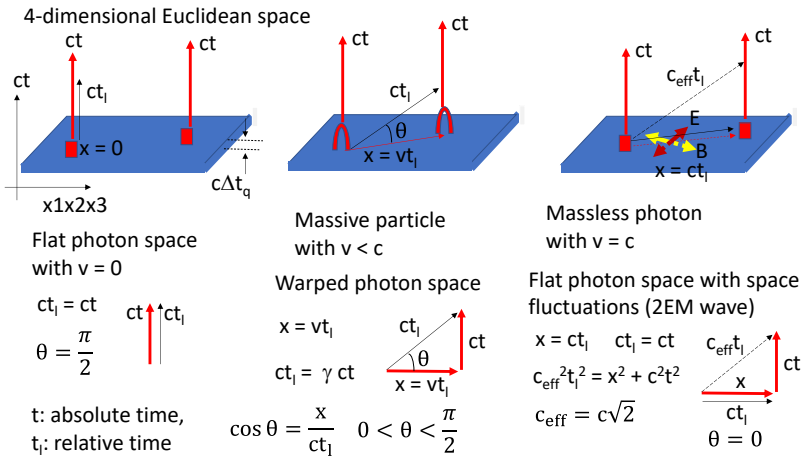

Fig. 4. The Flat photon space and warped photon space are compared.

from the nothing. The 4-D Euclidean space is the 3 - D space of x0y0z0 and 1-D time axis of ct. Here, c is defined as the constant photon (light) velocity. The 3-D quantized x1x2x3 space has the quantum time width of $c\Delta t_q$. The time axis of ct is the absolute time axis which does not change with changing of the particle velocity. The relative time axis of ct_l changes with changing of the particle velocity following the Lorentz transformation of the special relativity. Here, the 4 - D distance of $d=c\Delta t_l$ is expressed as $d^2 = (c\Delta t)^2 = \Delta x^2 + (c\Delta t)^2$. The relative time lapse of $c\Delta t_l$ is the

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4-D distance and the real time is the absolute time lapse of $c\Delta t$. The observed time in our lives is the relative time of ct_l. The system of 3 - D space and the 1-D relative time (ct_l) is called as the 4-D Minkowski space. The 4-D momenta are the (absolute) time momentum of $p_t = E/c$ and the 3 - D space momentum of p_x. And the relative total momentum of $p_{tl} = E_{total}/c$ is given. The total energy is E_{total}. Then $p_{tl}^2 = p_t^2 + p_x^2$. And $E_{total}^2 = E^2 + P_x^2c^2$. This is very important. Because the positive time momentum of $p_t = E/c > 0$ is along the positive time direction of the time axis of ct with the constant velocity of $c = x/t$, the negative time momentum of $p_t = E/c < 0$ is along the negative time direction. Then, the particle with the positive energy moves along the positive time axis and the particle with the negative energy moves along the negative time axis in Fig. 1. Because our universe has the positive energy and the matters, our universe is the matter universe with the negative charge and positive energy along the positive time axis. Therefore, from the energy and charge conservation, the partner anti-matter universe with the negative energy and positive charge

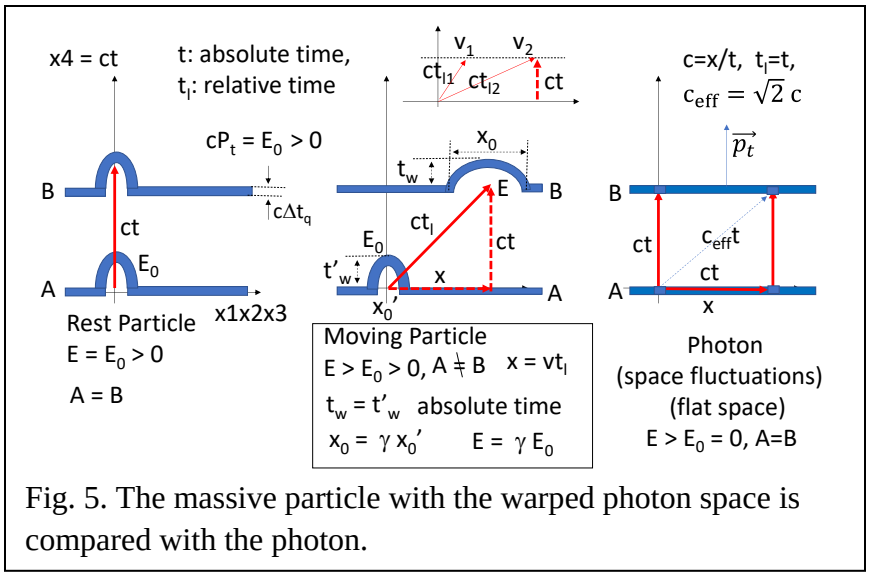

Fig. 5. The massive particle with the warped photon space is compared with the photon.

along the negative time axis should exist under the CPT symmetry. The pair creation of the virtual particle and virtual anti-particle with the positive energies cannot be made from the nothing with the zero energy because of the energy conservation. This indicates that the vacuum in our universe is the photon space which has the small quantum energy. Then the virtual particle and virtual anti-particle with the positive energies can be created from the background photon space with the positive energy. Then the energy and charge conservation is met for this quantum fluctuations.

3. Physical properties of the photon space, and force unification by the GEM waves

First of all, we are living on the x1x2x3 space associated with the absolute time of ct. Our x1x2x3 matter universe is located and moving along the time axis of ct on the x0y0z0 mother space associated with the same time axis of ct. We are living the instant present life with the very short time width of the time fluctuations. If the time width (time fluctuations) is rather long, we can move to the future and to the past. Because this time travel is not observed and our lives are stuck on the present time, the time fluctuations (time width) of our universe are assumed to have the short quantum time width of $c\Delta t_q$. This x1x2x3 space with the short quantum time width of $c\Delta t_q$ is called as the photon space of our universe. This photon space is the flat space without the warping toward the time axis of ct. The space fluctuations along the two space axes within the flat photon space are called as the electric (E) waves and magnetic (M) waves. The remaining one space axis

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is the space momentum direction of the photons. The physical properties of the E and M waves, and gravitational (G) wave are discussed in the present work. The time fluctuations are defined as the G waves. Because our universe is the 3-D quantized space, we have the E, M and G waves.

In Fig. 3, the flat photon space can be called as the vacuum space because there are no matters. In this case, the whole photon space can be considered as one particle moving along the absolute time axis with the photon velocity of c = x4/t. The internal photons move with the velocity of c within the x1x2x3 photon space. Because the whole photon space moves along the absolute time axis with the velocity of c, the effective 4-D velocity (c_{eff}) of the internal photons is $c_{eff} = c\sqrt{2}$ in Figs. 4 and 5 The massive particle is defined as the warped photon space along the absolute time axis of ct as shown in Figs. 2, 3 and 5. The mass of the particle is defined from $m = E/c^2$ and m = F/a. The mass can be described as the energy of $E=mc^2$. It is thought that the mass is proportional to the 4-D volume of the warped photon space. The flat photon space will have the zero mass. In the present work, the energy of the massive particle is the 4-D space volume of the warped photon space in Fig. 2. Because of the non-zero mass, the massive particle has the slow velocity of v < c. Then the energy is defined as $E = c\Delta t\Delta V$ and $m = \Delta t\Delta V/c$. The warped x1x2x3 photon space of the particle has the EC charge. The electric charges (ECs) of the elementary particles are defined as $q = c\Delta t$ in Fig. 2. The positive EC charge of q > 0 is $c\Delta t$ and the negative EC charge of q < 0 is $-c\Delta t$. The charges of the elementary particles can be quantized. The rest particle, moving particle and photons are compared in Figs. 3 and 4. The same concept can be applied to the LC and CC charges.

The photon space consists of the internal photons which are the 2EM waves. The photon (2EM waves) has the zero E and zero B fields. The E (electric) waves have the E fields and the

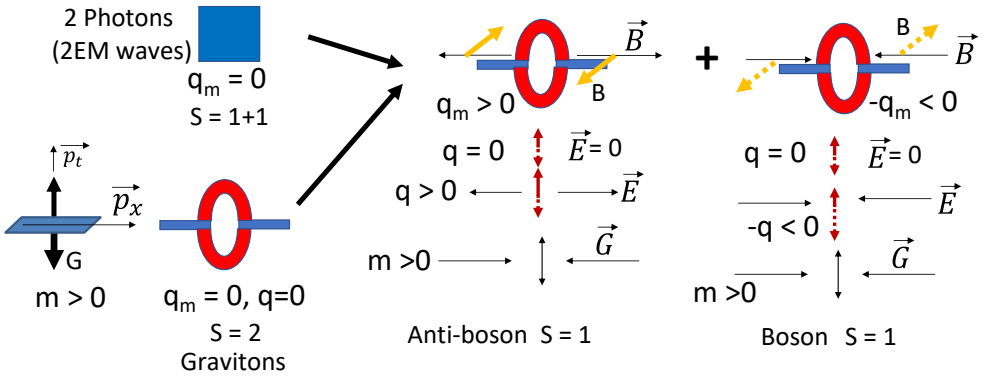

Fig. 6. The gravitons and photons decay to the boson and anti-boson.

M(magnetic) waves have the B fields. Therefore, the EM waves have the E fields and B fields. The photons of the background photon space do not have the E and M fields. The zero E and zero B fields of the photon space indicate that the photons of the background photon space are the 2EM waves which are made of one EM wave with the E and B fields and another EM wave with the opposite E and B fields. In the present work, the B field and M field are interchangeably used. This means that the gamma rays with the zero E and zero B fields are the 2EM waves. The E and M waves have the internal E and M fields. The gravitational waves also have the internal G fields. In the present work, the G wave is the time fluctuations of the photon space. And the E and M waves are the internal space fluctuations of the photon space. The gamma rays are the 2 EM waves with the velocity of c. The gravitation waves are transmitted as the GEM waves that consist of the G

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waves and 2EM waves. The gravitational waves of the GEM waves have the velocity of v < c. In other words, the graviton consists of the G waves and the graviton has the rest mass with the velocity of v < c. All forces between particles are transmitted through the photon spaces with the 2EM waves. Therefore, the photons are the intermediators for the gravitational force and Coulomb force. All forces can be unified by the GEM wave concept.

4. Elementary particles and warped photon spaces

The elementary fermions, elementary bosons, graviton and photons are defined based on the photon space in Figs. 3, 6 and 7. The massive particles are the warped photon space, and the photon is the flat photon space. The elementary particles have the physical properties such as the spins, electric charges, magnetic charges (for the first time, proposed in the present work), rest masses (rest energies) which are defined based on the warped photon spaces. The rest energy of the particle is defined as the 4-D volume of E = cΔtΔV in Figs. 2 and 3. It is proposed that the elementary bosons are the magnetic monopoles with the magnetic charges like the elementary fermions are the electric monopoles with the electric charges in Fig. 3. The electric charges and magnetic charges are newly defined in Fig. 3.

The 2 EM wave can be separated into the EM wave with the E and B field with the direction to the right and another EM wave with the E and B fields with the direction to the left as shown in

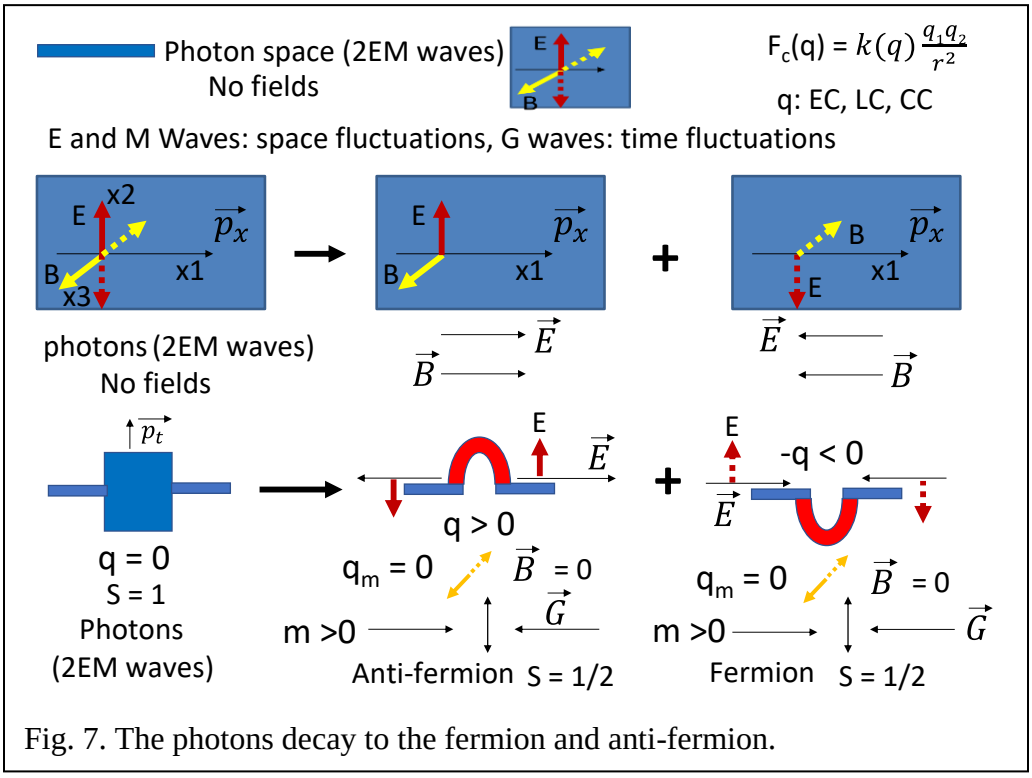

Fig. 7. The photons decay to the fermion and anti-fermion.

Fig. 7. And the photons (2EM waves) can make the pair creation of the fermion and anti-fermion in Fig. 7. And the 2 photons (2EM waves) can make the pair creation of the boson and anti-boson in Fig. 6. The gravitons can produce the pair of the boson and anti-boson in Fig. 6. In these events, the total energy should be conserved. The charges like the electric charges (ECs) should be

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conserved but the magnetic charges like the magnetic electric charges (MECs) can be created or destroyed in these events as shown in Fig. 8.

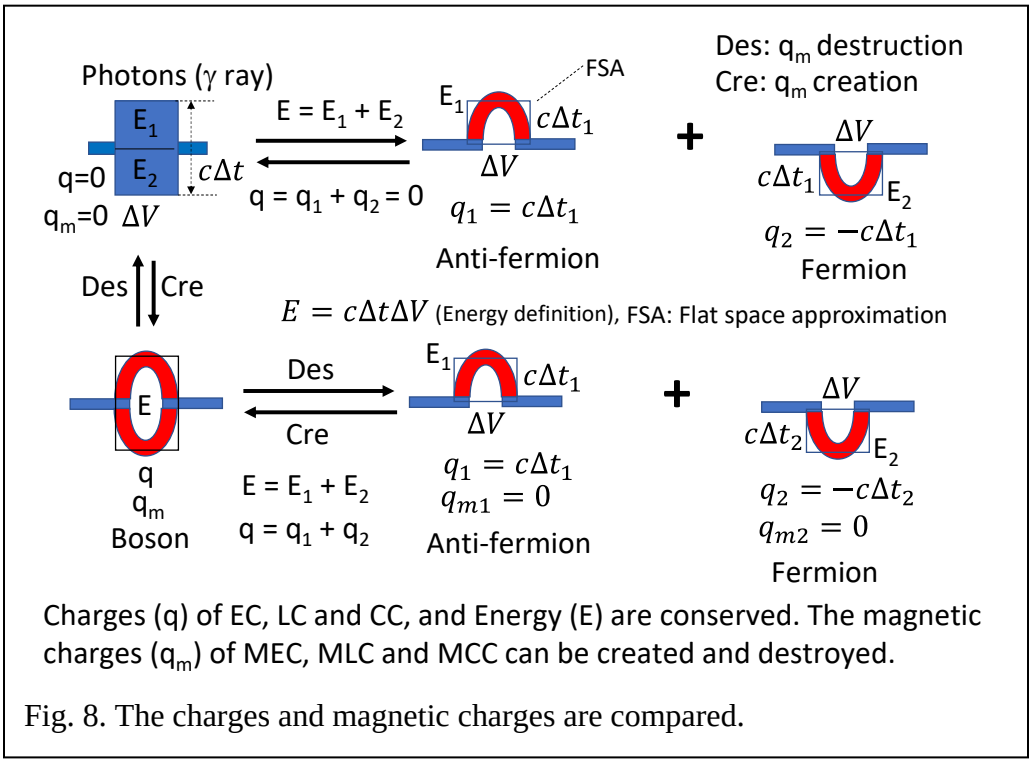

Fig. 8. The charges and magnetic charges are compared.

Space fluctuations (E, M, 2EM fields, photons, m = 0) move with the constant light velocity (c). The time fluctuations (G field, gravitons, m >0) move with the variable velocity (v) of v < c on the 2EM photon space. The G wave moves on the photon space with the 2EM waves and the G and 2EM waves can be combined to make the GEM waves.

5. Origins of the wave functions and imaginary numbers

The wave function and imaginary numbers are originated from the time component along the absolute time axis as shown in Figs. 2, 9, 10 and 11. The elementary particles are described as the wave function in the quantum mechanics [12-14]. The squared wave functions are the probability densities to find the particles as the function of the space and time coordinates. On the 4-D Euclidean space, the probability of the particle is the same to the 4-D shape of the warped photon space in Fig. 2. This indicates that the probability of the particle is the 4-D probability which has the space and time components in Fig. 2. In other words, $\Psi^2 = \Psi_x^2 + \Psi_t^2$. In this case, the wave function is the 4-D vector which has the space and time components. In other words, $\Psi\,\hat{l} = \Psi_x\,\hat{x} + \Psi_t\,\hat{t}$ in Fig. 9. In Fig. 10, the 4-D vectors on the 4-D Euclidean space can be converted to the complex numbers observed on the 3-D Euclidean space. These complex numbers have the complex conjugate property. The imaginary numbers in the complex numbers are the time axis components of the 4-D vector, the imaginary components should have the physical meaning. The complex conjugated numbers always can converted to the 4-D vectors on the 4-D Euclidean space. In Fig. 10, the 4-D distance vector and 4-D momenta on the 4-D Euclidean space are converted to the complex conjugate of the 3-D real Euclidean space and imaginary numbers. The same concept is applied to the quantum wave functions in Figs. 2 and 9. In Fig. 11, the quantum wave functions

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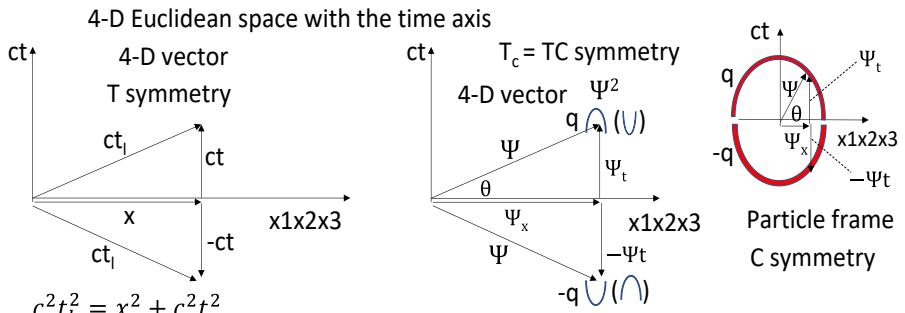
have the imaginary component. This imaginary component is originated from the time axis component of the wave functions in the 4-D Euclidean space.



$c^2 t_l^2 = x^2 + c^2 t^2$

$ct_l\,\hat{l} = x\,\hat{x} + ct\,\hat{t}$ or $ct_l\,\hat{l} = x\,\hat{x} - ct\,\hat{t}$

4-D 3-D time

x: 3-D space distance component,
ct: (absolute) time component,
ct_l: 4-D distance (relative time) vector component

$\Psi^2 = \Psi_x^2 + \Psi_t^2$ 4-D probability density

$\Psi\,\hat{l} = \Psi_x\hat{x} + \Psi_t\hat{t}$ or $\Psi\,\hat{l} = \Psi_x\hat{x} - \Psi_t\hat{t}$

Ψ_x: 3-D space component, $\Psi_x = \Psi\cos\theta$,
Ψ_t: (absolute) time component, $\Psi_t = \Psi sin\theta$
Ψ : 4-D vector wave component,
$P = \Psi^2$: probability density

The wave functions of Ψ_t and $-\Psi_t$ describe two particles with q and –q, respectively, under the T_c=CT symmetry.

Fig. 9. The wave functions with the time components instead the imaginary components are shown based on the 4-D Euclidean space.

In the quantum mechanics, the imaginary concept instead of the absolute time axis is introduced as shown in Fig. 11. In this case, the time component is treated as the imaginary number with i^2 = -1. The space component is treated as the real number. Then the space and time component of the 4-D vector is changed as the real and imaginary numbers of the 3-D space. In other words, $\Psi\,\hat{l} = \Psi_x\,\hat{x} + \Psi_t\,\hat{t}$ in Fig. 16 is replaced by $A = i\Psi = \Psi_x + i\Psi_t$, and $A^* = -i\Psi = \Psi_x - i\Psi_t$ in Fig. 18. Here, $A = i\Psi$ can be called as 4-D complex component. It is interesting that the quantum mechanics uses the absolute time and special and general relativity theories use the relative time. It is because the quantum mechanics is related with the 4-D volume of the particle and the special and general relativity theories are related with the 4-D distance of the moving particle. As seen more clearly in the particle frames of Figs. 9 and 11, the shape of the wave function is flipped on the space axis when the time component of the wave function is reversed in the sign. In the present work, the charge is defined as the q = cΔt and -q = -cΔt in Fig. 2. This indicates that when the time component of the wave function is reversed in the sign, the charge of the particle is reversed in the sign. This is the C symmetry. The squared wave function in the quantum mechanics is the probability density of the particle in Fig. 2, 9, 10 and 11. Therefore, the (absolute) time component of the probability density of the particle on the 4-D Euclidean space is given as the imaginary component of the probability density of the particle on the real 3-D space. The real number component of the wave function can describe the projection of the probability density on the 3-D space of the 4-D Euclidean space. The imaginary component of the wave function can describe the projection of the probability density on the absolute time axis of the 4-D Euclidean space. Therefore, Total probability density of the particle should be described on the 4-D Euclidean space. In other words, the (absolute) time component and 3-D space component of the wave function are required to describe the warped photon shape of the particle on the 4-D Euclidean space. Therefore, the wave function is considered as the 4-D vector on the 4-D Euclidean space as shown in Fig. 9.

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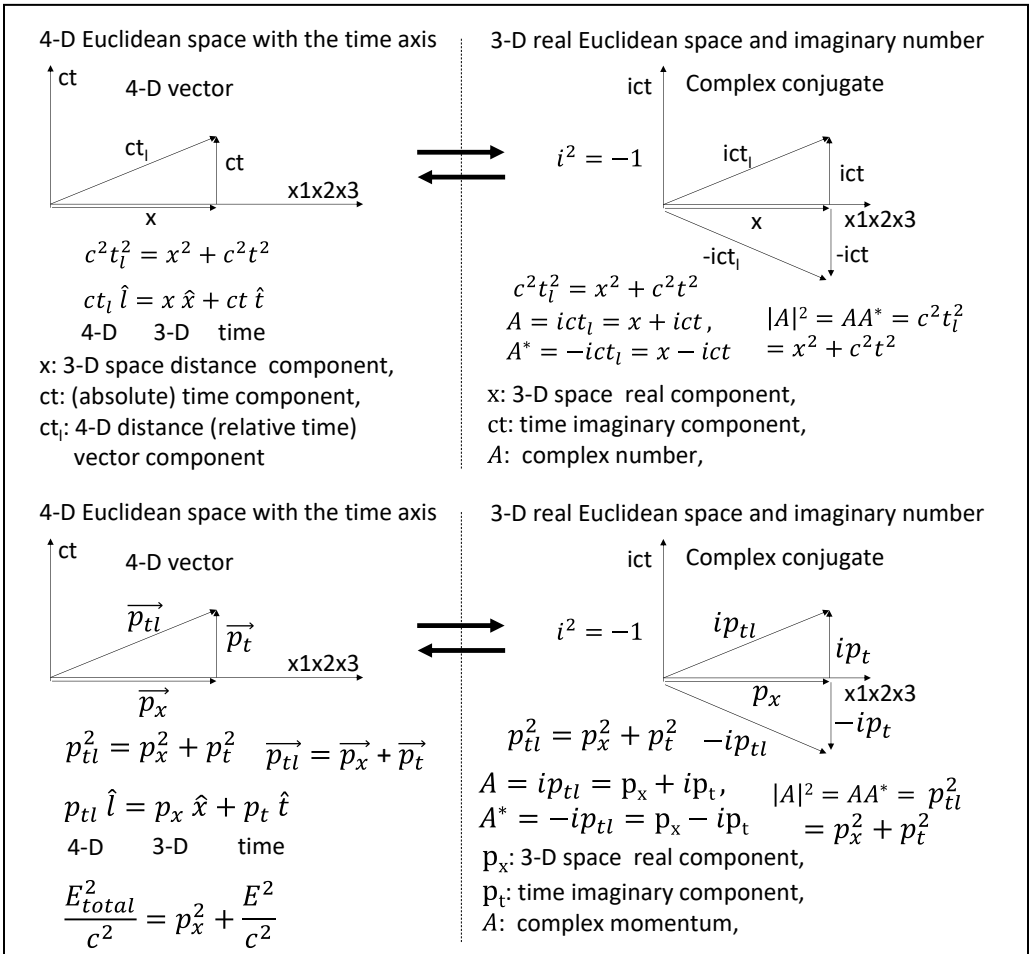

Fig. 10. The imaginary numbers instead of the time component in the 6-D Euclidean space are introduced with the real numbers observed in the 3-D Euclidean space for the 4-D distance vector and 4-D momentum vector.

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6. Modified Lorentz transformations

The Lorentz transformations have been studied on the special relativity based on the 4-D Minkowski space. Then the time of ct (ct_l in the present work) is changing with the space movement of the particle. Therefore, the time in the Lorentz transformations is expressed as the

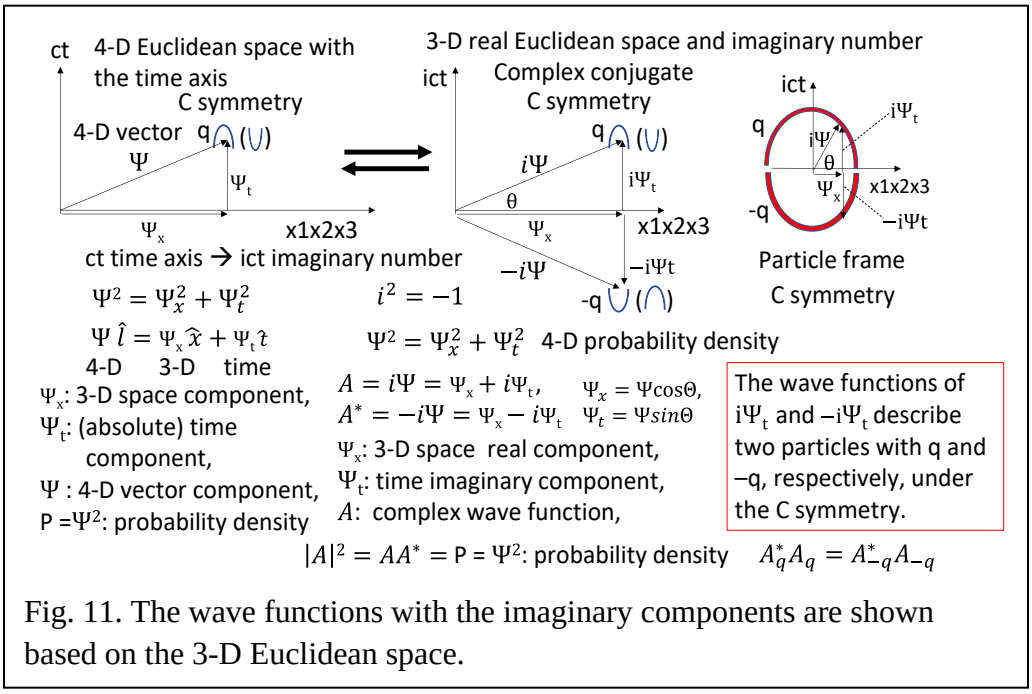
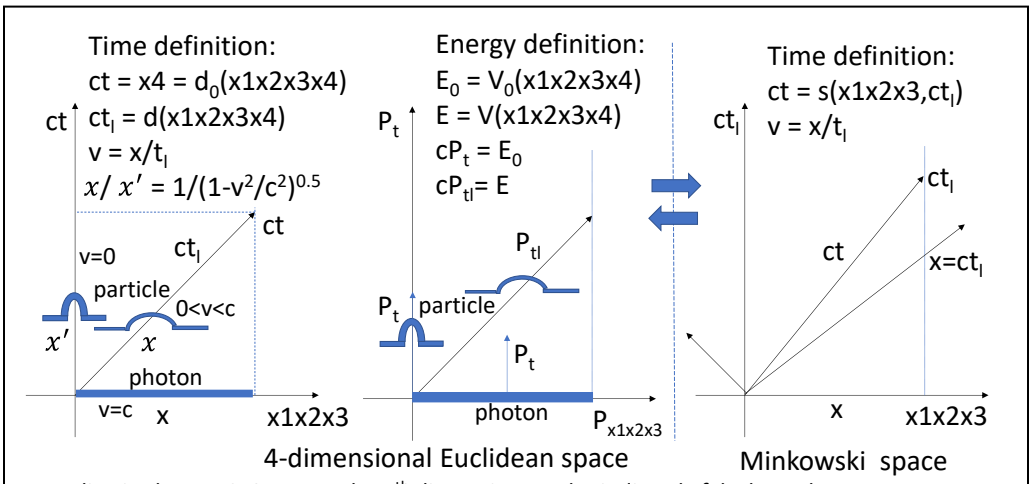


Fig. 11. The wave functions with the imaginary components are shown based on the 3-D Euclidean space.



We live in the x1x2x3 space. The 4th dimension can be indirectly felt through the observation of the relative time (ct_l) and energy (cP_{tl}). The space-time distance is $d(x1x2x3x4) = ct_l$. The rest mass (m_0) is defined as $m_0=E_0/c^2$.

Fig. 12. The Lorentz transformations in the 4-D Minkowski space should be modified on the 4-D Euclidean space.

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function of the velocity of the moving frame when the time is observed from the rest frame. The Lorentz transformations can be made on the 4-D Euclidean space in Fig. 12. The relative time axis

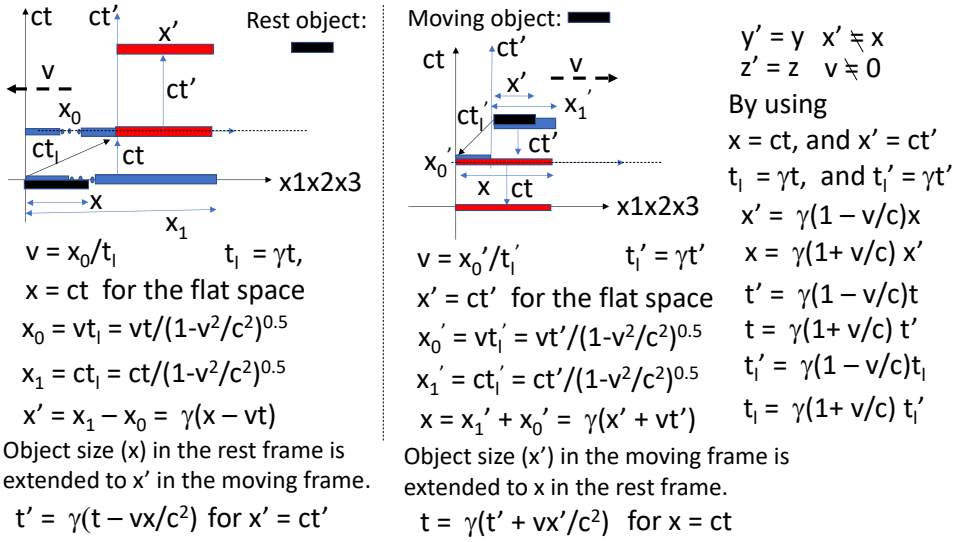

Fig. 13. The modified Lorentz transformations are derived based on the 4-D Euclidean space without the time-matching.

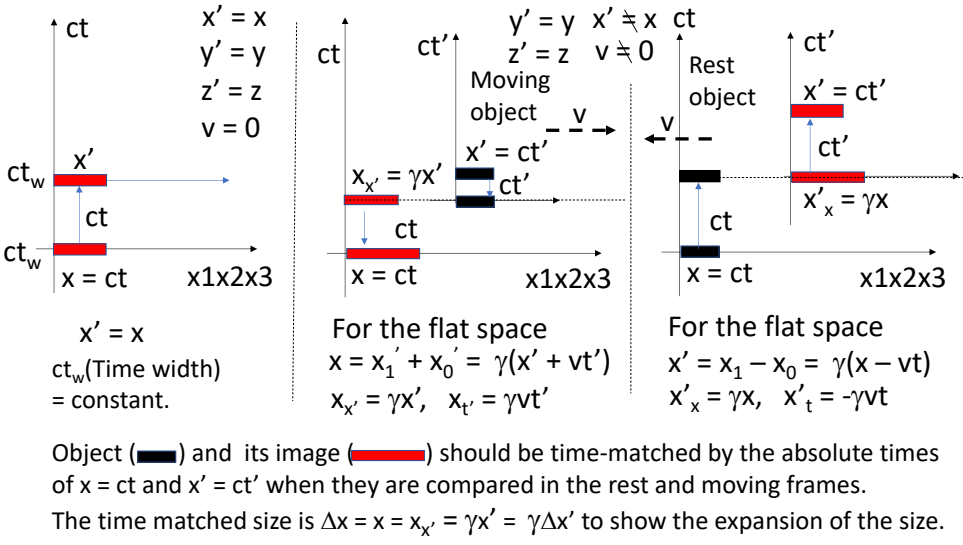

Fig. 14. The modified Lorentz transformations with the time matching are shown.

of ct_l is changing with the velocity of the particle. The absolute time axis of ct is fixed like the space axis. The 4-D momenta can be expressed in the 4-D Euclidean space. Now we can derive the modified Lorentz transformations in the 4-D Euclidean space in Fig. 13.

In Fig. 13, the modified Lorentz transformations based on the 4-D Euclidean space are shown. These formulae have the different absolute time for the rest frame and moving frame. The Lorentz

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transformations are not matched for the absolute time. To compare the space size of the particle at the same time, the absolute time of the rest frame should be the same to the absolute time of the moving particle frame. This is called as the time matched Lorentz transformations in Figs. 14 and 15. The object and its image should be time-matched by the absolute times of x = ct and x' = ct' when they

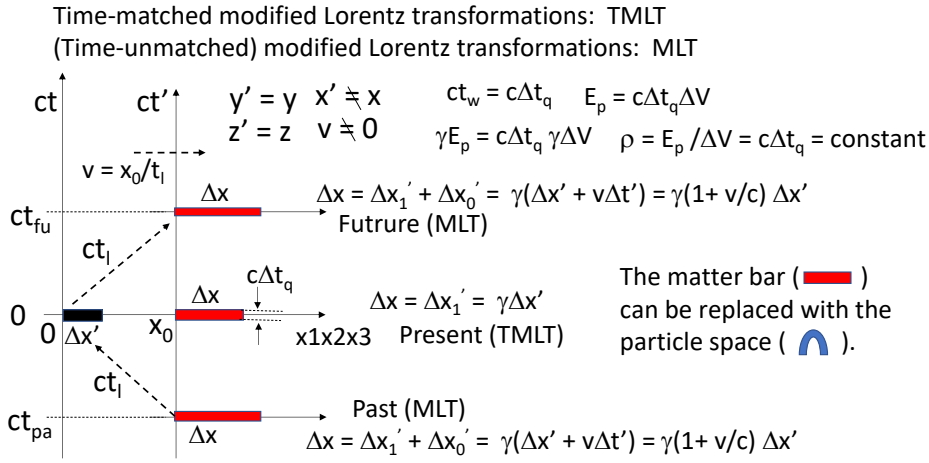

Fig. 15. The modified Lorentz transformations with the time matching and without time matching are compared.

are compared in the rest and moving frames in Figs. 14 and 15. The time matched size is $\Delta x = x = x_{x'} = \gamma x' = \gamma \Delta x'$ to show the expansion of the size.

7. Left-handed neutrinos and right-handed dark matters

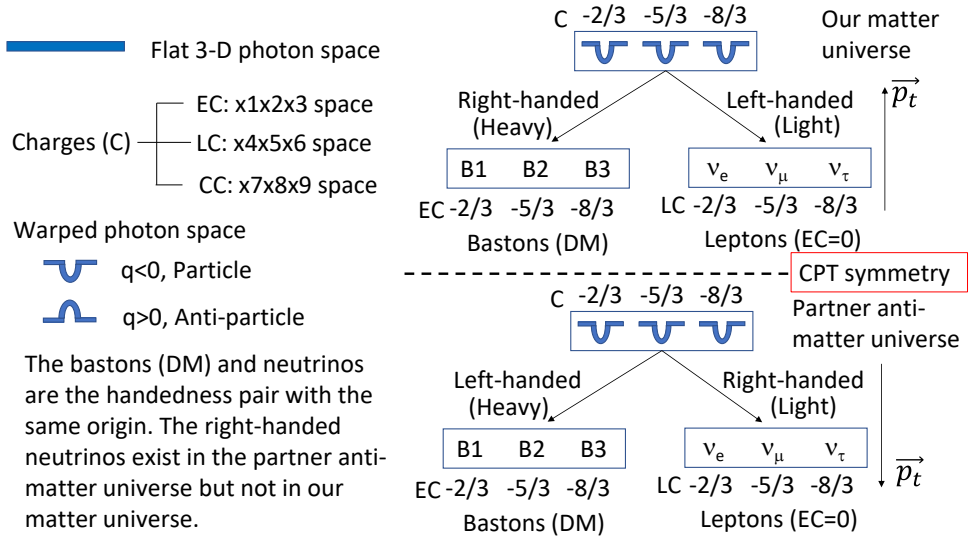

Fig. 16. The neutrinos and bastons (dark matters) are shown as the handedness partners. The left-handed neutrino puzzle can be solved.

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The neutrinos have the left-handedness. It is strange that the left-handed neutrinos have never been observed in our universe. This is the well-known asymmetry of the handedness. In standard model, It remains as the unsolved neutrino puzzle. In the present TQSM model, why this asymmetry takes

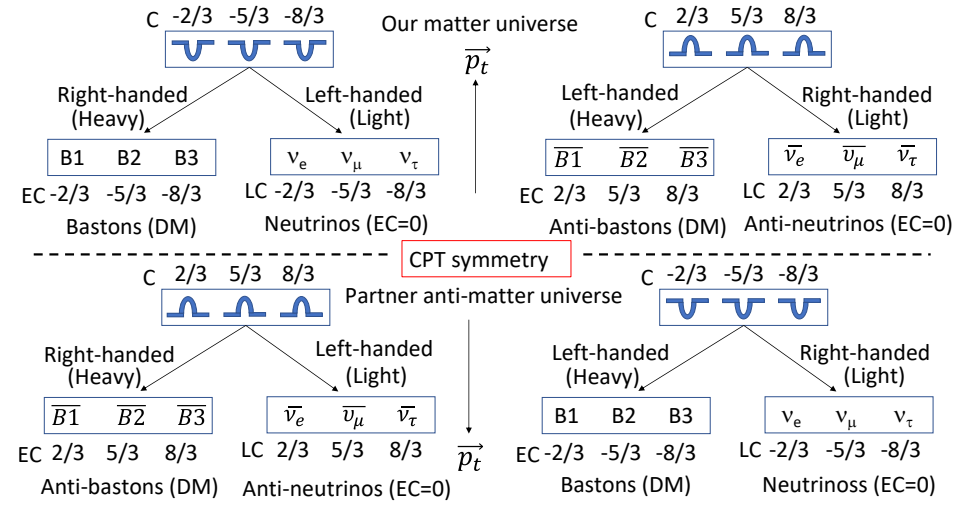

Fig. 17. The right-handed neutrinos can be observed in the partner universe.

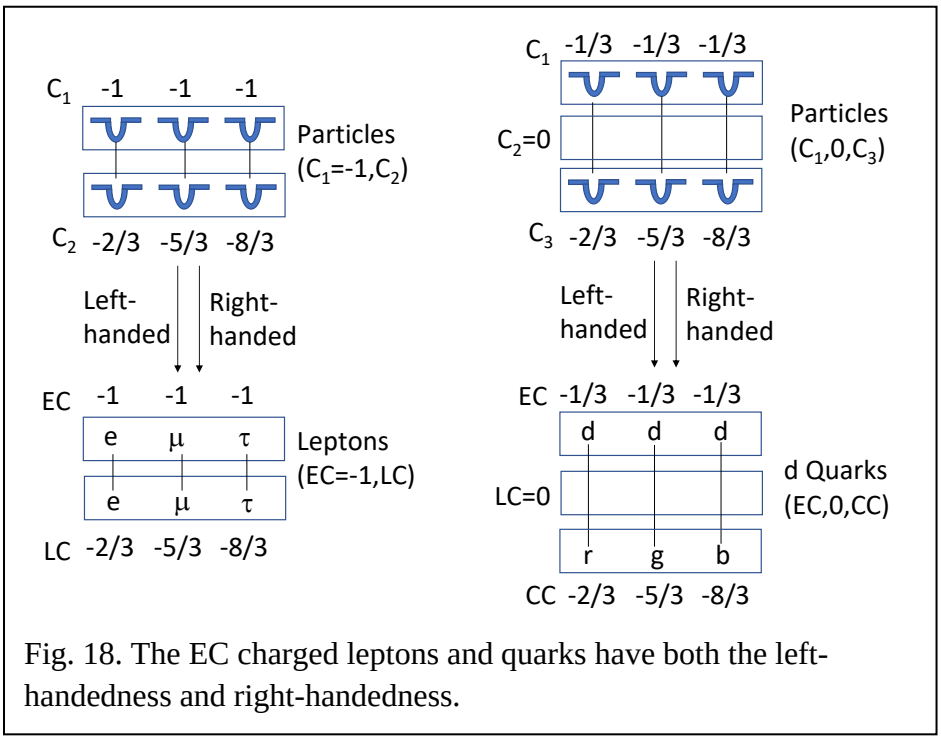

Fig. 18. The EC charged leptons and quarks have both the left-handedness and right-handedness.

place in our universe is explained from the handedness partnership of the neutrinos and bastons (dark matters). In the symmetry point of view, the handedness of the particle is changed under the space P symmetry. Therefore, in the 4-D Euclidean space, the physical quantity that is changed under the time T_c = TC symmetry should exist. In Fig. 1, the charge of the particle in the T_c symmetry corresponds to the handedness of the particle in the P symmetry. The time has only one

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axis of ct. Therefore, the photon space has only two warping directions of the upward direction and downward direction of the photon space along the time axis of ct. This indicates that the photon space should be warped to the upward direction or downward direction along the time axis of ct. The upward warping of the photon space gives the positive charge to the particle and the downward warping of the photon space gives the negative charge to the particle. This means that the charge strength is proportional to the warping length ($c\Delta t$) of the photon space. Therefore, the charge of the particle is defined as $|q| = c\Delta t$. And the energy is proportional to the 4-D volume of the warped space. Therefore, the energy of the particle is defined as the $E = c\Delta t\Delta V$ in the present work.

All the previously known elementary particles except the neutrinos have both the right-handedness and left-handedness. Only the neutrinos have the zero electric charges (EC). This could be the clue to the asymmetry neutrino puzzle. In TQSM [15], the neutrinos have the non-zero lepton charges (LC). In other words, the electron neutrino, muon neutrino and tau neutrino have the charges (EC,LC) of (0, -2/3), (0,-5/3) and (0,-8/3) in Fig. 16. The nonzero lepton charges give the nonzero masses to the neutrinos. Then the bastons (dark matters) of B1, B2 and B3 in Fig. 16 have the electric charges (EC) of (-2/3), (-5/3) and (-8/3). As shown in Fig. 17, neutrinos and dark matters have the same charge strengths. Just the neutrinos have those charges on the LC charge space of the x4x5x6 space and the bastons have those charges on the EC charge space of x1x2x3 space. If the handedness of the charge state of (-2/3,-5/3,-8/3) is separated to the left-handed neutrino states and right-handed baston states in our universe with $E > 0$, the handedness of the charge state of (2/3,5/3,8/3) is separated to the right-handed anti-baston states and left-handed anti-neutrino states in the partner universe with $E < 0$. The right-handed neutrinos missing in our universe can be observed in the partner universe in Figs. 16 and 17. All elementary particles except the bastons and neutrinos have both the left-handedness and right-handedness as shown in Fig. 18.

8. Summary

In summary, in the standard model (SM) the space P symmetry and time T symmetry have been used based on the 4-D Minkowski space. Then the time T symmetry changes the time direction from the forward movement to backward movement. The space momenta change the direction under the T symmetry and the time momentum ($p_t = E/c$) does not change under the time T symmetry. But in the three-D quantized space model (TQSM) the space P symmetry and the time T_c=TC symmetry are applied on the 4-D Euclidean space. Then the time T_c symmetry changes the sign of the time momentum ($p_t = E/c$). Then, our matter universe has the positive energy of $E > 0$ and the partner anti-matter universe has the negative energy of $E < 0$ under the $P_4 = T_cP = TCP$ symmetry. This can explain why the matters dominate over the anti-matters on our universe.

The vacuum space is the photon space. Then the E and B waves are the space fluctuations and the G waves are the time fluctuations. Because the photon space has the zero E fields and zero B fields, the photon space consists of the 2EM waves. Also, the gamma rays are the 2EM waves. All force carrying bosons and E and B waves go through the photon space. In other words, all forces are transmitted through the 2EM waves. This means that the photons with 2EM waves in the photon

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space are the intermediators for the forces. The G waves can be combined with the 2EM waves to make the GEM waves.

The photons are the flat photon space, and the particles are the warped photon space. The rest mass energy is defined as the 4-D space volume of $E = c\Delta t\Delta V$ of the warped photon space. Because the photons do not have the warped photon space, the photons have the zero-rest mass energy. The positive and negative charges are defined as the upward warping state and downward warping state, respectively. The signs of the charges are changed under the time T_c=TC symmetry. The time T_c symmetry is the symmetry between our matter universe with $E > 0$ and the partner anti-matter universe with $E < 0$. This can explain the left-handed neutrino puzzle and matter-anti-matter asymmetry in our universe. The magnetic charges are defined for the elementary bosons in the present work. The force carrying bosons are the magnetic monopoles.

The special and general relativity theories are built based on the 4-D distance concept of the 3 - D space and 1 - D time. However, the quantum mechanics are based on the 4-D volume of the 3 - D space and 1-D time. This means that the absolute time of t is used for the wave functions of the quantum mechanics and the relative time of t_l is used for the special and general relative theories. In the present work, the particles are defined as the warped shape of the photon space and the flat shape of the photon space is called as the photon or gamma ray. These warped shapes have the 4 - D volumes which are defined as the (rest mass) energy. Therefore, the 4 - D volumes of the particles can be expressed by using the wave functions of the quantum mechanics. The special and general relative theories to see the 4 - D distance and the quantum mechanics to see the 4 - D volume deal with the same warped shape of the photon space from the different perspectives.

The warped shape of the photon space corresponds to the squared wave functions that are the probability densities. The squared wave function means that the wave function can be the 4-D vector on the 4-D Euclidean space. The wave function vector has the space component and time component. In the quantum mechanics, the time component of the wave function vector is understood as the imaginary wave function by introducing the imaginary concept of $i^2 = -1$. Therefore, the wave function in the quantum mechanics has the real wave function on the 3-D Euclidean space and imaginary wave function on the imaginary concept. The imaginary wave function in the quantum mechanics corresponds to the time component of the wave function vector in the 4-D Euclidean space. This is the origin of the wave function in the quantum mechanics. Since the time axis component is the time imaginary component, the imaginary parts in the complex numbers have the physical meaning of the time components.

The Lorentz transformations have been derived on the 4-D Minkowski space. Because the 4-D Euclidean space is used in the present work, the modified Lorentz transformations need to be used. Therefore, the modified Lorentz transformations are shown for the time unmatched and time matched cases on the 4-D Euclidean space.

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The neutrinos have the left-handedness in our universe. This is called as the neutrino handedness puzzle. Why the right-handed neutrinos are not observed need to be explained. The standard model cannot explain the neutrino handedness puzzle. In the present work, the handedness partners of the neutrinos and bastons (dark matters) are newly introduced in terms of the TQSM model. This means that the bastons have the right handedness with the electric charges (EC) and the neutrinos have the left handedness in our matter universe with $E > 0$. Then the question is that where the right-handed neutrinos and left-handed bastons are observed. In the TQSM model, the right-handed neutrinos and left-handed bastons can be observed in the partner anti-matter universe with $E < 0$. All the elementary particles except the neutrinos and bastons have both the right handedness and left handedness.

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