New physics model proposed, for the first time, by myself.

Journey into the universe

Three-dimensional quantized spaces, elementary particles and quantum mechanics

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1996, 3,25 - 2014, 12, 31:
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Full paper to be downloaded;

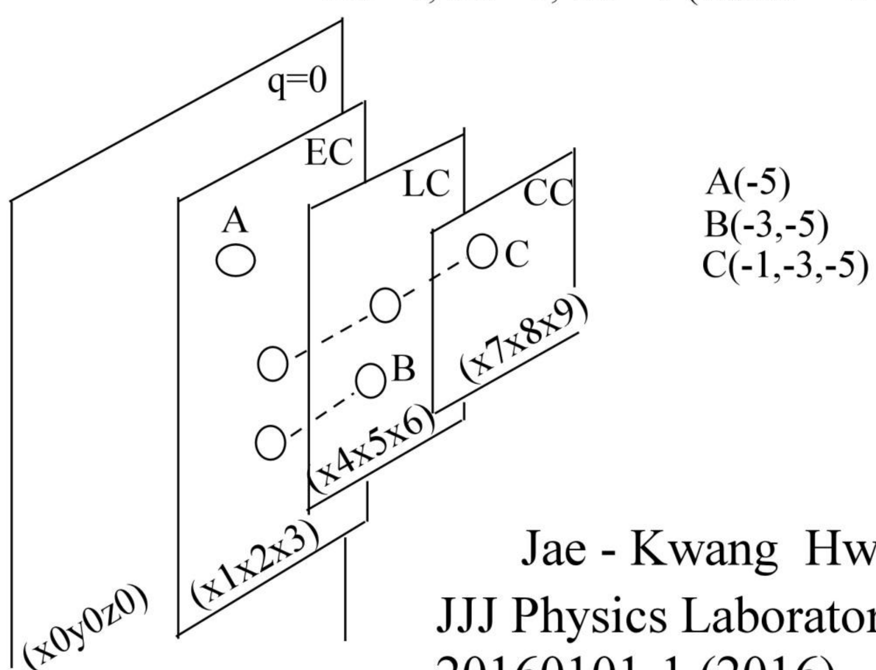
JJJPL report 20160101-1 (2016).
researchgate.net; DOI: 10.13140/RG.2.1.3484.5201(2016).

Journey into the universe

Three-dimensional quantized spaces, elementary particles and quantum mechanics

Mother universe
(x0y0z0) space with the infinite space-time range
q = 0, E=infinite, P_t : not defined, P_x : not defined
Daughter universes
(x1x2x3), (x4x5x6), (x7x8x9) spaces with the quantum time of t_q
q = 0 (flat space) or q $\neq$ 0 (warped space)
P_t = E/c > 0, $P_x \neq 0$ (non-zero positive energy): Finite space range

Matters (q < 0) with E>0:
A: x1x2x3 minimum warped quantum: EC = -5 (3 bastons)
B: x1x2x3-x4x5x6 minimum warped quantum: EC=-3, LC=-5
(3x3=9 leptons)
C: x1x2x3-x4x5x6-x7x8x9 minimum warped quantum:
EC=-1, LC=-3, CC=-5 (3x3x3 = 27 quarks)



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20160101-1 (2016)

Journey into the universe

Three-dimensional quantized spaces, elementary particles and quantum mechanics

Electric charges (EC), lepton charges (LC) and color charges (CC) for the elementary fermion particles. Red colored ones have been previously known. All charges are normalized to ECs of e (EC=-1) and ν_e (EC=0). u(r) = (2/3.0,-2/3)=(EC,LC,CC).

EC flavor	x1x2x3	x1x2x3	x1x2x3
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(M1,M2,M3)
Total EC	-5	-3	-1
LC flavor		x4x5x6	x4x5x6
x4		-2/3(ν_e,e,Le)	0(u,d,M1)
x5		-5/3(ν_μ,μ,Lμ)	-1(c,s,M2)
x6		-8/3(ν_τ,τ,Lτ)	-2(t,b,M3)
Total LC		-5	-3
CC flavor			x7x8x9
x7			-2/3(r)
x8			-5/3(g)
x9			-8/3(b)
Total CC			-5

I wish, in my heart, that this is the real physics story but not the scientific fiction (SF) story.
I wish, in my heart, that we on the earth live the peaceful and happy lives.

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Background fluctuation bosons (s=0,1,2) (zero charges, xi-xj):
photon (s =1, m=0),
graviton (s =2, m=2.1248 10^{-31} eV/c2),
b(baedal or bumo) - boson (s =0,1, E_b=8.1365 $10^{38}x^2$ (eV)(x:m))

Particles

Elementary particles

39 Fermions (s =1/2)

Quark (xi-xj-xk)
(3x3x3=27) (EC,LC,CC)
Lepton (xi-xj)
(3x3=9) (EC,LC)
Baston (xi)
(3) (EC)

39 Bosons (s =1)

Z/W/Y (xi-xj-xk)
(3x3x3=27) (EC,LC,CC)
Z/W/Y (xi-xj)
(3x3=9) (EC,LC)
Z/W/Y (xi)
(3) (EC)

Hadrons (xi-xj-xk) (EC,LC,CC)

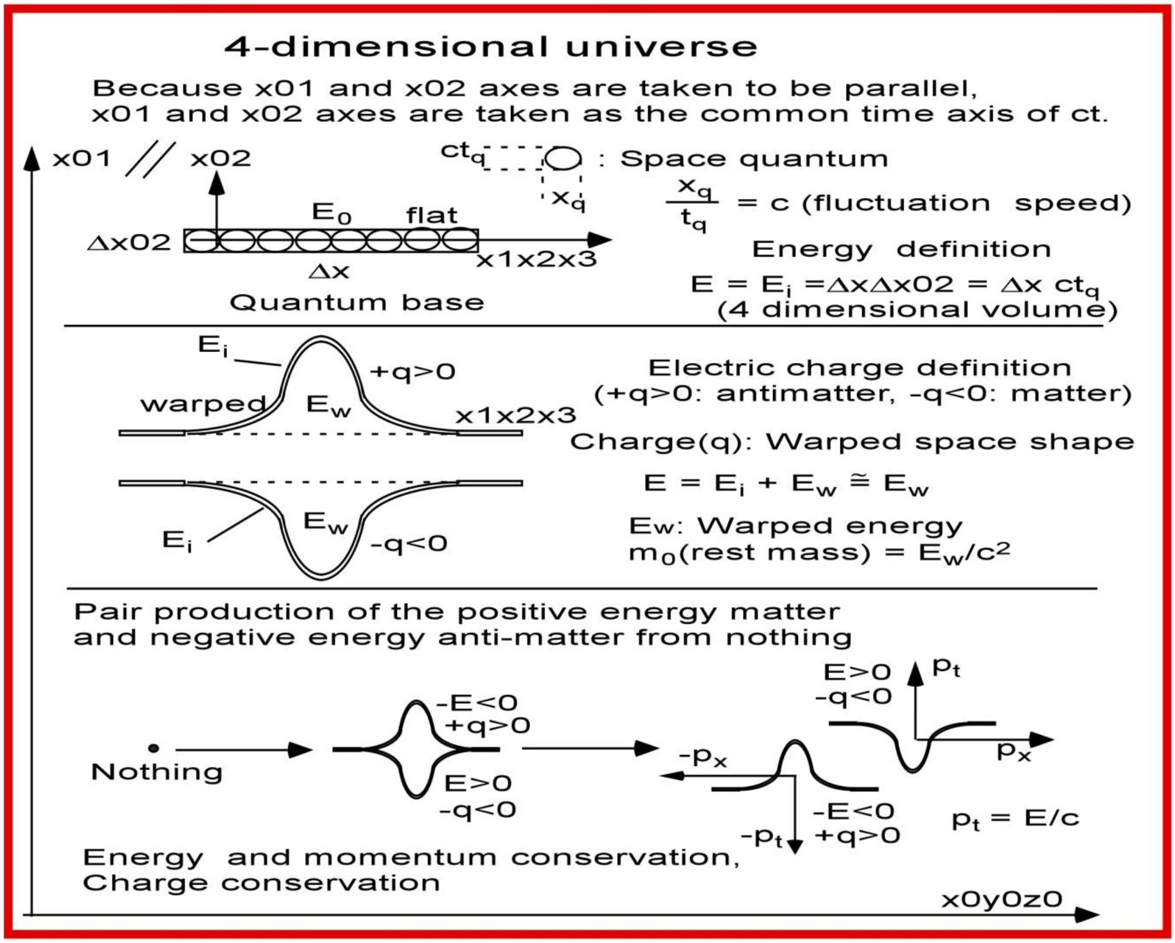
Baryon (3 quarks)
Meson (quark-antiquark)

Hadrons (xi-xj) (EC,LC)

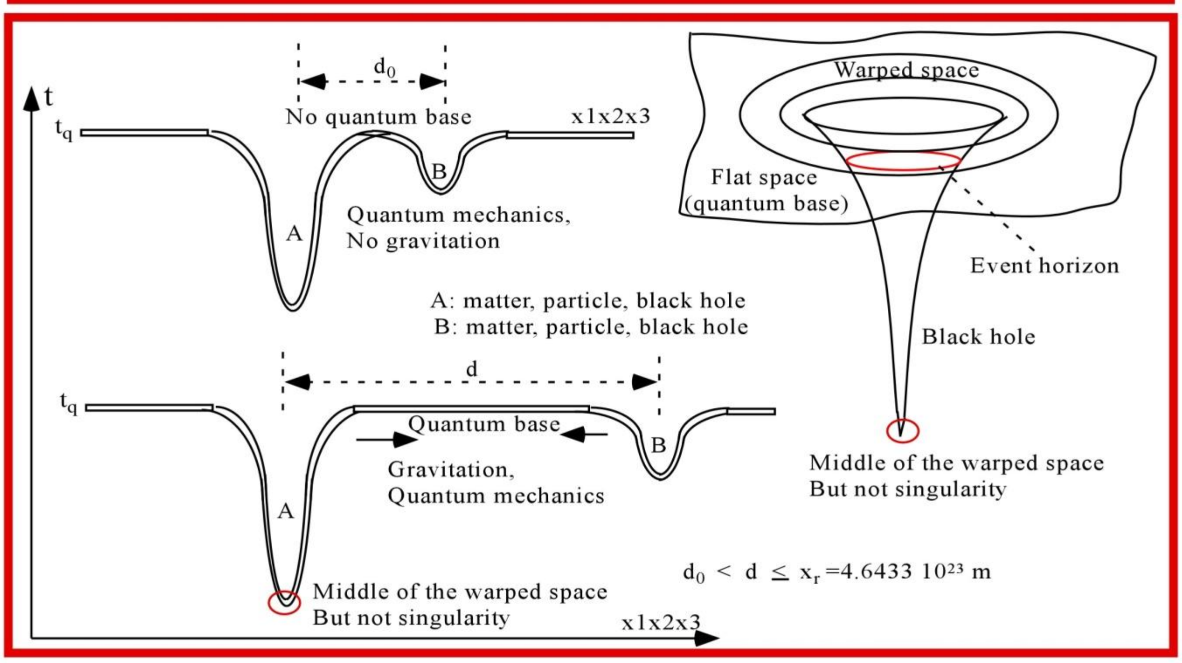
Paryon (3 leptons)
Koron (lepton-antilepton)

Hadrons (xi) (EC)

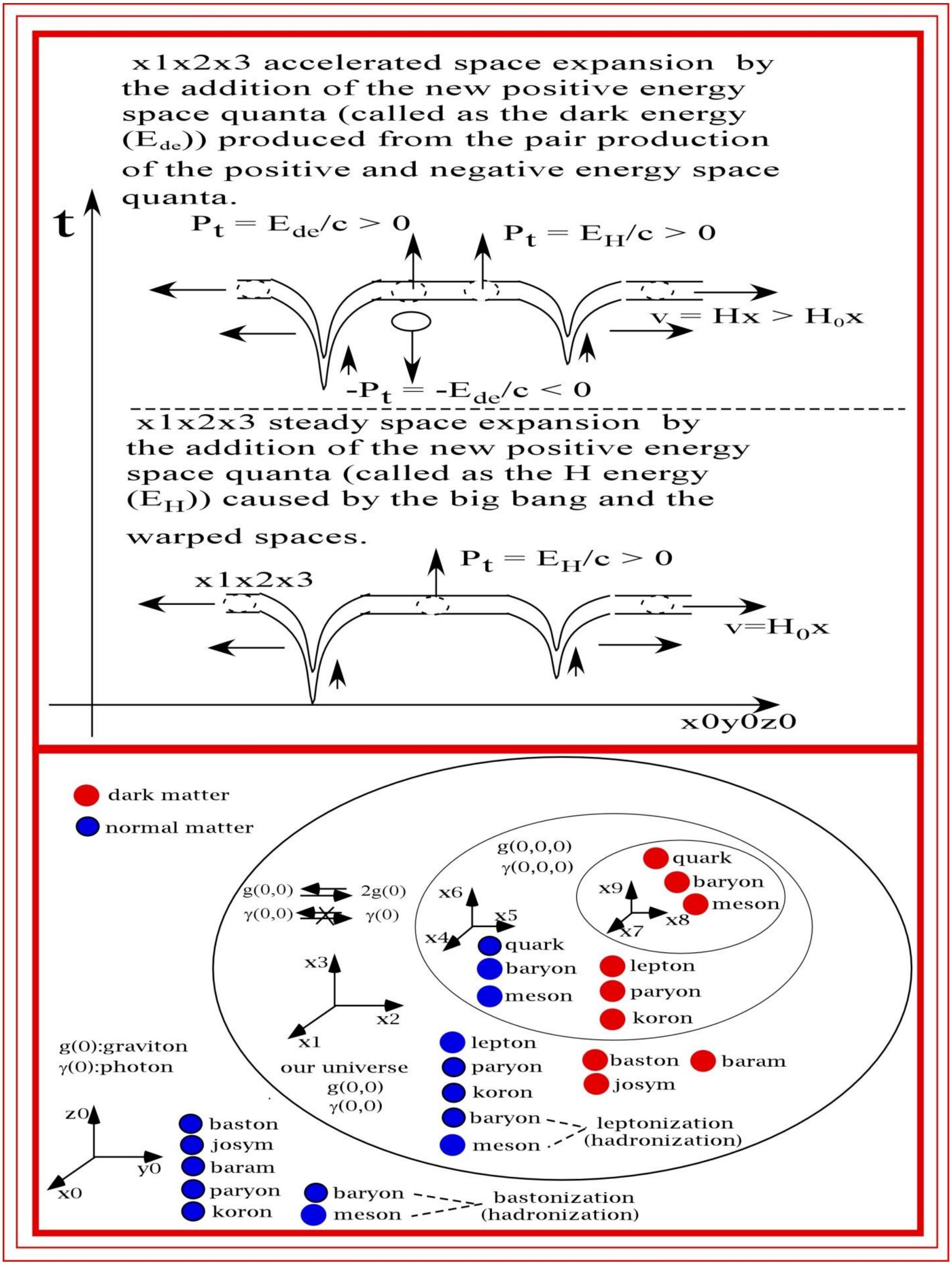
Josym (3 bastons)
Baram (baston-antibaston)



4-dimensional universe
Because x01 and x02 axes are taken to be parallel,
x01 and x02 axes are taken as the common time axis of ct.
x01 // x02
ct_q
: Space quantum
x_q
x_q / t_q = c (fluctuation speed)
E_0 flat
Δx02
Δx
x1x2x3
Quantum base
Energy definition
E = E_i = ΔxΔx02 = Δx ct_q
(4 dimensional volume)
E_i
+q>0
warped
E_w
x1x2x3
E_i
E_w
-q<0
Electric charge definition
(+q>0: antimatter, -q<0: matter)
Charge(q): Warped space shape
E = E_i + E_w ≅ E_w
Ew: Warped energy
m_0(rest mass) = E_w/c^2
Pair production of the positive energy matter
and negative energy anti-matter from nothing
Nothing
-E<0
+q>0
E>0
-q<0
E>0
-q<0
p_t
-p_x
p_x
-E<0
+q>0
-p_t
p_t = E/c
Energy and momentum conservation,
Charge conservation
x0y0z0



t
t_q
d_0
No quantum base
x1x2x3
B
A
Quantum mechanics,
No gravitation
A: matter, particle, black hole
B: matter, particle, black hole
d
t_q
Quantum base
B
Gravitation,
Quantum mechanics
A
Middle of the warped space
But not singularity
x1x2x3
Warped space
Flat space
(quantum base)
Event horizon
Black hole
Middle of the warped space
But not singularity
d_0 < d ≤ x_r =4.6433 10^23 m


x1x2x3 accelerated space expansion by the addition of the new positive energy space quanta (called as the dark energy (E_{de})) produced from the pair production of the positive and negative energy space quanta.
t
$P_t = E_{de}/c > 0$
$P_t = E_H/c > 0$
$v = Hx > H_0x$
$-P_t = -E_{de}/c < 0$
x1x2x3 steady space expansion by the addition of the new positive energy space quanta (called as the H energy (E_H)) caused by the big bang and the warped spaces.
$P_t = E_H/c > 0$
x1x2x3
$v=H_0x$
x0y0z0
dark matter
normal matter
g(0,0,0)
γ(0,0,0)
quark
baryon
meson
x9
x7
x8
x6
x5
x4
g(0,0)
2g(0)
γ(0,0)
γ(0)
quark
baryon
meson
lepton
paryon
koron
x3
x2
x1
g(0):graviton
γ(0):photon
our universe
g(0,0)
γ(0,0)
lepton
paryon
koron
baryon
meson
baston
baram
josym
leptonization
(hadronization)
z0
y0
x0
baston
josym
baram
paryon
koron
baryon
meson
bastonization
(hadronization)

Elementary fermions with the quantized charges associated with the b bosons (Fig. 12)

Because the quantized EC, LC and CC charges are conserved for a fermion, one fermion cannot be changed into another fermion.

xi particle (baston) ↮ xi-xj particle (lepton) ↮ xi-xj-xk particle (quark)

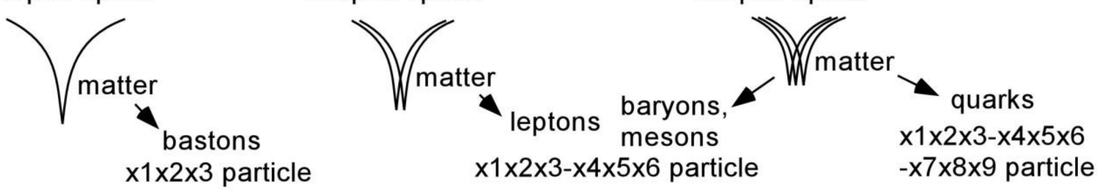
x1x2x3 particle ↮ x1x2x3-x4x5x6 particle ↮ x1x2x3-x4x5x6-x7x8x9 particle

---

Three-dimensional warped spaces with the unquantized charges (Fig. 2)

The three-dimensional warped spaces are not associated with the b bosons and have the unquantized EC, LC and CC charges. Therefore, the EC, LC and CC charges are not conserved for these three-dimensional warped spaces. In other words, the space-time shapes (energies) of these warped spaces can be changed into the different space-time shapes of other warped spaces under the condition of the energy conservation as shown below. The matter and antimatter spaces can be changed only to the matter and antimatter spaces, respectively.

x1x2x3 warped space ↔ x1x2x3-x4x5x6 warped space ↔ x1x2x3-x4x5x6-x7x8x9 warped space



Hadrons (Matters)

Hadronization: Leptonization, Bastonization

g(0,0,0),γ(0,0,0)	Leptonization	g(0,0),γ(0,0)	Bastonization	g(0),γ(0)
Baryon(EC,LC,CC)	↔ CC=-5	Baryon(EC,LC)	↔ LC=0 or LC=-3	Baryon(EC)
Meson(EC,LC,CC)	↔ CC=0	Meson(EC,LC)	↔ LC=0	Meson(EC)
		Paryon(EC,LC)	↔ LC=-5	Paryon(EC)
		Koron(EC,LC)	↔ LC=0	Koron(EC)
				Josym(EC)
				Baram(EC)

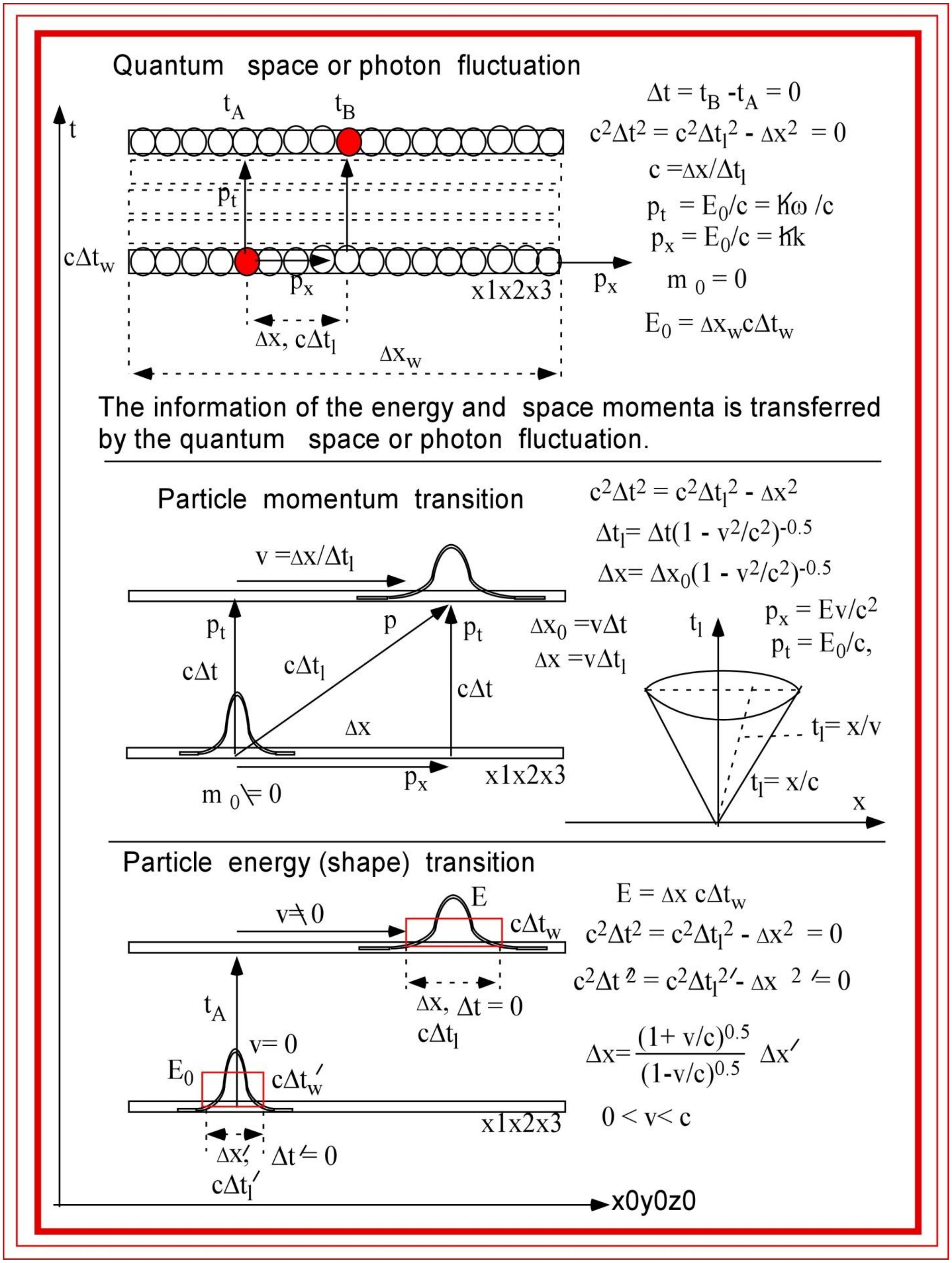
g(0,0,0) ↔ g(0,0) ↔ g(0): Graviton

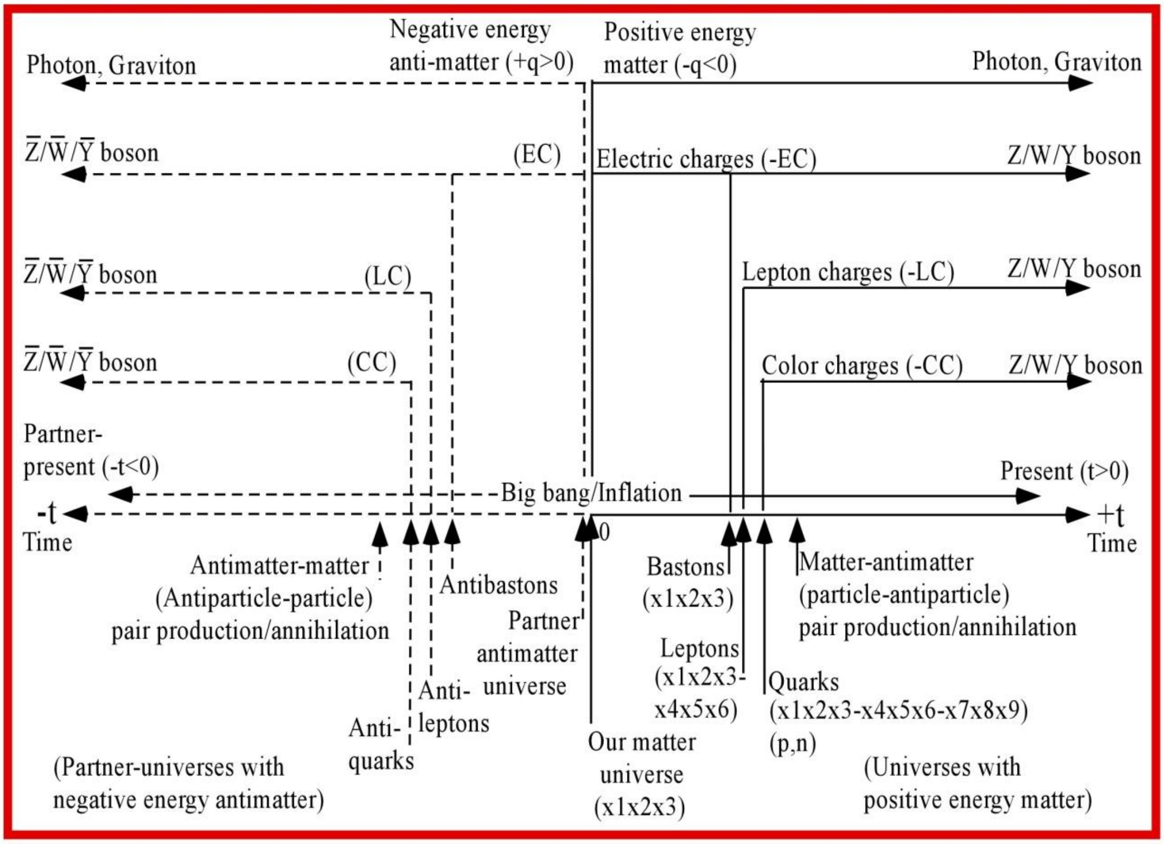
γ(0,0,0) ↮ γ(0,0) ↮ γ(0): Photon

Baryon(-1,-3,-5) ↔ x1x2x3-x4x5x6-x7x8x9 particle

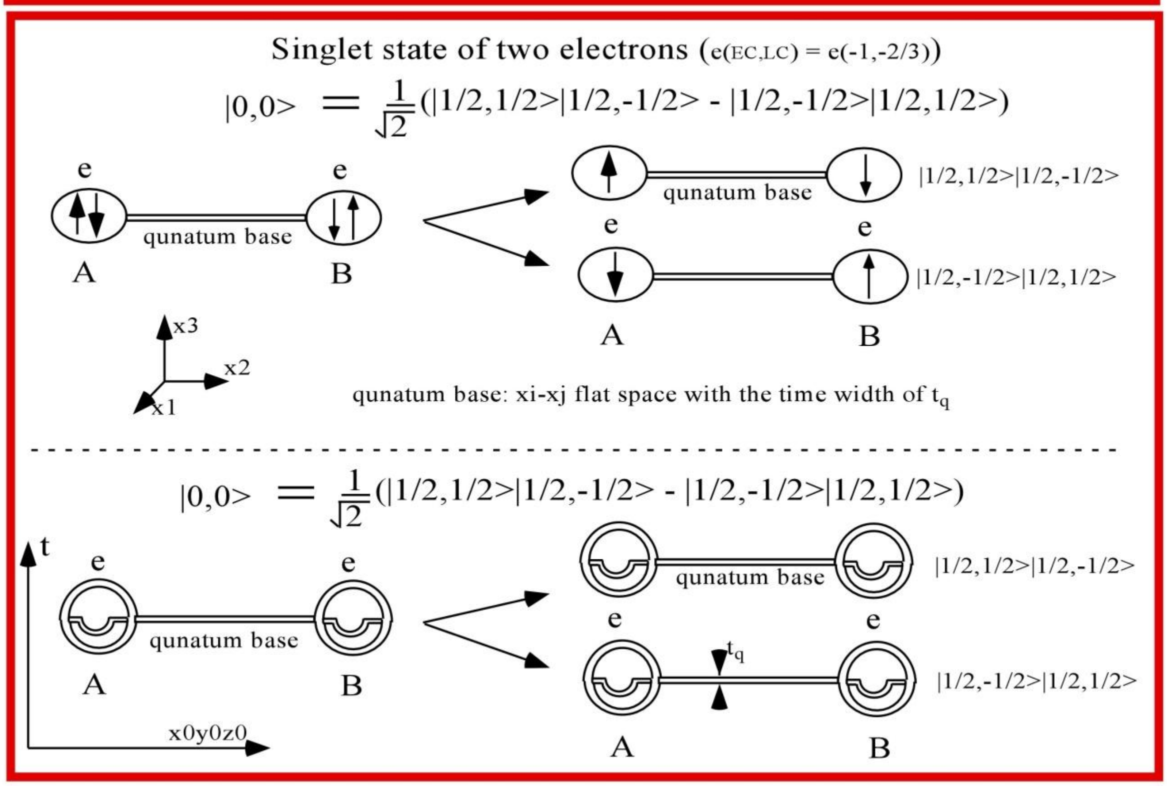
Paryon(-3,-5) ↔ x1x2x3-x4x5x6 particle

Josym(-5) ↔ x1x2x3 particle

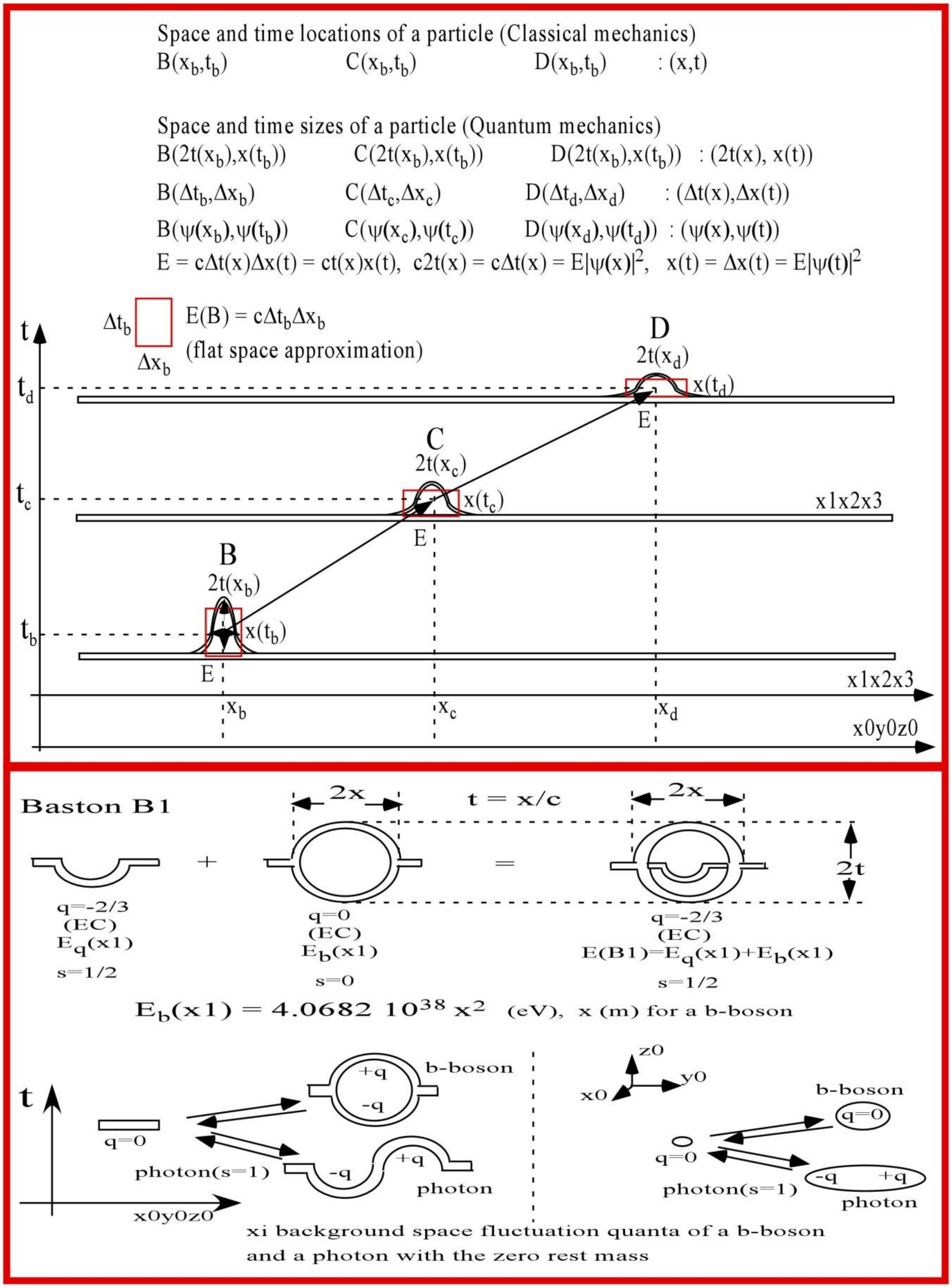

Quantum space or photon fluctuation
t
tA
tB
pt
cΔtw
px
x1x2x3
px
Δx, cΔtl
Δxw
Δt = tB - tA = 0
c2Δt2 = c2Δtl2 - Δx2 = 0
c = Δx/Δtl
pt = E0/c = ħω /c
px = E0/c = ħk
m 0 = 0
E0 = ΔxwcΔtw
The information of the energy and space momenta is transferred
by the quantum space or photon fluctuation.
Particle momentum transition
c2Δt2 = c2Δtl2 - Δx2
Δtl= Δt(1 - v2/c2)-0.5
Δx= Δx0(1 - v2/c2)-0.5
v = Δx/Δtl
pt
p
pt
Δx0 = vΔt
Δx = vΔtl
tl
px = Ev/c2
pt = E0/c,
cΔt
cΔtl
cΔt
Δx
tl= x/v
px
x1x2x3
m 0 ≠ 0
tl= x/c
x
Particle energy (shape) transition
E
E = Δx cΔtw
v ≠ 0
cΔtw
c2Δt2 = c2Δtl2 - Δx2 = 0
c2Δt′2 = c2Δtl′2 - Δx′2 ≠ 0
tA
Δx, Δt = 0
cΔtl
v= 0
Δx= (1+ v/c)0.5 / (1-v/c)0.5 Δx′
E0
cΔtw′
x1x2x3
0 < v< c
Δx′, Δt ≠ 0
cΔtl′
x0y0z0



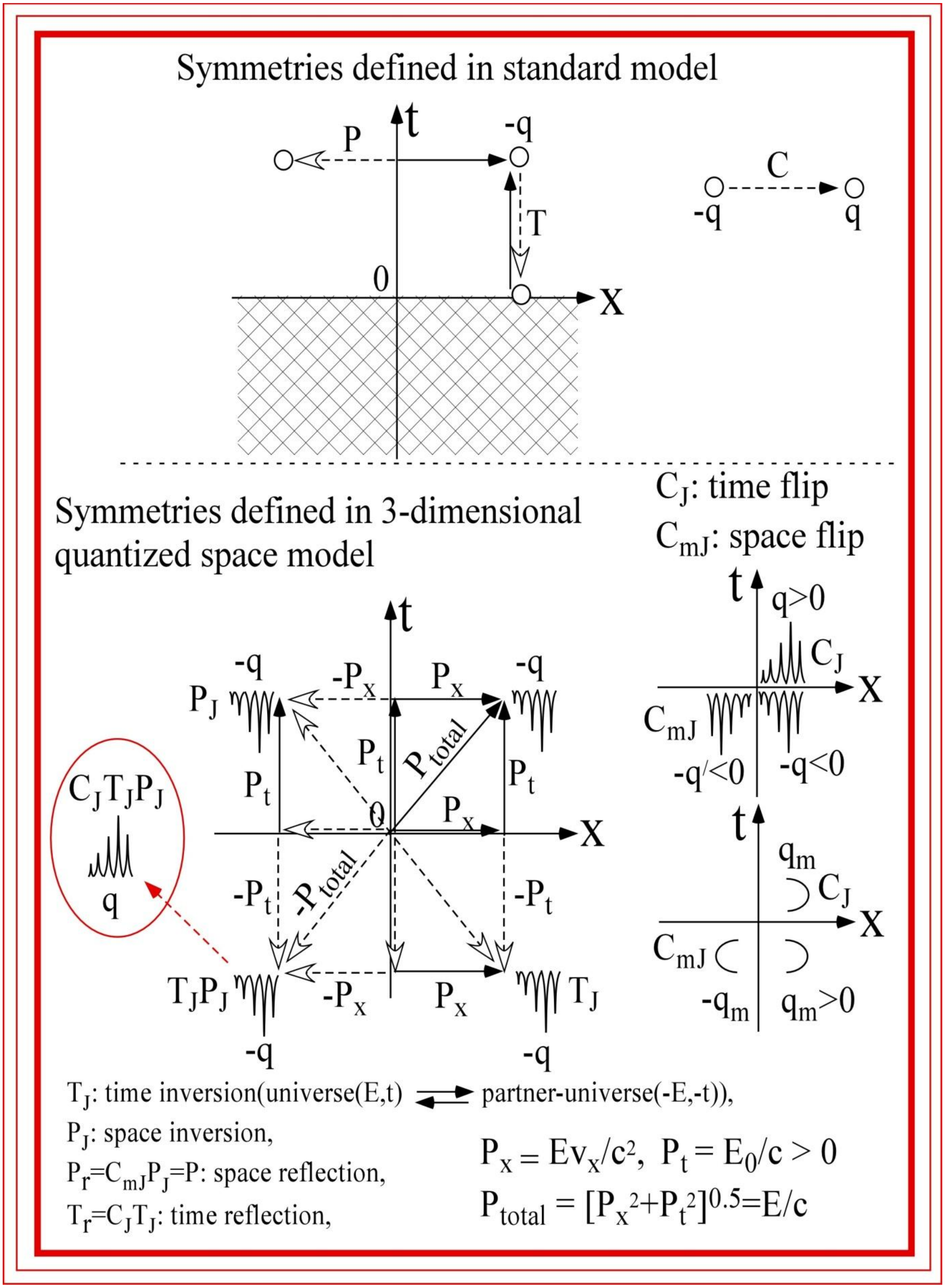
Negative energy
anti-matter (+q>0)
Positive energy
matter (-q<0)
Photon, Graviton
Photon, Graviton
Z̄/W̄/Ȳ boson
(EC)
Electric charges (-EC)
Z/W/Y boson
Z̄/W̄/Ȳ boson
(LC)
Lepton charges (-LC)
Z/W/Y boson
Z̄/W̄/Ȳ boson
(CC)
Color charges (-CC)
Z/W/Y boson
Partner-
present (-t<0)
Present (t>0)
Big bang/Inflation
-t
Time
0
+t
Time
Antimatter-matter
(Antiparticle-particle)
pair production/annihilation
Antibastons
Partner
antimatter
universe
Anti-
leptons
Anti-
quarks
Bastons
(x1x2x3)
Leptons
(x1x2x3-
x4x5x6)
Quarks
(x1x2x3-x4x5x6-x7x8x9)
(p,n)
Matter-antimatter
(particle-antiparticle)
pair production/annihilation
Our matter
universe
(x1x2x3)
(Partner-universes with
negative energy antimatter)
(Universes with
positive energy matter)

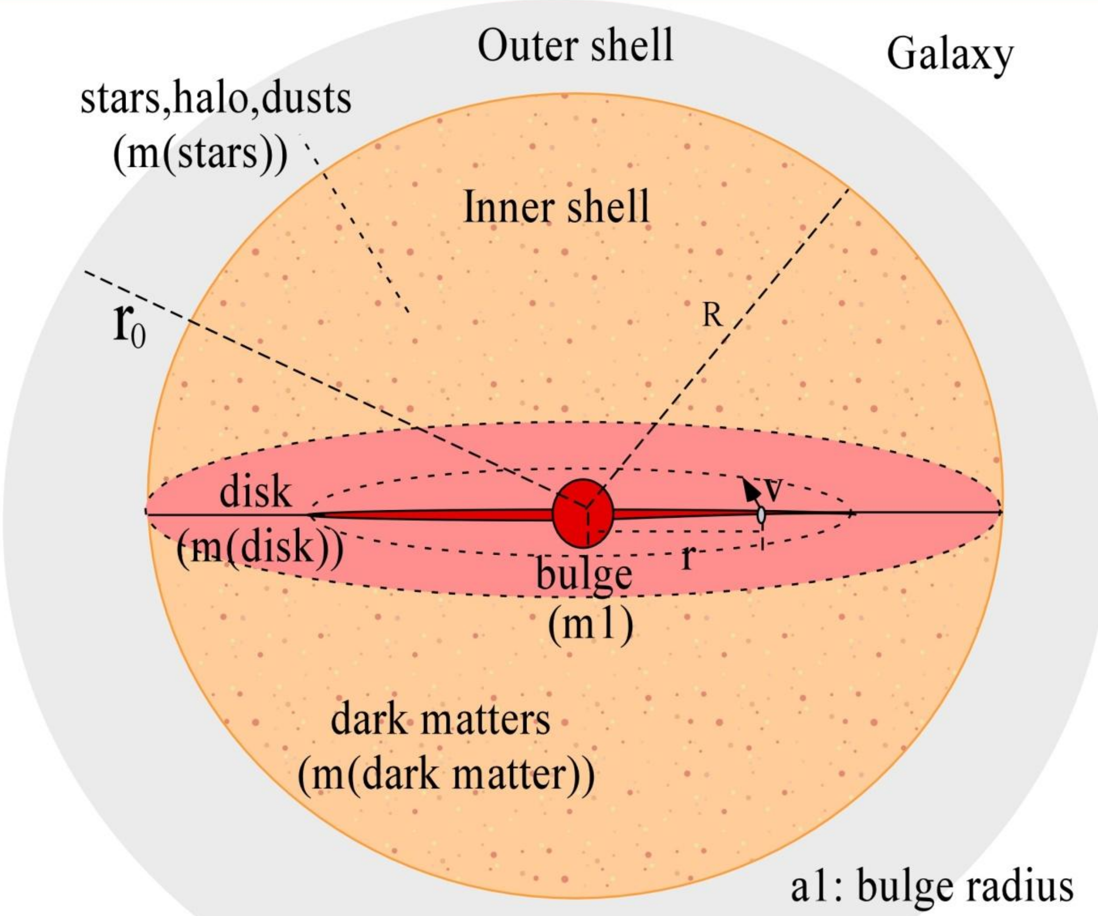


Singlet state of two electrons (e(EC,LC) = e(-1,-2/3))
|0,0> = 1/√2(|1/2,1/2>|1/2,-1/2> - |1/2,-1/2>|1/2,1/2>)
e
e
qunatum base
A
B
qunatum base
|1/2,1/2>|1/2,-1/2>
e
e
|1/2,-1/2>|1/2,1/2>
A
B
x3
x2
x1
qunatum base: xi-xj flat space with the time width of tq
|0,0> = 1/√2(|1/2,1/2>|1/2,-1/2> - |1/2,-1/2>|1/2,1/2>)
t
e
e
qunatum base
A
B
x0y0z0
qunatum base
|1/2,1/2>|1/2,-1/2>
e
e
tq
|1/2,-1/2>|1/2,1/2>
A
B



Space and time locations of a particle (Classical mechanics)
B(xb,tb) C(xb,tb) D(xb,tb) : (x,t)
Space and time sizes of a particle (Quantum mechanics)
B(2t(xb),x(tb)) C(2t(xb),x(tb)) D(2t(xb),x(tb)) : (2t(x), x(t))
B(Δtb,Δxb) C(Δtc,Δxc) D(Δtd,Δxd) : (Δt(x),Δx(t))
B(ψ(xb),ψ(tb)) C(ψ(xc),ψ(tc)) D(ψ(xd),ψ(td)) : (ψ(x),ψ(t))
E = cΔt(x)Δx(t) = ct(x)x(t), c2t(x) = cΔt(x) = E|ψ(x)|2, x(t) = Δx(t) = E|ψ(t)|2
Δtb
Δxb
E(B) = cΔtbΔxb
(flat space approximation)
t
td
tc
tb
B
C
D
2t(xb)
2t(xc)
2t(xd)
x(tb)
x(tc)
x(td)
E
x1x2x3
xb
xc
xd
x0y0z0
Baston B1
2x
t = x/c
2t
q=-2/3
(EC)
Eq(x1)
s=1/2
q=0
(EC)
Eb(x1)
s=0
q=-2/3
(EC)
E(B1)=Eq(x1)+Eb(x1)
s=1/2
Eb(x1) = 4.0682 10^38 x^2 (eV), x (m) for a b-boson
t
q=0
+q
-q
b-boson
photon(s=1)
-q
+q
photon
x0y0z0
z0
y0
x0
b-boson
q=0
q=0
photon(s=1)
-q
+q
photon
xi background space fluctuation quanta of a b-boson
and a photon with the zero rest mass


Symmetries defined in standard model
t
-q
P
C
T
-q
q
0
X
Symmetries defined in 3-dimensional quantized space model
C_J: time flip
C_mJ: space flip
t
q>0
C_J
X
C_mJ
-q'<0
-q<0
t
q_m
C_J
X
C_mJ
-q_m
q_m>0
t
-q
-P_x
P_x
-q
P_J
P_t
P_total
P_t
C_J T_J P_J
P_t
0
P_x
X
q
-P_t
-P_total
-P_t
T_J P_J
-P_x
P_x
T_J
-q
-q
T_J: time inversion(universe(E,t) partner-universe(-E,-t)),
P_J: space inversion,
P_r=C_mJ P_J=P: space reflection,
T_r=C_J T_J: time reflection,
P_x = Ev_x/c², P_t = E_0/c > 0
P_total = [P_x²+P_t²]^0.5=E/c



$$m(\text{normal matter}) = m(\text{stars}) + m(\text{disk})$$

$$m(\text{stars}) = 4\pi d_1(r\text{-}a1)m1,\ m(\text{disk}) = d_2(r\text{-}a1)m1$$

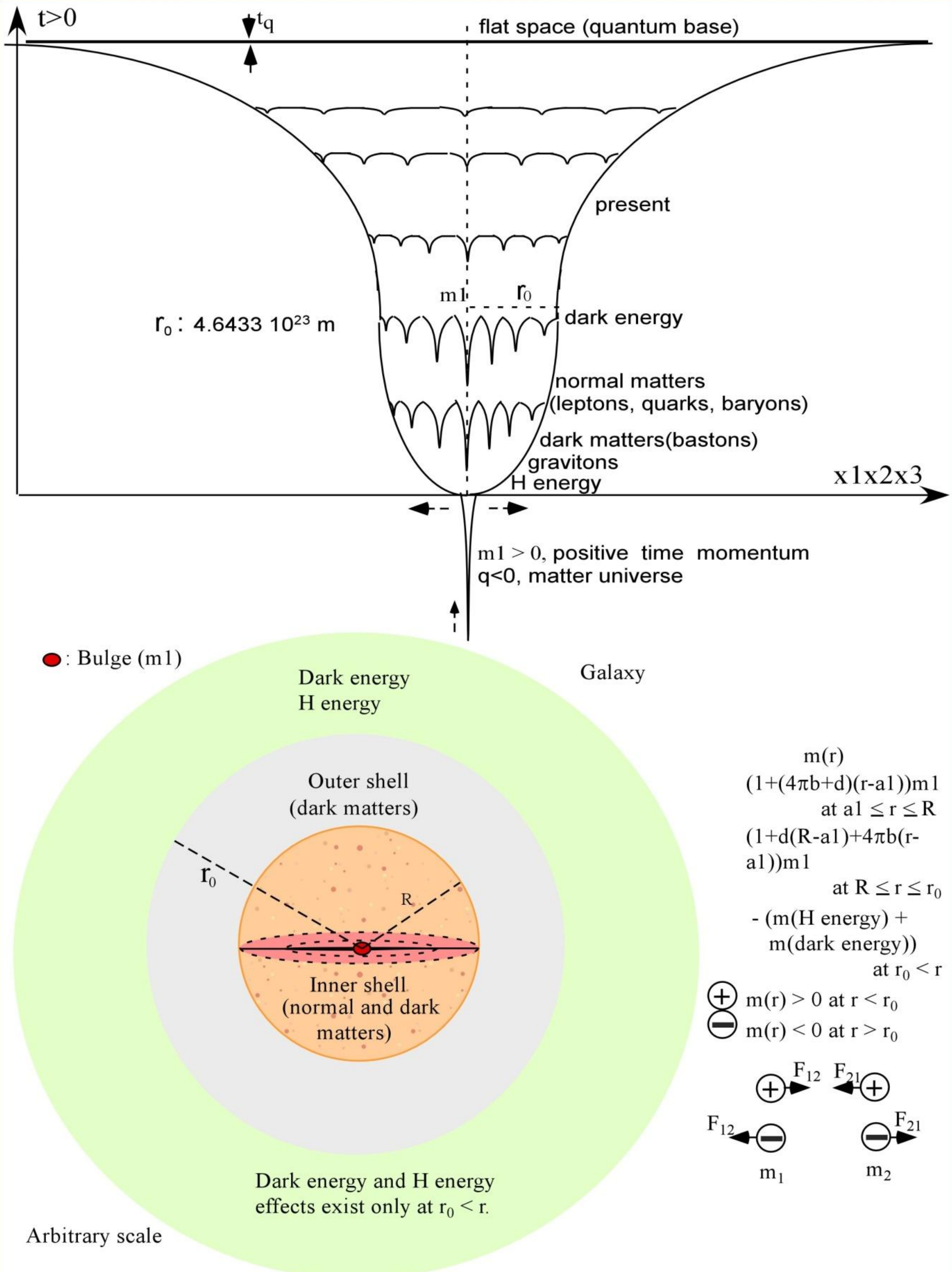
$$m(\text{normal matter}) = d(r\text{-}a1)m1 = (4\pi d_1+d_2)(r\text{-}a1)m1$$

If $m(\text{disk}) = 0$, $m(\text{normal matter}) = d(r\text{-}a1)m1 = 4\pi d_1(r\text{-}a1)m1$

$$\begin{aligned} m(\text{dark matter}) &= m(\text{dark matter halo}) + m(\text{dark matter disk}) \\ &= 4\pi b_1(r\text{-}a1)m1 + b_2(r\text{-}a1)m1 \\ &= 4\pi b(r\text{-}a1)m1 \end{aligned}$$

$$m(\text{galaxy}) = (1+(4\pi b+d)(r\text{-}a1))m1$$

$$v = \left(G\frac{1+(4\pi b+d)(r\text{-}a1)}{r}m1\right)^{0.5} \quad \text{for } a1 \le r \le R$$


t>0
tq
flat space (quantum base)
present
m1
r_0
dark energy
r_0 : 4.6433 10^{23} m
normal matters
(leptons, quarks, baryons)
dark matters(bastons)
gravitons
H energy
x1x2x3
m1 > 0, positive time momentum
q<0, matter universe
: Bulge (m1)
Dark energy
H energy
Galaxy
Outer shell
(dark matters)
r_0
R
Inner shell
(normal and dark
matters)
m(r)
(1+(4πb+d)(r-a1))m1
at a1 ≤ r ≤ R
(1+d(R-a1)+4πb(r-
a1))m1
at R ≤ r ≤ r_0
- (m(H energy) +
m(dark energy))
at r_0 < r
m(r) > 0 at r < r_0
m(r) < 0 at r > r_0
F_{12}
F_{21}
F_{12}
F_{21}
m_1
m_2
Dark energy and H energy
effects exist only at r_0 < r.
Arbitrary scale

Within the galaxy cluster (group), $r < r_0$

$\oplus \xrightarrow{F}$ m(A) (galaxy) $\xleftarrow{F} \oplus$ m(B) (galaxy)

Attractive force

$$F = G\frac{m(A)\,m(B)}{r^2}$$

m(A) = m(r) for the A galaxy

m(B) = m(r) for the B galaxy

Within the galaxy $r < r_0$ m(A) m(B)

earth ------ moon : m(A) = m(earth), m(B) = m(moon)

sun --------- earth : $m(A) = (1+ 9.1403\ 10^{-11})\ m(sun)$
$m(B) = m(earth)$

milky way galaxy ---- sun : $m(A) = (1+23.517)m(bulge)$
$m(B) = (1+6.2838\ 10^{-6})\ m(sun)$

Not belonging to the galaxy cluster (group)

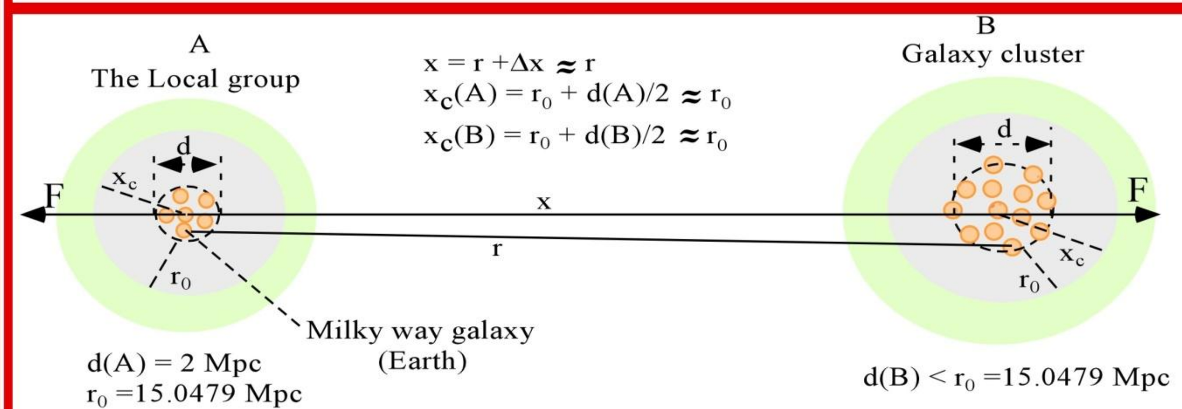
Repulsive force

$r > r_0$	$m(A,r_0)$ (galaxy) $\xleftarrow{F}\ominus$	$\ominus\xrightarrow{F}$ $m(B,r_0)$ (galaxy)	$F = G\frac{m(A,r_0)\,m(B,r_0)}{r^2}$
$r > r_0$	$m(A,r_0)$ (galaxy)	$m(B,R)$ (star)	$F = G\frac{m(A,r_0)\,m(B,R)}{r^2}$
$r > R$	$m(A,R)$ (star)	$m(B,R)$ (star)	$F = G\frac{m(A,R)\,m(B,R)}{r^2}$

$r_0 < x_c \leq 3r_0/2$, $r > x_c$ $m(A,x_c)$ (galaxy cluster (group)) $m(B,x_c)$ (galaxy cluster (group))

$$F = G\frac{m(A,x_c)\,m(B,x_c)}{r^2}$$

$$m(A,r_0) = -\,4\pi\varepsilon_1(A)(r^4/4 - 2r_0r^3/3 + r_0^2r^2/2 - 5r_0^4/12) - 2\pi\varepsilon(A)\,(2r^3 - 3r_0r^2 + r_0^3)/3 = -\,m(\text{dark energy}) - m(\text{H energy})$$



$$F = G\frac{m(A,x_c(A))\,m(B,x_c(B))}{x^2} \approx G\frac{m(A,r_0)\,m(B,r_0)}{r^2}$$

JJJ PL report, 20160101-1 (2016); researchgate.net ; DOI: 10.13140/RG.2.1.3484.5201(2016).

Three-dimensional quantized spaces, elementary particles and quantum mechanics

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Abstract
Three-dimensional quantized spaces are newly introduced by myself. Four three-dimensional quantized spaces with total 12 dimensions are used to explain the universes including ours. The warped three-dimensional quantized spaces with the quantum time width ($\Delta t=t_q$) (see Fig. 4B) are applied to explain the origin of the charges and evolution of the universe. Also, the warped quantized time with the quantum space size ($\Delta x=x_q$) of the three-dimensional spaces (see Fig. 4C) is used to explain the magnetic charges. In the present work, the positive energy has the positive time momentum (E/c>0) flowing toward the positive time direction and the negative energy has the negative time momentum (-E/c<0) flowing toward the negative time direction (see section 17). The birth of our positive energy matter universe is justified from the production of the positive and negative energy warped space pair from nothing. This birth is the beginning of the physical universe with the big bang. The energy is newly defined as the space-time volume of E = cΔtΔV in the present work. The quantum length (x_q) and time (t_q) of our universes are $2x_p^2$ = 5.223 10^{-70} m and x_q/c = 1.7422 10^{-78} s, respectively, which give the present masses of the elementary particles. The time is originated from the unobservable quantum space fluctuation.

Electric (EC), lepton (LC) and color (CC) charges are defined to be the charges of the x1x2x3, x4x5x6 and x7x8x9 warped spaces, respectively, in the present work. Here i = 1, 2 or 3, j = 4, 5 or 6 and k = 7, 8 or 9. Then, the lepton is the xi (EC) - xj (LC) correlated state which makes 3x3 = 9 leptons and the quark is the xi (EC) – xj (LC) – xk (CC) correlated state which makes 3x3x3 = 27 quarks because the elementary particles of leptons and quarks are one-dimensional warped space quantum states (see Table 3 and Fig. 12). In addition to those, the new particle of a baston is proposed to have the xi (EC) state which gives three bastons which are the one-dimensional warped space quanta. These bastons are proposed as the dark matters seen in the x1x2x3 space, too (see Fig. 46). The new b bosons (Baedal boson or Bumo boson) give the rest masses to the the elementary particles (see Figs. 12-15). The Higgs bosons of the quantum field theory should be replaced with the b bosons. The charge configuration of each particle can be applied to the particle decays. Many kinds of particles and magnetic particles are defined in terms of the three-dimensional quantized spaces. Also, the magnetic electric charges (MEC), magnetic lepton charges (MLC) and magnetic color charges (MCC) are newly defined. Many particle decay modes published by particle data group need to be modified a little bit from the EC, LC and CC charge conservations, if needed. New compound nuclei of the paryons, korons, josyms and barams are introduced (see Fig. 44). The quantum mechanics and modified relativity theory are unified with the three-dimensional space quantization. The space, time and charge symmetries are newly defined. There are many physical problems which we do not know how to solve. Based on the present model, those problems are discussed in the present work. Those problems are including the matter universe question, three generations of the leptons and quarks, the proton decay, Majorana particle, dark matter, dark energy, dark flow, magnetic monopoles, graviton, hadronization, quark confinement, time before the big bang, a black hole, very high energy cosmic rays, hard x-rays, high temperature superconductor, quantum entanglement, quantum wave function collapse, neutrino oscillations, CP violations and proton spin crisis. Also, it is shown for the first time that the wave function in the quantum mechanics is closely connected to the energy of the warped space caused by the moving elementary particles. The fermion charges are explained as the internal harmonic vibration quantum numbers obtained by solving Schrodinger harmonic vibrational equation with the Planck length scale. Then it is shown that the fractional electric charge of a quark comes from the charge unit system based on the electron charge of EC=-1. So, if we use the different charge unit system based on the electron charge of EC=-3, the fractional charges can disappear. Also, a photon is the space axis background fluctuation and a xi-xj graviton has the rest mass of 2.1248 10^{-31} eV/c^2 and the force range (x_r) of 4.6433 10^{23} m. The accelerated space expansion is caused by the newly added x1x2x3 space quanta called as the dark energy and H energy (Hanul energy or Hwang energy). The observable minimum excitation energy of the x1x2x3 space is caused by the x1x2x3 Planck size b-boson with the energy of E_p(x1x2x3) = 3E_p(xi) = E_p(x1x2x3-x4x5x6)/2 = 3.1872 10^{-31} eV. The Schrodinger equation is connected to the change of the space-time sizes of the particles. Also, three kinds of photons are proposed (see Figs. 21, 24 and 45). And the dark matters, dark energy and structure of the galaxy are presented along with the evolution of the universe.

Prologue

The present phenomenological model can be considered as an addition to the standard model. I hope that this paper makes a positive and helpful contribution to the related research fields academically and to the human life intellectually. To be honest, now I am very afraid of the high possibility that this model may not be right and some people may throw my ideas and results away. However, I feel, fortunately, somewhat comfortable in another viewpoint that I have made my best efforts ever on this paper in order to understand our nature and universe we stand on. Now, I am getting ready to accept, most possibly, the very harsh and most disappointing comments and even the perfect disregard from the main-stream people who may not welcome my ideas and may blame me for some reasons I do not know.

I try to unify the universe and particles under the assumption of three-dimensional quantized spaces. Also, the real meaning of the time is conjectured through the energy flow in the three-dimensional quantized space with the time momentum of E/c which can allow the positive and negative energies corresponding to positive and negative time flows, respectively. These basic questions motivated me to start this work. Beyond these basic questions, the relation between the real macroscopic world and the virtual microscopic world has been definitely all the time in the center of my mind. I love the nature itself, as it is, much more than the artificial things. Always the rules of the nature to operate and manage herself attract me so strongly much more than any other artificial things.

I have enjoyed the great journey of my life since I was born from the most beautiful and precious mother and father ever whom I have loved the most. My father and mother are the most precious gifts awarded to me from the nature along with my present family members. I can never forget them. I am and feel so much sad and sorry because I have not much helped them with sickness, old age, poorness and sacrifice. Now I try to figure out another long journey that our universe has taken up to now since its birth from the energy and matter big bangs by discovering the nature's rules as they are. Those rules seem to be related with the 3 charges of EC, LC and CC and three magnetic charges of MEC, MLC and MCC. The energy is interpreted to be equal to the non-zero time momentum of E/c related to the fluctuations and warping of the mathematical three-dimensional spaces with the time width. Also, the warped space with the Planck size space and the huge time length can experience the fast space expansion from the Planck size space scale along with the fast decreasing of the huge time length which can be called as the inflation and acceleration of the universe. This is the main contributor to the expansion and acceleration of our universe. I love the standard model so much even though it needs the modification. So many good people have made big efforts to elaborate the standard model. I have respected those good people. So I hope that the present model is the extended version of the present standard model and the unified model of all four known forces. Humans, particles and the universe are so beautifully connected. I think positively so.

I wish, in my heart, that this is the real physics story but not the scientific fiction (SF) story. I wish other brilliant researchers including the independent researchers can extend this model. Also, I wish the brilliant mathematicians can develop the geometrical and manifold descriptions of the n-dimensional quantized spaces. I wish all the independent researchers have the good luck and the courage. I wish, in my heart, that we on the earth live the peaceful and happy lives.

In memory of my mother and father;

This work is dedicated to my mother (Jung-Sun Yun, 연 정순) and father (Jung-Sup Hwang, 황 정섭) who passed away on August 28th 2009 and on February 5th 2015, respectively. I have been respecting and loving my mom and dad the most in the world. And I have been feeling sorry to my mother and father who have been suffering so much for a long time. I am now so sad, in my heart, for not having helped them. The fact they passed away breaks my heart.

This work is, also, dedicated to my family of my wife (Kyung-Saeng Hwang(Koh), 황(고) 경생), son and daughter.

I could not start this work without the full sacrifice of my beloved mother and father and without the full support of my wife, son and daughter.

Jae-Kwang Hwang, January 19, 2016.

JJJ PL report, 20160101-1 (2016); researchgate.net ; DOI: 10.13140/RG.2.1.3484.5201(2016).

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1. Introduction

Space and time are the mathematical concept and the energy is the physical concept of the space and time correlated status. The space with the non-zero time width (Δt) is called as the universe with the energy in the physics point of view. The universe has been so far discussed based on the unquantized space with the infinite number of dimensions. In the present work, the new concept of the n-dimensional quantized space (n=1,2,3,4, …) with the non-zero time width (Δt) is, for the first time, introduced in Fig. 1. Four three-dimensional quantized spaces with total 12 dimensions are used to explain the universes including ours as shown in Figs. 1 and 2. The physics and

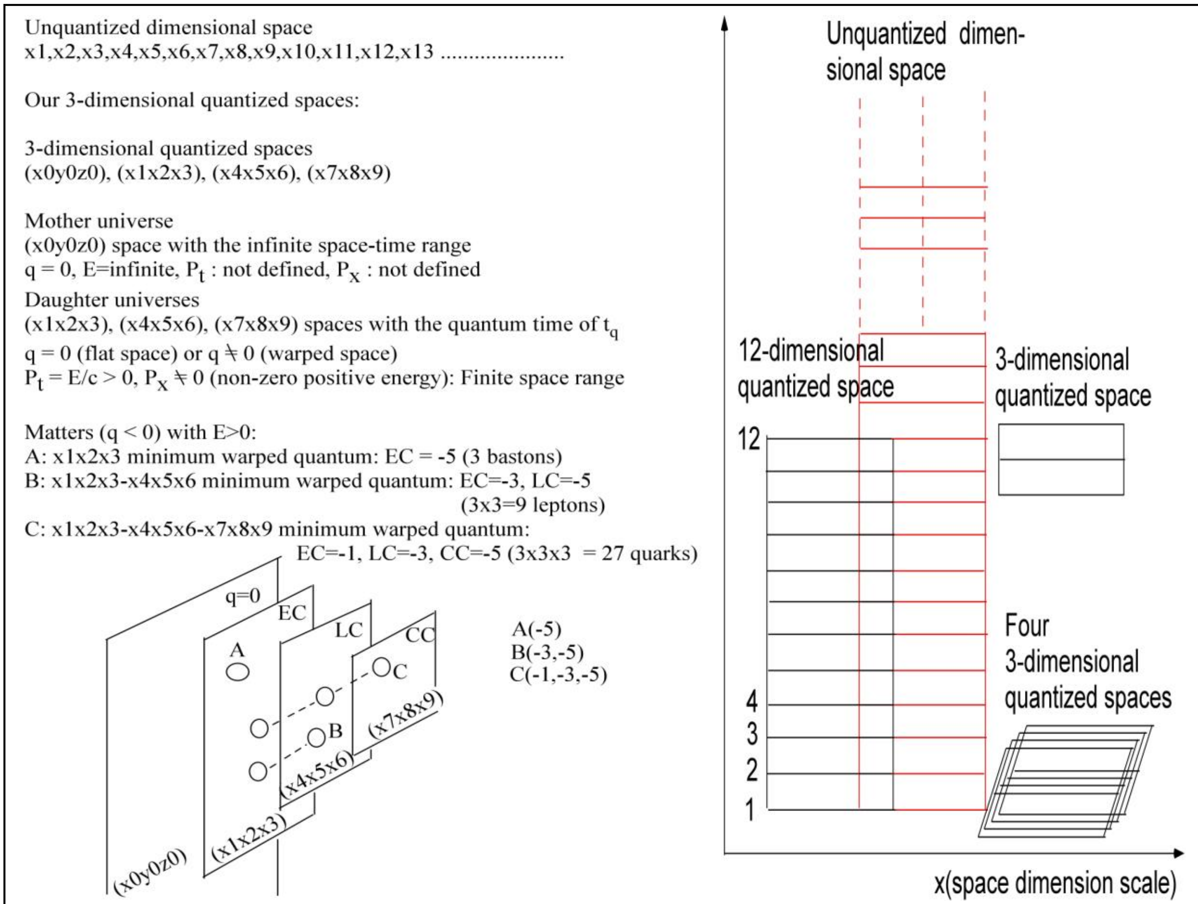


Fig. 1. 3-dimensional quantized spaces of x0y0z0, x1x2x3, x4x5x6 and x7x8x9 associated with each other. The unquantized space is compared with the quantized spaces.

mathematics of the universe based on the standard model, quantum mechanics, general relativity, string theory etc. have been developed based on the unquantized space in Fig. 1. Each n-dimensional quantized space has the energy when it has the time width because the energy is defined as $E_n = c\Delta t\Delta V_n$. ΔV_n is the volume of the n-dimensional quantized space. For example, for the 3-dimensional quantized space, $E = c\Delta t\Delta V$ where ΔV is the three dimensional space volume. Our universe is formed with the four 3-dimensional quantized spaces as shown in Figs. 1 and 2. Four 3-dimensional quantized spaces can be overlapped over the same states as shown in Fig. 1. There is the flat mother quantized space (x0y0z0 space in Fig. 1) with the infinite time width and infinite space width. The mother quantized space cannot be warped because it has the infinite time width and infinite space width. The overlapped quantized spaces in Fig. 1 are associated with each other. The daughter quantized spaces (x1x2x3, x4x5x6 and x7x8x9 spaces in Fig. 1) with the finite time width and finite space width can be warped on the flat mother quantized space. Therefore, if one daughter quantized space is warped, other daughter quantized spaces are warped, too. The warped space is defined with the charge and rest mass. The negative warping of the quantized space is defined as the negative charge which means the matters.

In the present work, the energy (E_n) of the n-dimensional quantized flat space is defined as $E_n = c\Delta t\Delta V_n$ where ΔV_n is the n-dimensional quantized space volume and Δt is the time width (see Figs. 48 – 52 and 64 for the n=3 (anti)matter). The time momentum and the space momentum are not defined for the universe where Δt and ΔV_n have the infinite values (see Figs. 48-52, 64, sections 15 and 17). These infinite-energy n-dimensional quantized flat spaces are called as the n-dimensional mother universes. If Δt and ΔV_n have the finite values, the energy of E_n is finite and the time momentum of $P_t = E_n/c$ and the space momentum of P_x have the finite values. These finite energy n-dimensional quantized universes are called as the n-dimensional daughter universes. Specifically, under the assumption that our universe is the 3-dimensional matter quantized space, I am going to explain the case of the 3-dimensional quantized spaces in the present work as shown in Figs. 1 and 2.

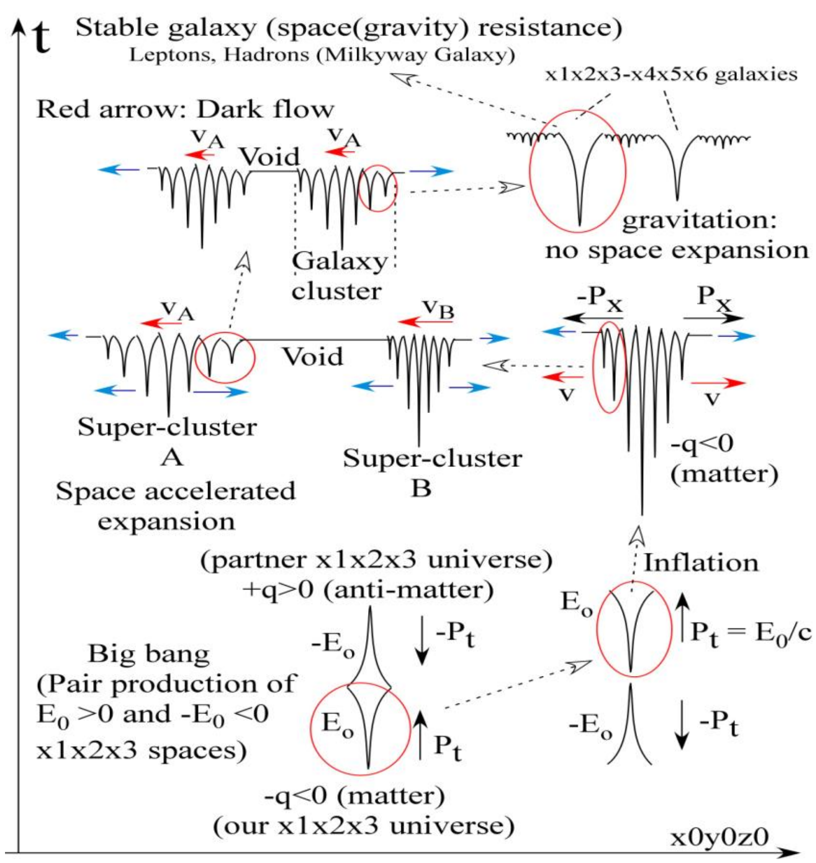


Fig. 2. Evolution of the matter universe with the positive energy from the big bang through the inflation to the particles (see Fig. 16). Peaks are the black holes. The group of black holes becomes a super-cluster or galaxy cluster. See sections 13, 16, 17, 19 and Figs. 5, 16, 25, 37, 38, 41, 59, 83, 84 and 92. The void is the flat or nearly flat space (see section 24).

Mathematically, all kinds of n-dimensional quantized flat spaces with $0 < n \leq \infty$ including the space with the infinite number of the space dimensions exist in Fig. 1. In the present work, the mother universes of the n = 1-, 2- and 3- dimensional quantized flat spaces with infinite energies are expressed as the x0, x0y0 and x0y0z0, respectively. For example, the first 3-dimensional quantized space with the infinite space and time ranges (3-dimensional x0y0z0 mother universe) is expressed as x0y0z0 in Fig. 1. This x0y0z0 space (x0y0z0 mother universe) is stable with the infinite energy in the physics point of view (see section 15). In order for the space to have the physical meaning, the space should have the finite limited space and time ranges which can give the finite time and space momenta as shown in Figs. 1-5. These spaces with the finite energies can be warped in order to make the matters. In the present work, those spaces with the physical meaning are expressed as the x1x2x3, x4x5x6 and x7x8x9 spaces which are intertwined with each other in Fig. 1. Then the physical quantity of the energy ($E = c\Delta t\Delta V_3$) can be defined for the three-dimensional quantized spaces such as the x1x2x3, x4x5x6 and x7x8x9 spaces. I think that a lot of three-dimensional quantized spaces (daughter universes) with the different sizes of the time width and space length can be created and annihilated, all the time, at the different time and different locations (see section 15). These daughter universes will take place from the quantum fluctuations of the space-time which creates the energy (see Figs. 2-4, 16, 64 sections 15 and 17). Physically only the three-dimensional quantized space is observed at the very short (instant) time width around us. We observe only the matters with the three-dimensional space volumes which are made of the elementary particles with the electric charges of 2/3, 0, -1/3 and -1. In the present work, it is assumed that we are living and locked in the three-dimensional quantized spaces of x1x2x3, x4x5x6 and x7x8x9 with the minimum time width of $\Delta t = t_q$ (quantum time) (see section 15 and Figs. 1, 2, 3 and 4). In Fig. 2, the evolution of the matter universe is shown as one example for the purpose of the simple explanation (see Fig. 15).

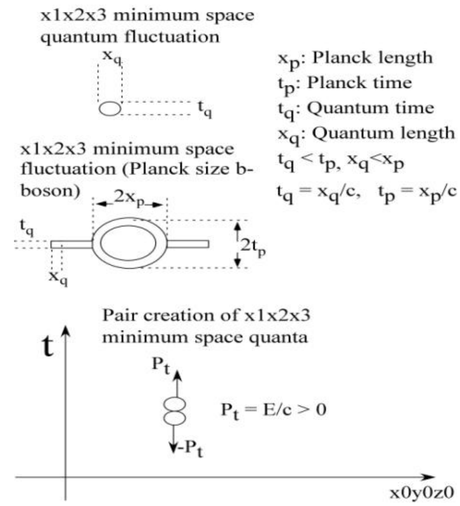


Fig.3. Observable minimum b-boson and the unobservable minimum space quantum pair production. See section 15.

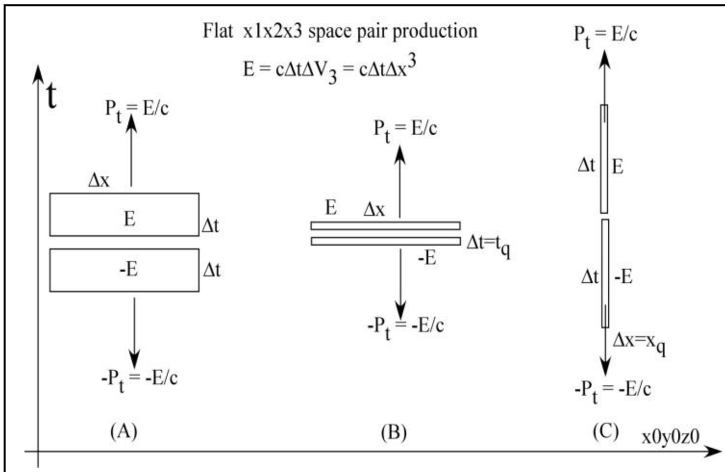


Fig. 4. Production of the flat $x_1x_2x_3$ space pair. See Figs. 20, 21, 22 and 24 for the warped version of case (C) related to the magnetic charges (monopoles). See Figs. 5, 2 and 6-19 for the warped version of case (B) related to the electric charges (monopoles). E>0.

If the x1x2x3 space is warped to the +t direction, it is called as the +q > 0 (positive electric charge) warping which creates the anti-matter universe. If the x1x2x3 space is warped to the -t direction, it is called as the -q <0 (negative electric charge) warping which creates the matter universe (see Fig. 64). Electric (EC), lepton (LC) and color (CC) charges are defined to be the charges of the x1x2x3, x4x5x6 and x7x8x9 warped spaces, respectively, in the present work.

In the present work, the quantum length (x_q) and quantum time (t_q) with the relation of $t_q = x_q/c$ are defined for the three-dimensional quantized spaces in Fig. 3. The quantum length is smaller than the Planck length (x_p). If the matter with E>0 is given, the time momentum ($P_t = E/c$) is constant and positive. Therefore, the time of the matter is increasing constantly along the positive time axis. It is because all of the three dimensional quantized spaces are made up of the quantum spaces with the constant quantum space fluctuation time of $t_q = x_q/c$ as shown in Fig. 3 (see Fig. 63). The quantum time of t_q is the minimum size of the time. Also, the observable time increase of $\Delta t_l = \Delta x/v$ can be indirectly measured by the non-zero velocity of the matter. For example, $\Delta t_l = \Delta x/c$ from the photon movement with the constant velocity of c. The space momentum of ($P_x = Ev/c^2$) is changing according to the velocity of v and the space position of the matter can be increasing or decreasing depending on the direction of the velocity. Therefore, the time of the three-dimensional quantized spaces is originated from the constant fluctuation velocity ($c=x_q/t_q$) of the quantum spaces. Also, the mother universe has the infinite quantum time which means the

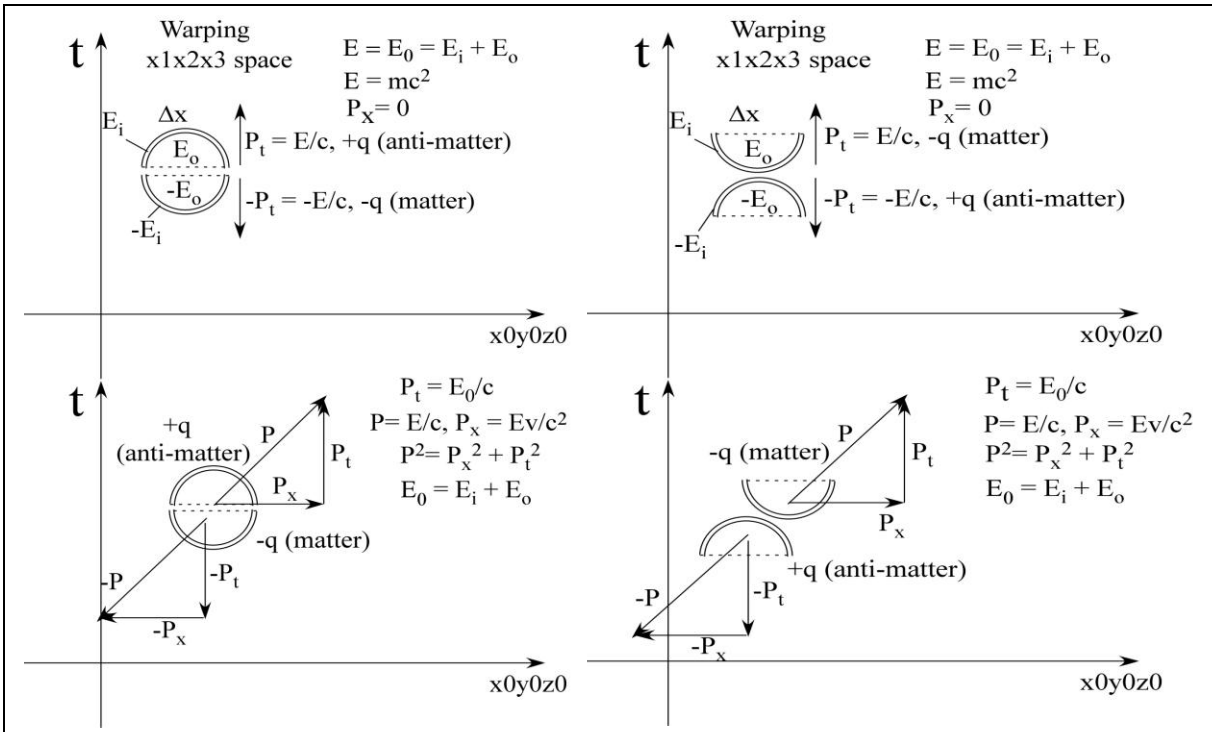


Fig. 5. Warped x1x2x3 quantized space pair production. These are the warped versions of the case (B) in Fig. 4. Here, q > 0 and E_0>0. Here, $v = v_x$. See Figs. 41 and 48-51.

stable mother universe because it takes the infinite time to fluctuate. It indicates that the mother universes are present permanently with the infinite quantum times and their daughter universes are fluctuating within the finite quantum times. Therefore, the quantum time fluctuation is the origin of the time we on the earth have experienced (see section 15 and Fig. 63).

In the present work, the x2-x4 one-dimensional matter is defined as the matter with the size of $\Delta x2 \geq 2x_p$, $\Delta x4 \geq 2x_p$ and $\Delta x1=\Delta x3=\Delta x5=\Delta x6=x_q$. And the x1x2x3-x4x5x6 three-dimensional matter is defined as the matter with the size of $\Delta x1 \geq 2x_p$, $\Delta x2 \geq 2x_p$, $\Delta x3 \geq 2x_p$, $\Delta x4 \geq 2x_p$, $\Delta x5 \geq 2x_p$ and $\Delta x6 \geq 2x_p$ (see Figs. 10-14 and Table 3). Here x_p and x_q are the Planck length and quantum length, respectively, in Fig. 3. And the x2 one-dimensional matter is defined as the matter with the size of $\Delta x2 \geq 2x_p$ and $\Delta x1=\Delta x3=x_q$. The quantum length (x_q) and the quantum time (t_q) of our universes are $2x_p^2$ = 5.223 10^{-70} m and x_q/c = 1.7422 10^{-78} s, respectively, which give the present masses of the elementary particles (see section 15). Different quantum time gives the different masses of the elementary particles (see section 15).

Table 1. n-dimensional quantized spaces and their quantized charges assigned systematically to the matters (see Table 3). These have the space dimensions of N=n(n+1). Antimatters have the charges of –Q(-Q1,…,-Qn) opposite to the charges of matters. N_{ep} is the number of the elementary fermion particles. $Q_i - Q_{i-1} = -1$.

(n,N)	*Q(Q1,…,Qn)*	*N_{ep}*
(1,2)	*-1(-1)*	*1*
(2,6)	*-2(-1/2,-3/2)* *-4 (-3/2,-5/2)*	*6*
(3,12) (our universe)	*-1(2/3,-1/3,-4/3)* *-3(0,-1,-2)* *-5(-2/3,-5/3,-8/3)*	*39*
(4,20)	*-2(1,0,-1,-2)* *-4(1/2,-1/2,-3/2,-5/2)* *-6(0, -1, -2, -3)* *-8(-1/2,-3/2,-5/2,-7/2)*	*340*
(n,n(n+1))	…….	$\sum_{i=1}^{n} n^i$

2. n-dimensional quantized spaces and their quantized charges and particles

The relationships between the n-dimensional quantized space and its corresponding charges are shown in Table 1 for matters with n=1, 2, 3 and 4. Total number of the quantized space dimensions is N=n(n+1). Antimatters have the charges of –Q(-Q1,…,-Qn) opposite to the charges of Q(Q1, …, Qn) of matters. Only the negative charges (Q<0) of the matters in n-dimensional quantized spaces (daughter universes) with the minimum time width of $\Delta t = t_q$ (quantum time) are considered in Table 1. But this can be extended easily to the antimatter by changing the signs of the charges. The quantized minimum observable warped spaces have the Planck size of $2x_p$ (see Table 6). In the one-dimensional quantized space (n=1) of Table 1, the space shape is projected as the line. This means that there is only one kind of a charge, which corresponds to the warping of the line along the x1 axis with t_q. This space is called as a x1 daughter universe. Here x1 is the axis of the one-dimensional shape (line). The x1 matter quantized minimum warped space (x1 matter) with the Planck length size has the quantized charge of -1 in Table 1 and allows only the two space dimensions (N=2) which consists of the x0 mother and x1 daughter universes. In other words, Q = Q1 = -1 (electric charge, EC) and N = 1 +

1 = 2. Here a x1 matter with the x1 b-boson corresponds to a x1 elementary fermion particle (see Figure 12). In the two-dimensional quantized space (n=2), N = n(n+1) = 6 and Q = Q1+Q2 = -2 or -4 in Table 1. The six space dimensions (N=6, x0y0, x1x2, and x3x4) are possible. The x1x2 matter minimum warped space (x1x2 matter) with Q = -4 and the Planck length size corresponding to a charge configuration of (EC)=(-4) decays to two one-dimensional matter minimum warped spaces (x1 and x2 matters) with the charge configurations of (EC)=(-3/2) and (EC)=(-5/2), respectively. And x1 and x2 matters correspond to two elementary (one-dimensional) particles. The x3x4 matter minimum warped space (x3x4 matter) with Q=-4 (Lepton charge, LC) intertwined with the x1x2 matter minimum warped space (x1x2 matter) with Q=-2 (Electric charge, EC) is called as a x1x2-x3x4 matter with a charge configuration of (EC,LC)=(-2,-4). This x1x2-x3x4 matter decays to four (2x2=4) one-dimensional matter minimum warped spaces (four xi-xj matters). These four x1-x3, x1-x4, x2-x3 and x2-x4 matters have the (EC,LC) charge configurations of (-1/2,-3/2), (-1/2,-5/2), (-3/2,-3/2) and (-3/2,-5/2), respectively and correspond to the four xi-xj elementary fermion particles (see Fig. 12). Therefore, the total number of the elementary fermion particles can be calculated by using the equation of $N_{ep} = \sum_{i=1}^{n} n^i = 6$. In the three-dimensional quantized space (n=3), N = n(n+1) = 12 and Q = Q1+Q2+Q3 = -1, -3 or -5 in Table 1 (see Tables 3, 6 and Fig. 12). The 12 space dimensions (N=12, x0y0z0, x1x2x3, x4x5x6 and x7x8x9) are possible. The three-dimensional quantized space case shown in Figs. 1 and 2 is explained in the later sections in more detail (see Table 3). Our universe is the three-dimensional quantized space with three generations of Q1, Q2 and Q3 which are closely related to the warped space energy along each of three axes in each space. Electric (EC), lepton (LC) and color (CC) charges are defined to be the charges of the x1x2x3, x4x5x6 and x7x8x9 warped spaces, respectively, in the present work. The four-dimensional quantized space (n=4) correspond to N = n(n+1) = 20 and Q = Q1+Q2 +Q3+Q4 = -2, -4, -6 or -8 in Table 1. The 20 space dimensions (N=20, x0y0z0q0, x1x2x3x4, x5x6x7x8, x9x10x11x12 and x13x14x15x16) are allowed. Then the four generations of Q1, Q2, Q3 and Q4 are possible. There are the four charge sets (Q1,Q2,Q3,Q4) of (-1/2,-3/2,-5/2,-7/2), (0, -1, -2, -3), (1/2,-1/2,-3/2,-5/2) and (1,0,-1,-2). The number of the elementary fermion particles is calculated by using the equation of $N_{ep} = \sum_{i=1}^{n} n^i = 340$. Electric (EC), lepton (LC), color (CC) and jaek (JC) charges are defined to be the charges of the x1x2x3x4, x5x6x7x8, x9x10x11x12 and x13x14x15x16 warped spaces, respectively, in the present work. The five and higher – dimensional quantized space cases not shown here can be possible, too.

The electric charges (EC) of 2/3, 0, -1/3 and -1 assigned to the quarks and leptons should correspond to the space of (3,12) in Table 1 (see Table 3). There are many kinds of matters which come from the different n-dimensional matter quantized spaces in Table 1. The n-dimensional matters cannot interact with the m-dimensional matters if m is different from n. In other words, the one-dimensional matter in the space of (1,2) in Table 1 cannot interact with the three-dimensional matter in our space of (3,12) because of the different quantized space dimensions. This means that other n-dimensional quantized spaces with $n \neq 3$ cannot penetrate through our three-dimensional quantized space system because there are no interactions. However, there should be interactions between the matters or daughter n-dimensional quantized spaces like the x1x2x3, x4x5x6 and x7x8x9 spaces within the same mother n-dimensional quantized space like the x0y0z0 space. Therefore, those daughter n-dimensional quantized spaces like the x1x2x3, x4x5x6 and x7x8x9 spaces can fission into several daughter n-dimensional quantized spaces or merge with other daughter n-dimensional quantized spaces because of the possible interactions. Also, note that the quantum time (t_q) decides the masses of the elementary particles in the corresponding daughter universes (see section 15).

3. Three-dimensional quantized spaces

Let's start from the three-dimensional quantized space of the $x_0y_0z_0$ mother universe which has the infinite space length and infinite time width with the infinite energy. Quantum fluctuations of the x0y0z0 space mean the creation and annihilation of the x1x2x3 space quantum pair as shown in Fig. 3. In a pair creation process, a pair of one x1x2x3 space quantum with the positive time momentum of $P_t = E/c$ and another x1x2x3 space quantum with the negative time momentum of $-P_t = -E/c$ is created (see Figs. 48-51). In a pair annihilation process, this x1x2x3 quantum pair is annihilated. This space quantum has the zero charge which means it is flat. The minimum space length and time width are x_q (quantum length) and t_q (quantum time), respectively. Quantum time(t_q) is shorter than the Planck time(t_p) as shown in Fig. 3. The x1x2x3 space quantum with the time (P_t) and space (P_x) momenta can be called as the minimum universe with the energy. The x0y0z0 space is not the physical universe but the mathematical space geometry because this x0y0z0 space cannot have the defined time and space momenta from the infinite energy. If many x1x2x3 minimum space quanta in Fig. 3 are combined to make the x1x2x3 quantized space, the energy of the x1x2x3 space is increased. And this x1x2x3 space can be fluctuated by the creation and annihilation of the Planck size b-boson (minimum observable space-time volume) as shown in Fig. 3. The x1x2x3 space expansion is closely related to the minimum space quanta coming from the E and –E space pair production in Fig. 6. The energy (E_p(xi-xj) = 2.1248 10^{-31} (eV)) of the one-dimensional xi-xj Planck size b-boson can be calculated from the empirical equation of E_p(xi-xj) = 8.1365 $10^{38}x_p^2$ (x_p: m) as explained in more detail in the next sections (see Table 2). Therefore, the energy (E_p(x1x2x3-x4x5x6)) of a x1x2x3-x4x5x6 Planck size b-boson, which is three-dimensional, is E_p(x1x2x3-x4x5x6) = 3E_p(xi-xj) based on the quantum simple harmonic oscillation along each space axis. Let's calculate the energy of the one-dimensional xi Planck size b-boson in the x_q=1 unit system. $E_p(xi) = \pi(x_p)^2$= 8.2041 10^{-70} (Tms) where c is the light speed and Tms is defined to be the energy unit calculated from $E = c\Delta t\Delta x$ (t:sec, x:m) and $\Delta t=\Delta x/c$. The energy of the one- dimensional xi Planck size b-boson can be calculated in another equation of E_p(xi) =4.0662 $10^{38}x_p^2$ = 1.0624 10^{-31} (eV) (x: m) (see the related text). Therefore, E_p(xi) = 8.2041 10^{-70} (Tms) = 1.0624 10^{-31} (eV). It means that 1 Tms = 2.2950 10^{38} eV and 1 eV = 7.7222 10^{-39} Tms. Really, Tms is x_q^2Tms because the x2 one-dimensional particle is defined as the particle with the size of $\Delta x2 \geq 2x_p$ and $\Delta x1=\Delta x3=x_q$.

A pair of flat x1x2x3 (daughter) universes with the finite energy is created within the x0y0z0 (mother) universe as shown in Fig. 4. These flat x1x2x3 universes are composed of many x1x2x3 space quanta. This flat universe can be expressed by the plane wave propagation with zero rest mass of m=0 as explained in sections 11 and 20. In the plane wave, the energy and space momentum are expressed as $P_x = \hbar k_x$ and $E = cP_t = \hbar\omega$, respectively (see section 11). In Figs. 4 and 5, generally the total momentum (P^{total}) and total energy (E^{total}) of the space pair are zero from the energy-momentum conservation rule. The energy of E is defined as $E = c\Delta t\Delta x = c\Delta t\Delta V_3 = c\Delta t\Delta V_{x1x2x3}$. ΔV_3 is the x1x2x3 space volume. Then the positive energy universe with the positive time momentum is moving toward the positive time direction and the negative energy universe with the negative time momentum is flowing toward the negative time direction (see Figs. 48-51). There are three kinds of the flat x1x2x3 space pair production in Fig 4. The warped versions of the cases (B) and (C) are used to explain the electric charges and the magnetic charges, respectively, in the present work. Our universe belongs to the warped version of the flat x1x2x3 space (case (B) in Fig. 4) with the positive energy of E>0 as shown in Figs. 4, 5 and 6. The warped version of the case (C) in Fig. 4 is shown in the later section (see Figs. 20, 21, 22, 24, section 11.2).

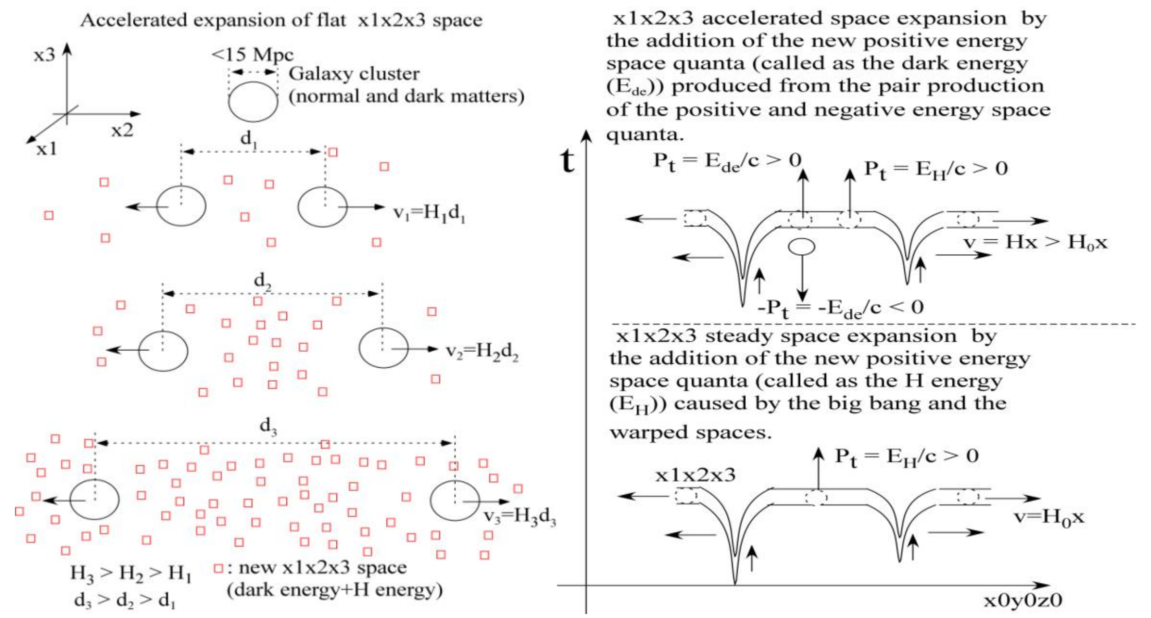


Fig. 6. Expansion and acceleration of the x1x2x3 space. See Fig. 77 and 85 for the dark energy and H energy effects. See Figs. 2, 3, 25, 59, 84 sections 13, 15, 20.2 and 24, too.

If the x1x2x3 quantized space is warped as shown in Fig. 5, the warping energy (E_o) is added as the outside space energy (E_o) to the internal space energy (E_i). Therefore, the total energy is $E_0 = E_o + E_i$ where the warping energy (E_0) is called as the rest energy of this universe. Generally, $E_0 \approx E_o$. The value of E_o/c^2 is defined as the rest mass (m(rest mass) = m_0) of this warping space. The rest mass is defined only for the warping energy (E_o) of the warping space. The flat space can be described as the plane waves with the zero rest mass (see section 11). The space warping energy of E_o is closely related to the electric charge (q) as explained in more detail in the next sections. There are two types of the space warping to the positive time (+t) direction and negative time (-t) direction. In other words, if the x1x2x3 space is warped to the +t direction, it is called the +q>0 (positive electric charge) warping which creates the anti-matter universe. If the x1x2x3 space is warped to the -t direction, it is called the –q<0 (negative electric charge) warping which creates the matter universe. Our universe is the matter universe and time is flowing to the +t direction. This means that our universe belongs to the universe with the positive time momentum (positive energy) of $P_t = E_0/c$ and negative electric charge (matter) of –q<0. In this case, the space momentum of $P_x = mv = Ev/c^2$ can have positive or negative value depending on the velocity sign (see section 17). And, when the matter with the positive energy is moving with the velocity, v, within the x1x2x3 space, the space momentum is $P_x = Ev/c^2$ (see Figs. 48-51). Then, $E = (1-v^2/c^2)^{-0.5}E_0 \cong E_0 + m_0v^2/2 = E_0 + E_k$ (see section 20). Here, E_k is the kinetic energy of $p_x^2/(2m_0)$ where p_x is m_0v (see section 20). Here, m_0 can be replaced with m(rest mas) because $m_0 \approx m(rest\ mass)$ (see Fig. 64).

4. Matter minimum warped space quanta and charges (see Section 11.1)

4.1. x1x2x3 matter, dark energy and electric charge

First I will talk about the space expansion of the x1x2x3 universe. We cannot move freely to the +t and –t time directions within our universe but we can move freely to the +x and –x space directions within our universe. Therefore, it is assumed that the time width of our universe is limited to the minimum time width (quantum time, t_q) of the space quantum in Fig. 3. Our universe belongs to this kind of three-dimensional quantized space with the minimum time width (quantum time, t_q) of the space quantum. The space expansion of the x1x2x3 space can be explained by adding up the new x1x2x3 space quanta (called as the dark energy) produced from a pair production of the +E and –E space quanta and the new x1x2x3 space quanta (the H energy) caused by the big bang and the warped spaces in Fig. 6. The number of the added new space quanta (called as the H energy) caused by the big bang and the warped spaces to move toward the less warped space is proportional to the length (x) of the space region of interest.

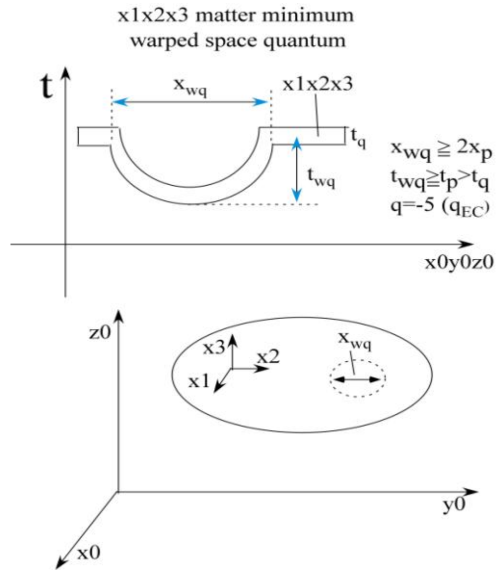


Fig. 7. The x1x2x3 matter minimum warped space quantum (x1x2x3 warped quantum or x1x2x3 matter).

The expansion speed (v) of this universe is proportional to x. Therefore, Hubble's law of this universe is expressed as $v=H_0x$ where H_0 is the Hubble's constant. The warped space has the space expansion effect tending to be changed toward the flat space. The more warped the space is, the bigger the space expansion effect is. The expansion speed of the warped universe is $v=H_0x$. In our local universe, the gravitational effect is large. Within the galaxy cluster, there is no space expansion because of the dominating gravitational attraction effect between the matters including the normal and dark matters. In other words, the new x1x2x3 space quanta cannot be added to the local x1x2x3 space within the galaxy cluster. Therefore, the space expansion speed is v=0 within the galaxy cluster. For the x1x2x3 space between the galaxy clusters, with increasing of the distance (d) between the galaxy clusters, the density of the added new positive energy space quanta (called as the dark energy (E_{de}) and H energy (E_H)) as shown in Figs. 3and 6 is increasing. And the H value is increased from H_1 to H_3 as shown in Fig. 6. In other words, $H_3 > H_2 > H_1$. Then, H is getting larger than the Hubble's constant of H_0 because of this dark energy effect added to the H energy (Hanul energy or Hwang energy). This can explain why the expansion of our x1x2x3 universe is accelerated by the dark energy effect (see Fig. 84 for the galaxy). Therefore the accelerated space expansion is caused by the added new x1x2x3 spaces which is called as the dark energy effect. This additional dark energy effect plays the role of the negative gravitational effect on the mass of m1 as shown in Figs. 6 and 77 (see section 24).

The warped x1x2x3 matter universe has the negative charge of q<0. Therefore, the x1x2x3 matter minimum warped space quantum (x1x2x3 matter) has the negative charge of q<0 as shown in Fig. 7. The charge of the x1x2x3 matter minimum warped space quantum (a x1x2x3 matter) is proposed as q=-5 and is defined as the electric charge (EC, q_{EC}) as explained in Table 3.

4.2. x1x2x3-x4x5x6 matter and lepton charge

The x1x2x3 flat space with q=0 and E>0 expressed as A(0) can be changed to the x1x2x3-

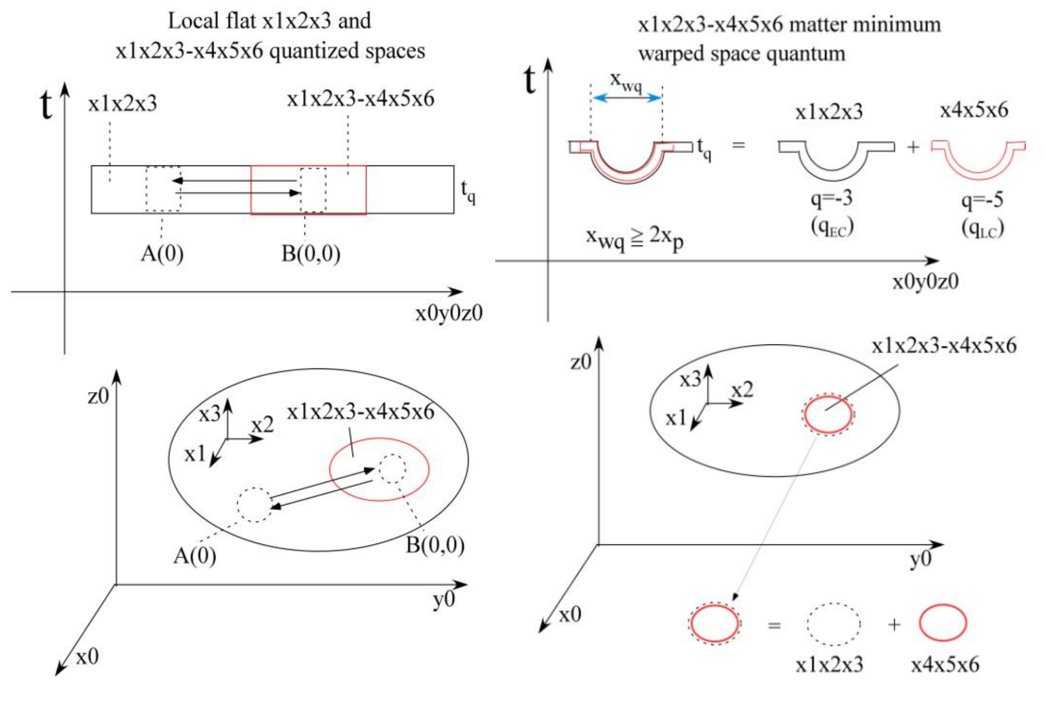


Fig. 8. The x1x2x3-x4x5x6 flat minimum space quantum and the x1x2x3-x4x5x6 matter consisting of the x1x2x3 matter minimum warped space quantum (x1x2x3 matter) and the x4x5x6 matter minimum warped space quantum (x4x5x6 matter).

x4x5x6 flat space with q=0 and E>0 expressed as B(0,0) in Fig. 8. This process can expand the x4x5x6 space a little bit. The x1x2x3 space shrinks by the lost space. Therefore, the likable x4x5x6 accelerated space expansion can be partly explained by this process. Also the warped x4x5x6 space will increase the x4x5x6 space expansion rate and the possible gravitational effects between the x1x2x3-x4x5x6-x7x8x9 matters will resist the x4x5x6 space expansion.

The x4x5x6 warped quantized space is always intertwined by the x1x2x3 warped quantized space in Fig. 8. Therefore, when the x4x5x6 flat space is warped, the corresponding x1x2x3 flat space is also warped. The x4x5x6 minimum warped space quantum (x4x5x6 matter) has always the partner x1x2x3 minimum warped space quantum (x1x2x3 matter) as shown in Fig. 8. The charge of the x4x5x6 minimum warped space quantum (x4x5x6 matter) is proposed as q=-5 and is defined as the Lepton charge (LC, q_{LC}). Here the charge of the intertwined x1x2x3 matter minimum warped space quantum is proposed as EC=-3 and is defined as the electric charge (EC,q_{EC}). Then the x1x2x3-x4x5x6 matter minimum warped space quantum which is called as the x1x2x3-x4x5x6 matter can be described as (EC,LC) = (-3,-5) as explained later in Table 3. The energy of the x1x2x3-x4x5x6 matter minimum warped space quantum is E=E(EC)+E(LC).

4.3. x1x2x3-x4x5x6-x7x8x9 matter and color charge

The x7x8x9 warped quantized space is intertwined by the corresponding x1x2x3 and x4x5x6 warped quantized spaces as shown in Fig. 9. When the x7x8x9 flat space is warped, the x1x2x3 and x4x5x6 flat spaces are also warped as shown in Fig. 9. The x7x8x9 minimum warped space quantum (x7x8x9 matter) has always the partner x1x2x3 and x4x5x6 minimum warped space quanta. The charge of x7x8x9 minimum warped space quantum (x7x8x9 matter) is proposed as q=-5 and is defined as the color charge (CC,q_{CC}) as explained later in Table 3. Here the charge of the x4x5x6 minimum warped space quantum is proposed as LC=-3 and is defined as the lepton charge (LC,q_{LC}). And the charge of the x1x2x3 minimum warped space quantum is proposed as EC=-1 and is defined as the electric charge (EC,q_{EC}). The x1x2x3-x4x5x6-x7x8x9 minimum warped space quantum (x1x2x3-x4x5x6-x7x8x9 matter) can be described as (EC,LC,CC) = (-1,-3,-5). The energy of the x1x2x3-x4x5x6-x7x8x9 matter minimum warped space quantum (x1x2x3-x4x5x6-x7x8x9 matter) is E=E(EC)+E(LC)+E(CC).

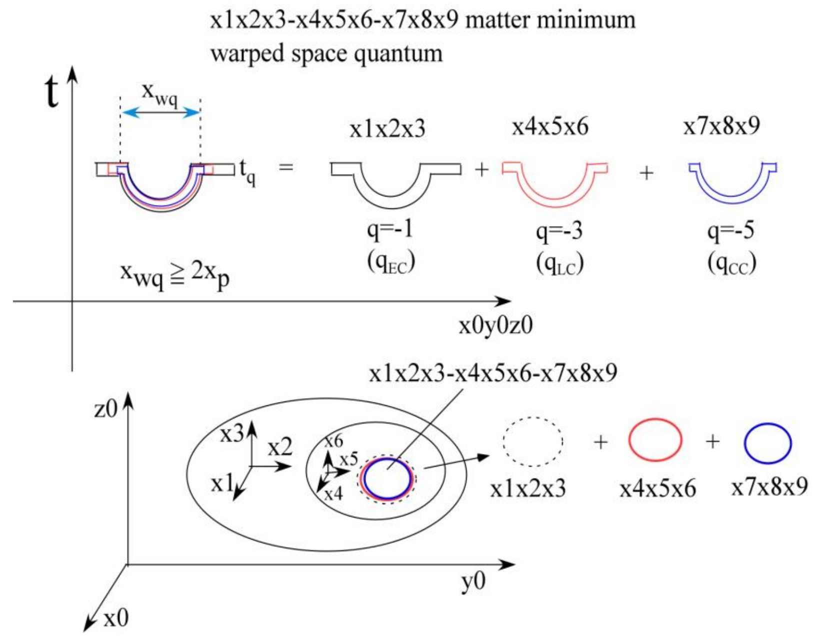


Fig.9. The x1x2x3-x4x5x6-x7x8x9 matter consisting of the x1x2x3 matter minimum warped space quantum (x1x2x3 matter), the x4x5x6 matter minimum warped space quantum (x4x5x6 matter) and the x7x8x9 matter minimum warped space quantum (x7x8x9 matter).

4.4. x1x2x3-x4x5x6-x7x8x9-x10x11x13 matter

The next x1x2x3-x4x5x6-x7x8x9-x10x11x12 minimum warped space quantum (x1x2x3-x4x5x6-x7x8x9-x10x11x12 matter) must have, systematically, the x1x2x3 minimum warped space quantum with the charge of q=+1>0 which means it is the antimatter space. Three x1x2x3, x4x5x6 and x7x8x9 minimum warped space quanta in sections of 4.1, 4.2 and 4.3 have the negative charges which mean that those are the matter spaces. Therefore, the x1x2x3 minimum warped space quantum should be the matter which means that its charge is negative. The x1x2x3 minimum warped space quantum with the charge of +1 is not allowed. The matter universe (or space) has only the matter minimum warped space quantum as its daughter universe (or space). Therefore, a x1x2x3 minimum warped space quantum with the positive charge of q=+1 cannot

Table 2. Energies of the previously known particles are shown as the function of the possible sizes (radius, x (m)) of the particles from the equations of E_b(eV) = 8.1365 10^{38} x^2 for a xi-xj b-boson (ν_e,ν_μ,ν_τ,e,μ,τ) and E_b(eV) = 12.2047 10^{38} x^2 for a xi-xj-xk b-boson (quarks, p, baryons, mesons). The equation of E_b(eV) = 12.2047 10^{38} x^2 is obtained from the measured proton size (charge radius: 8.768(69) 10^{-16} m) and proton energy (E=938.27 10^6 eV) (P.J. More et al., Rev. Mod. Phys. **80**, 633-730 (2008)). Here, E_b is the energy of the background fluctuation quantum (b-boson) which takes the most part of the particle energy.

x(m)	E_b(eV)	particles
8.768(69)10^{-16}	938.27 10^6	p
1.229 10^{-22}	(10^{-4})	ν_e,ν_μ,ν_τ
2.506 10^{-17}	0.511 10^6	e
3.604 10^{-16}	105.7 10^6	μ
1.478 10^{-15}	1.777 10^9	τ
4.434 10^{-17}	2.4 10^6	u
6.271 10^{-17}	4.8 10^6	d
2.919 10^{-16}	104 10^6	s
1.020 10^{-15}	1.27 10^9	c
1.855 10^{-15}	4.2 10^9	b
1.184 10^{-14}	171.2 10^9	t
1.616 10^{-35}	2.1248 10^{-31}	xi-xj graviton

coexist with the x1x2x3 - x4x5x6 - x7x8x9 -x10x11x12 matter minimum warped space quantum. It means that the x1x2x3-x4x5x6-x7x8x9-x10x11x12 matter minimum warped space quantum is not allowed. Therefore, under this proposition our universe has to be described by the x1x2x3, x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 matters with four 3-dimensional quantized spaces of x0y0z0, x1x2x3, x4x5x6 and x7x8x9 which have the total 12 space and one time dimensions. Because we are located within the x1x2x3 space, we will observe only the x1x2x3-x4x5x6 matters and leptons (xi-xj particles) which can be described as (EC,LC). Therefore, the quarks (xi-xj-xk particles) cannot be observed in the x1x2x3 space (see Figs 91 and 92). The mesons and baryons can be observed in the x1x2x3 space through the hadronization (leptonization) (see section 7 and Fig. 93).

5. Fermions and three generations

Table 3. Electric charges (EC), lepton charges (LC) and color charges (CC) for the elementary fermion particles. Red colored ones have been previously known. All charges are normalized to ECs of e (EC=-1) and ν_e (EC=0). u(r) = (2/3.0,-2/3)=(EC,LC,CC). Also, see Tables 3 and 6.

EC flavor	x1x2x3	x1x2x3	x1x2x3
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(M1,M2,M3)
Total EC	-5	-3	-1
LC flavor		x4x5x6	x4x5x6
x4		-2/3(ν_e,e,Le)	0(u,d,M1)
x5		-5/3(ν_μ,μ,Lμ)	-1(c,s,M2)
x6		-8/3(ν_τ,τ,Lτ)	-2(t,b,M3)
Total LC		-5	-3
CC flavor			x7x8x9
x7			-2/3(r)
x8			-5/3(g)
x9			-8/3(b)
Total CC			-5

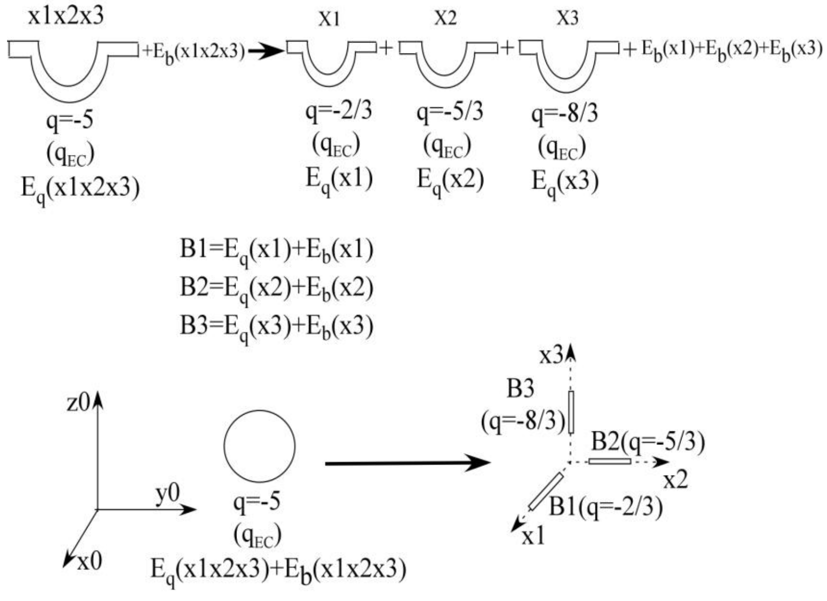


Fig. 10. Three fermions of B1, B2 and B3 (which are called as bastons) are produced by the decay of x1x2x3 particle to three x1, x2 and x3 particles. See Figs. 11 and 12. Also, see Table 6.

In Table 2, the energies of the previously known fermions (see Figs. 10-12) are shown as the function of the possible sizes (radius, x (m)) of the fermions from the equation of E_b(eV) = 8.1365 10^{38} x^2 for a xi-xj b-bosons of the leptons and E_b(eV) = 12.2047 10^{38} x^2 for a xi-xj-xk b-boson of the quarks and hadrons. The equation of E_b(eV) = 12.2047 10^{38} x^2 is obtained from the measured proton size (charge radius: 8.768(69) 10^{-16} m) and proton energy (E=938.27 10^6 eV). A xi-xj-xk proton has a xi-xj-xk b-boson (see Fig. 13). The fermion size prediction from this equation is within the reasonable range for each fermion in Table 2. When the one-dimensional space size (diameter) is 2x and time length is 2t=2x/c, the energy of a fermion is proportional to x^2 if a fermion is an one-dimensional xi, xi-xj or xi-xj-xk particle in Fig. 11. From the reasonable predictability of a fermion size by the equations of E_b(eV) = 12.2047 10^{38} x^2 or 8.1365 10^{38} x^2, all of fermions are considered as one-dimensional xi, xi-xj or xi-xj-xk particles (see Figs. 10-12). Fermions (particles) which are one-dimensional particles can be produced from the decay of the three-dimensional matter minimum warped space quantum to three one-dimensional matter warped space quanta. For example, a x1x2x3 particle in Fig. 7 can decay to three fermions of B1, B2 and B3 which are called as bastons in the present work as shown in Figs. 10-12. The q=0 (charge) and s=0(spin) background fluctuation space quanta called as the b-bosons with the energies of E_b(x1), E_b(x2), E_b(x3) and E_b(x1x2x3) are introduced here by coupling with the minimum warped space quanta of E_q(x1) (x1 matter), E_q(x2) (x2 matter), E_q(x3)(x3 matter) and E_q(x1x2x3) (x1x2x3 matter), respectively. One example is shown for a baston B1 in Fig. 11 (also, see Fig. 12). If the minimum warped space quanta (xi matters or x1x2x3 matter) are not present, these background fluctuation space quanta (b-bosons) will continue appearing and disappearing to give the background space fluctuations as shown in Fig. 11. The b- boson is the time axis background fluctuation with the spin of 0 or 1. The space axis background fluctuation with the spin of 1 is defined as the photon with the spin of 1as shown in Fig. 11.

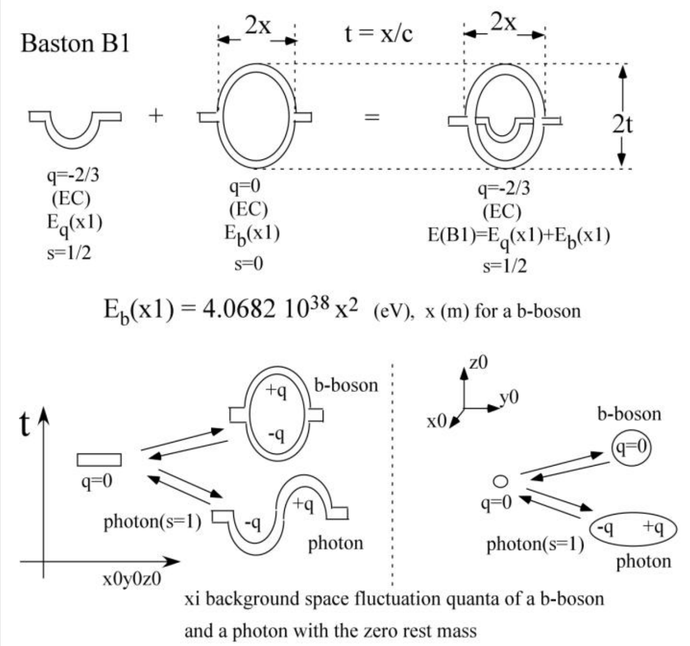


Fig. 11. The x1 baston (B1) has two parts of the x1 b-boson and the x1 matter (see Fig. 12). For a photon, see Figs. 21, 24 and 45.

The q=0 and s=0 background fluctuation quanta (b-boson) with the proper energies should be added to all of elementary fermions with q and s=1/2. The proper electric charges (EC) of bastons (B1, B2, B3) are assigned by systematics as shown in Table 3. The electric charge (EC=-

5) of the x1x2x3 matter minimum warped space quantum (x1x2x3 matter) is assigned by systematics as shown in Table 3. The x1x2x3 matter minimum warped space quantum (x1x2x3 matter) in Fig. 10 has the three-dimensional electric charge state of -5 which decays to the three bastons with three one-dimensional electric charge states of -2/3 (x1 matter), -5/3 (x2 matter) and -8/3 (x3 matter). The x1, x2 or x3 matter has the spin of ½ and x1, x2 or x3 background fluctuation space quantum (b-boson) has the spin of 0. Then a baston has the spin of ½ which

Fermions

x1x2x3 matter + x1x2x3 b-boson =
x1x2x3 particle (EC)=(-5)
x_i matter + x_i b-boson = x_i particle (3 bastons) (EC)

x1x2x3-x4x5x6 matter + x1x2x3-x4x5x6 b-boson =
x1x2x3-x4x5x6 particle (EC,LC)=(-3,-5)
x_i - x_j matter + x_i - x_j b-boson =
x_i - x_j particle (3x3=9 leptons) (EC,LC)

x1x2x3-x4x5x6-x7x8x9 matter + x1x2x3-x4x5x6-x7x8x9 b-boson = x1x2x3-x4x5x6-x7x8x9 particle (EC,LC,CC)=(-1,-3,-5)
x_i - x_j - x_k matter + x_i - x_j - x_k b-boson =
x_i - x_j - x_k particle (3x3x3=27 quarks) (EC,LC,CC)

i: 1,2,3 j: 4,5,6 k: 7,8,9

ES:Electric spin for x1x2x3 space,
LS:Lepton spin for x4x5x6 space,
CS:Color spin for x7x8x9 space;

spin = ES = LS = CS = 1/2 for a fermion
spin = ES = LS = CS = 1/2 for a matter
spin = ES = LS = CS = 0 for a b-boson

Background fluctuation quantum is called as b-boson
(Bumo boson) with $E_{b(xi-xj-xk)}=12.2047\ 10^{38}x^2$ (eV)(x:m)

Fig. 12. Fermions of bastons, leptons and quarks are compared (see Fig. 93).

indicates that the baston is the fermion. Similarly, leptons are made by the decay of two intertwined x1x2x3 and x4x5x6 matter minimum warped space quanta (x1x2x3-x4x5x6 matter) in Fig. 8. The x4x5x6 matter minimum warped space quantum (x4x5x6 matter) in Fig. 8 has the three-dimensional lepton charge state of -5 which decays to three one-dimensional lepton charge states of -2/3 (x4 matter), -5/3 (x5 matter) and -8/3 (x6 matter) in Table 3. The x1x2x3 matter minimum warped space quantum (x1x2x3 matter) in Fig. 8 has the three-dimensional electric charge state of -3 which decays to three one-dimensional electric charge states of 0 (x1 matter), -1 (x2 matter) and -2 (x3 matter) in Table 3.

Each xi-xj fermion created from a x1x2x3-x4x5x6 matter has two charge configurations of an electric charge (EC) and a lepton charge (LC) which give nine fermions called as leptons with the charge configuration of (EC,LC). A lepton can be described as (EC,LC) as shown in Table 3 and Fig. 12. For example, electron and ν_e are described as (-1,-2/3) and (0,-2/3), respectively. One-dimensional intertwined electric and lepton charge part (xi-xj matter) and one dimensional electric and lepton background fluctuation space quantum part (xi-xj b-boson) of a lepton have the spins of ½ and 0, respectively as shown in Fig. 12. Then the lepton has the total spin of ½. A neutrino with zero EC and non-zero LC have the flat x1 space (x1 matter) within a x1 b-boson and a warped xj space (xj matter) within a xj b-boson. Here, j is 4, 5 or 6.

Also, quarks are made by the decay of three intertwined x1x2x3, x4x5x6 and x7x8x9 matter minimum warped space quanta (a x1x2x3-x4x5x6-x7x8x9 matter) in Fig. 9. The x1x2x3 matter minimum warped space quantum (x1x2x3 matter) in Fig. 9 has the three-dimensional electric charge state of -1 which decays to three one-dimensional electric charge states of 2/3 (x1 matter), -1/3 (x2 matter) and -4/3 (x3 matter) as shown in Table 3. The x4x5x6 matter minimum warped space quantum (x4x5x6 matter) in Fig. 9 has the three-dimensional lepton charge state of -3 which decays to three one-dimensional lepton charge states of 0 (x4 matter), -1 (x5 matter) and -2 (x6 matter). The x7x8x9 matter minimum warped space quantum (x7x8x9 matter) in Fig. 9 has the three-dimensional color charge state of -5 which decays to three one-dimensional color charge states of -2/3 (x7 matter), -5/3 (x8 matter) and -8/3 (x9 matter). Then each quark has three charge configurations of an electric charge (EC), a lepton charge (LC) and a color charge (CC) which give 27 fermions called as quarks with the charge configuration of (EC,LC,CC) as shown in Table 3 and Fig. 12. For example, u and d are described as (2/3,0,-2/3) and (-1/3,0,-5/3), respectively. One-dimensional intertwined electric, lepton and color charge part (xi-xj-xk matter) and one-dimensional electric, lepton and color charge background fluctuation space quantum part (xi-xj- xk b-boson) of a quark have the spins of ½ and 0, respectively as shown in Fig. 12. Then the quark has the spin of ½. The u, d and M1 quarks with non-zero EC, zero LC and non-zero CC have the flat x4 space with the x4 b-boson and the warped xi and xk spaces with the xi and xk b-bosons, respectively. Here, i is 1, 2 or 3 and k is 7, 8 or 9.

In Fig. 12 and Table 3, fermions are compared for the bastons, leptons and quarks. Three-dimensional particles which decay to the bastons, leptons and quarks are shown, too. In Table 3, ECs of the electron and neutrino are defined to be -1 and 0, respectively. ECs of u and d quarks are assigned (normalized) as 2/3 and -1/3 based on the electron's EC of -1. If we define the electron charge (EC=-1) as the different values, the ECs of all quarks, also, will be changed (see section 11). Therefore, EC, LC and CC charges in Table 3 are normalized on the basis of the previously defined electric charges of the neutrino, electron, u and d quarks. Of course the electric charges of the antiparticles have the opposite signs to those of the particles. Neutrinos have the zero electric charge. The electron, μ and τ leptons have the electric charges of EC=-1. Next unknown three leptons of Le, Lμ and Lτ in Table 3 are proposed to have the -2 electric charges because an electric charge of an electron is decreased by -1 from the electric charge of an electron neutrino. This gives the electric charge of -3 to the x1x2x3 matter minimum warped space quantum (x1x2x3 matter) of the leptons. Because an electric charge of d is decreased by -1 from an electric charge of u, next unknown three quarks of M1, M2 and M3 in Table 3 are proposed to have the -4/3 electric charge. This gives the electric charge of -1 to the x1x2x3 matter minimum warped space quantum (x1x2x3 matter) of the quarks. The x1x2x3 and x4x5x6 matters are on the first and second three-dimension quantized spaces with EC=-3 and LC=-5, respectively, of leptons in Table 3 and Fig. 1. The x1x2x3, x4x5x6 and x7x8x9 matters are on the first, second and third three-dimensional quantized spaces with EC=-1, LC=-3 and CC=-5, respectively, of quarks in Table 3 and Fig. 1. Total color charge of quarks is proposed to be -5 in Table 3. By this systematics, total electric charge of three bastons (B1, B2 and B3) is proposed to be -5. Total lepton charges of leptons and quarks in Table 3 are proposed to be -5 and -3, respectively.

6. Bosons

In Table 4, quantized charges allowed for the force mediating bosons are tabulated. The 27 xi-xj-xk bosons (Z/W/Y bosons) are expressed as (EC,LC,CC), the 9 xi-xj bosons (Z/W/Y bosons) are expressed as (EC,LC) and the 3 xi bosons (Z/W/Y bosons) are expressed as (EC). The Z, W and

Table 4. Electric charges (EC), lepton charges (LC) and color charges (CC) for the virtual elementary boson particles with nonzero masses. Red colored ones may correspond to the previously known gauge bosons. And Z/W/Y(EC,LC)CC(CC) = Z/W/Y(EC,LC,CC) for the 27 xi-xj-xk bosons. Black colored bosons are newly proposed in the present model.

EC flavor	x1x2x3	x1x2x3	x1x2x3
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 EC	-3	-3	-3
LC flavor		x4x5x6	x4x5x6
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(–2,–1)	-1 Z(0,-1),W(-1,-1),Y(-2,-1)
x6		-2 Z(0,–2),W(–1,–2),Y(–2,–2)	-2 Z(0,-2),W(-1,-2),Y(-2,-2)
Total LC		-3	-3
CC flavor			x7x8x9
x7			0 CC(0)
x8			-1 CC(-1)
x9			-2 CC(-2)
Total CC			-3

Y bosons correspond to the bosons with EC= 0, -1 -2 charges, respectively. These quantized charges in Table 4 correspond to the charge differences between two flavors of the elementary fermions in Table 3. The charges of the anti-bosons have the positive charges. Zero charges in the boson particles become the zero charges in the anti-boson particles. Photon (γ) can be expressed as (0), (0,0) or (0,0,0) with m = 0 for the description of the EM (Electromagnetic) interaction. The gluons with zero rest masses in the standard model are replaced with the 27 xi-xj-xk bosons (Z/W/Y bosons) of (EC, LC, CC) with nonzero masses in the present model. Z^0, W^- and W^+ bosons in the standard model correspond to Z(0, 0), W(-1, 0) and W(+1, 0), respectively, in the present model. Charges of anti-bosons have the opposite signs to those of corresponding bosons. Observed rest masses of Z(0, 0) and W(-1, 0) are 91.2 and 80.4 GeV/c^2, respectively. Standard model indicates the zero rest masses to the gluons, but the present model assigns the non-zero rest masses to the corresponding 27 xi-xj-xk bosons (Z/W/Y bosons). Table 4 will restrict the interactions between the elementary fermion particles because the quantized charges for the force mediating bosons in Table 4 are integer numbers of 0, -1 and -2. All of the elementary bosons can be classified by using the charge quantum numbers.

If the xi-xj-xk boson has the zero color charge of CC=0, this boson can be transformed to the corresponding xi-xj boson with the same EC and LC in Table 4. For example, Z(0,-1,0) and W(-1,-1,0) can be transformed to the Z(0,-1) and W(-1,-1) bosons which can be seen in the x1x2x3 space. The xi-xj-xk bosons with non-zero color charge cannot be seen in the x1x2x3 space because the color charges of those bosons are not zero and cannot be disregarded. I want to call it a leptonization or hadronization because the xi-xj-xk bosons of Z/W/Y(EC,LC,0) with CC=0 can be seen in the x1x2x3 space by being transformed to the xi-xj bosons of Z/W/Y(EC,LC) on the x1x2x3 lepton space. Also, see Figs. 13, 14 and 15 for the description of the bosons.

7. Mesons, baryons and proton spin crisis

Table 5. (a) SU(4) 16-plets (green and red colors) for the pseudo-scalar made of u, d, s and c quarks for the mesons. The CC value for the mesons is zero. (b) The 20-plet with an SU(3) decuplet such as the decuplet including the Δ(1234) for the baryons. The CC vale for the baryons is -5 which completes the x7x8x9 matter minimum warped space.

LC\EC	-1	0	1
2	$d\bar{t}$	$u\bar{t}$ $d\bar{b}$	$u\bar{b}$
1	$s\bar{t}$	$d\bar{s}$ $u\bar{c}$ $c\bar{t}$ $s\bar{b}$	$u\bar{s}$ $c\bar{d}$ $c\bar{b}$
0	$d\bar{u}$ $s\bar{c}$ $b\bar{t}$	$d\bar{d}$ $u\bar{u}$ $s\bar{s}$ $c\bar{c}$ $t\bar{t}$ $b\bar{b}$	$u\bar{d}$ $c\bar{s}$ $t\bar{b}$
-1	$s\bar{u}$ $d\bar{c}$ $b\bar{c}$	$s\bar{d}$ $c\bar{u}$ $t\bar{c}$ $b\bar{s}$	$t\bar{s}$
-2	$b\bar{u}$	$t\bar{u}$ $b\bar{d}$	$t\bar{d}$

LC\EC	-1	0	1	2
0	**ddd**	**udd**	**uud**	**uuu**
-1	**dds**	**uds,ddc**	**uus,udc**	**uuc**
-2	**dss**	**uss,dsc**	**usc, dcc**	**ucc**
-3	**sss**	**ssc**	**scc**	**ccc**

All quarks which are the xi-xj-xk fermions can be seen only in the x4x5x6 space because quarks have the x7x8x9 space with the non-zero color charges of -2/3, -5/3 and -8/3. In other words, we who reside in the x1x2x3 space cannot observe the independent single quark because each quark has the non-zero color charge which cannot be disregarded (see Figs. 46, 91, 92 and 93). If the particle made up of several quarks has the zero combined color charge, this particle can be seen by us in the x1x2x3 space. Because the mesons consisting of the quark and antiquark have been seen by us in the x1x2x3 space, the mesons are proposed to have the zero color charges of CC=0 along the xk = x7 axis as shown for the K^+ meson in Fig. 13. In other words, the mesons with (EC,LC,0) which are seen in the x4x5x6 space can be transformed to the quasi-mesons (hadronized meson) with (EC,LC) which can be, also, seen in the x1x2x3 space because CC=0 can be disregarded in the x1x2x3 space (see Fig. 91 and 93). For a particle consisting of three quarks, three one-dimensional color charges of -2/3 (x7 matter), -5/3 (x8 matter) and -8/3 (x9 matter) can be combined to complete one three-dimensional color charge state of -5 (x7x8x9 matter) as shown in Fig. 13 (see Fig. 46). In other words, three one-dimensional color states along x7, x8 and x9 axes (x7, x8 and x9 matters, respectively) are combined to complete a three-dimensional x7x8x9 minimum warped space quantum (x7x8x9 matter) with the color charge of CC=-5 as shown for the x1x2x3 matter with EC=-5 in Fig. 10. In this case, the lepton and electric charges of this baryon particle are one-dimensional and the color charge of this particle is three-dimensional. Two matters with the different dimensions have no interaction between two matters. In other words, the x7x8x9 matter is intertwined with the x4x5x6 and x1x2x3 spaces and the xk matter is intertwined with the xj and xi matters as shown in Fig. 12. But the x7x8x9 matter is not intertwined with the xj and xi matter. Therefore, the x7x8x9 matter of this particle acts like the spectator. In other words, the baryon with (EC,LC,-5) which is seen in the x4x5x6 space can be transformed to the quasi-baryon with (EC,LC) which can be, also, seen in the x1x2x3 space and a x7x8x9 matter with CC=-5 which can be seen only in the x4x5x6 space. Because the baryons have been seen in the x1x2x3 space, the baryons are proposed to have the combined color charges of CC = -5 to complete the x7x8x9 matter. This is called as the hadronization which makes the mesons and baryons to be seen by us in the x1x2x3 space (see Fig. 93). I want to call it a leptonization, too, because hadrons of mesons and baryons can be seen in the x1x2x3 lepton space. Therefore, a leptonization like the CC=0 condition for the mesons and the CC=-5 condition for the baryons is needed in order for these quark combinations to be seen in the x1x2x3 space like mesons and baryons (see Figs. 46, 91, 92 and 93).

Two- and three-quark systems have the spins of 0(1) and ½, respectively. And a background fluctuation part (xi-xj-xk b-boson) for the meson and baryons has the charge of (0,0,0) and the spin of 0 or 1. Then the mesons have the total spins of 0 or 1 for each of the electric spin (ES), lepton spin and color spin of the x1x2x3 space. The baryons have the electric spin (ES) of ½ which can be obtained from the spin combination of 0 and ½ or 1 and ½ for the electric spin (ES) of the x1x2x3 space as shown in Fig. 13. A question is that only 20-30 % of the proton's electric spin (ES) comes from its constituent quarks from the EMC data in 1988 (Phys. Lett. **B206**, 364 (1988)). The contribution of three uud quarks to the proton electric spin (ES) of ½ was known to be around 30%. In order to explain this proton electric spin (ES) crisis, we need the spin combination of 1 and ½. Then the xi-xj-xk b-boson has the electric spin of 1 and three quarks have total electric spin of ½ as shown in Fig. 13. The xi-xj-xk b-boson with ES=1 in Fig. 13 can represent the most of the proton energy and 2/3 (67%) of proton electric spin. Generally speaking, only 1/3 (33%) of the baryon electric spin is thought to come from its constituent three quarks. The same discussion can be applied for the lepton spin (LS) and color spin (CS) as shown in Fig. 13. Therefore, baryons have the ES, LS and CS values of ½. The mesons have the ES, LS and CS values of 0 or 1. The whole EC, LC and CC charges of the baryon come from its constituent three quarks. In Table 5, SU(4) 16-plets (green and red colors) for the pseudo-scalar made of u, d, s and c quarks for the mesons are arranged according to the lepton charge quantum number along with the mesons including the b and t quarks. All of mesons can be expressed as (EC,LC,0). For example, π^+ = (+1, 0, 0), B^0 = (0, 2, 0) and K^- = (-1, -1, 0). All of mesons have the zero color

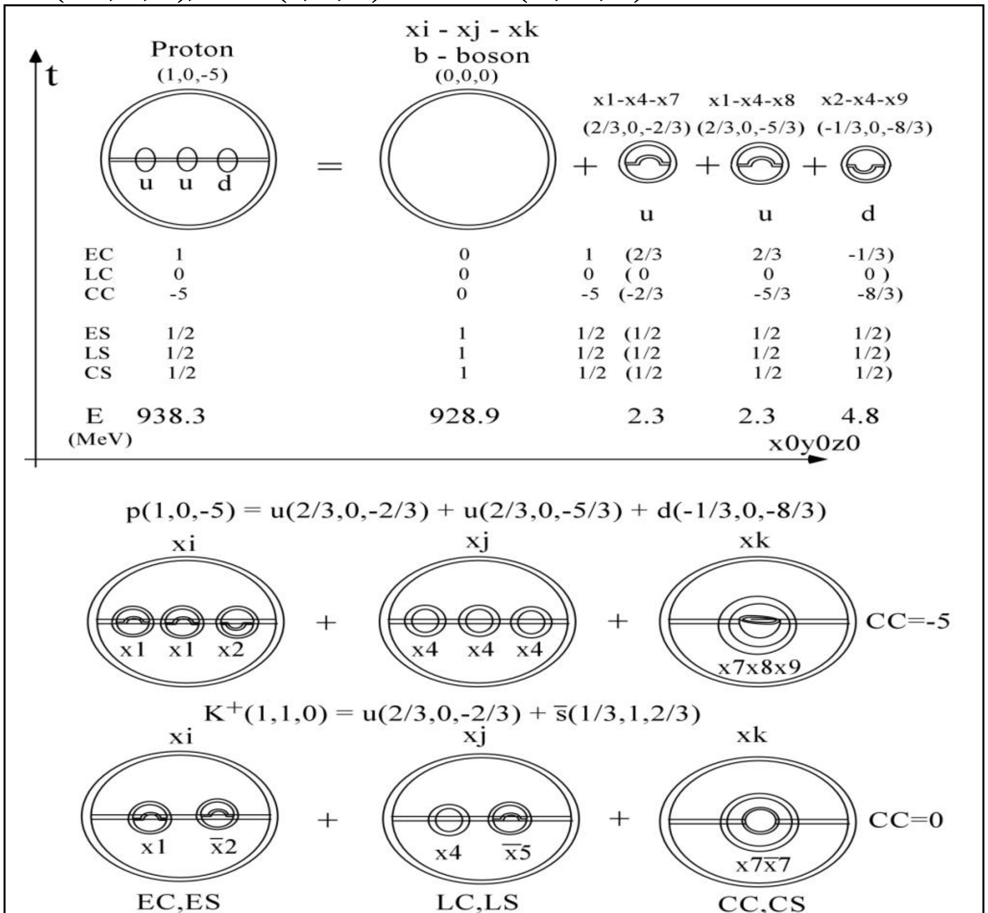


Fig. 13. The xi-xj-xk b-boson with the electric spin of 1 can represent the most of the proton energy and 2/3 (67%) of proton electric spin. Generally speaking, only 1/3 (33%) of the baryon electric spin is thought to come from its constituent three quarks. The whole EC, LC and CC charges of the baryon come from its constituent three quarks. An example of the K^+ meson is shown, too. See Figs. 46, 91 and 93.

charges (CC = 0). In Table 5, the 20-plet with an SU(3) decuplet such as the decuplet including the Δ(1234) for the baryons are tabulated according to the lepton charge quantum number. If we include the baryons with b and t quarks, Table 5 will be more complicated. All of baryons seen in the x1x2x3 space have the color charges of CC = -5 (see Figs. 46, 91 and 93).

The baryons with CC=-5 and LC=-3 can be called as the bastonization (see Fig. 93). This baryon can be described as the charge configuration of (EC). Also, the baryons with CC=-5, LC=-3 and EC=-1 are possible (see Fig. 93). This baryon can be described as the x1x2x3-x4x5x6-x7x8x9 particle within the xi-xj-xk b-boson. The paryons with LC=-5 and EC=-3 are possible (see Figs. 44, 46 and 93). This paryon can be described as the x1x2x3-x4x5x6 particle within the xi-xj b-boson. And the josyms with EC=-5 are possible, too (see Figs. 44, 46 and 93). This josym can be described as the x1x2x3 particle within the xi b-boson.

8. Massive graviton

As summarized in Fig. 14, the elementary fermions and bosons are one-dimensional xi, xi-xj or xi-xj-xk particles. Bosons are connecting between two fermions including the hadrons. Fermions can exist by themselves and have the closed ends. Bosons need the fermions (or matters) at both ends. It indicates that the bosons have the open ends which need two fermions (or matters) in order to close both open ends. A massive xi-xj boson system has two parts of the xi-xj flat space (boson base) and massive xi-xj boson (including a graviton and a photon) as shown in Figs. 14 and 15. The xi-xj flat space (boson base) has the time width of quantum time (t_q) and the open ends. The one-dimensional space length (x_r) of the xi-xj flat space (boson base) is the force range caused by this boson. The xi-xj flat space (boson base) connects two xi-xj fermions and the massive xi-xj boson moves along this xi-xj flat space (boson base) between two xi-xj fermions. The masses of the xi and xi-xj bosons can be calculated by using the equations of E_B=9.866 $10^{-8}/x_r$ (eV) (x_r: m) and m = E_B/c^2. This E_B equation is obtained from the uncertainty principle of $\Delta E \Delta t \geq \hbar/2$. In Table 2, the masses of the xi-xj-xk fermions can be calculated by using the equations of $E_F \approx E_b$ = 12.2047 10^{38} x_F^2 (eV) (x_F: m) and m = E_F/c^2. For a xi-xj particle, $E_F \approx E_b$ = 8.1365 10^{38} x_F^2 (eV) (x_F: m). This E_F equation is obtained by using the measured energy and charge radius of the proton as shown in Table 2. It can be easily applied at the same way to the mesons, baryons and quarks, too.

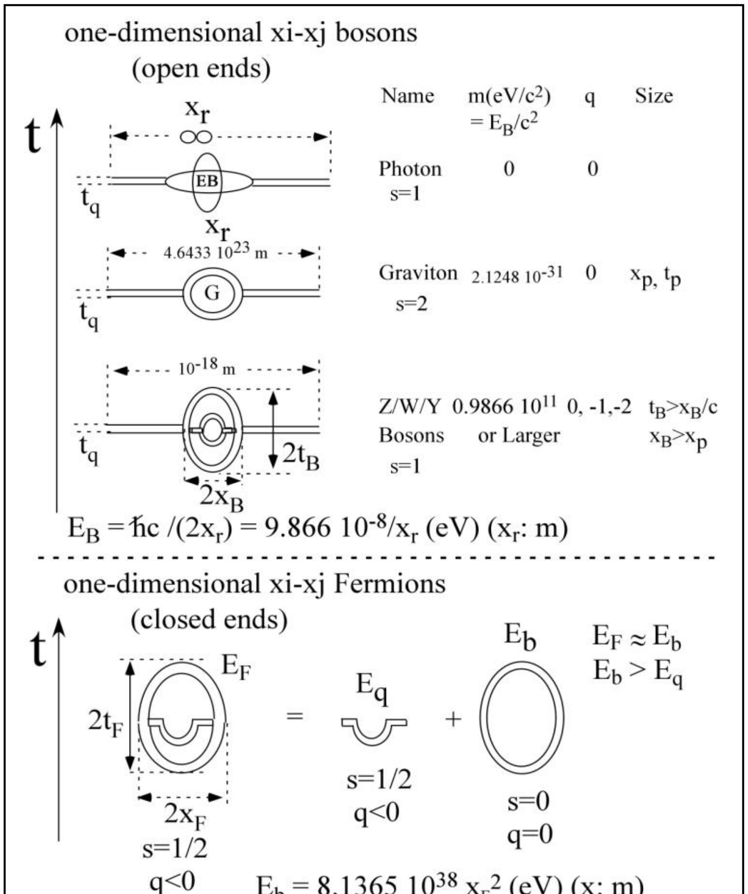


Fig. 14. Comparison of the xi-xj fermion and bosons. See Fig. 15. For a photon, see Figs. 21, 24 and 45.

The gravitational force between two matters is explained by the force carrying graviton (g). The largest gravitational system is the galaxy cluster which has been known to have the largest diameter around 10 Mpc = 3.08568 10^{23} m (http://en.wikipedia.org/wiki/Galaxy_cluster (2015)). Therefore, in the present work, the gravitational force range is taken roughly as the x_r = 3.08568 10^{23} m for the xi-xj graviton which works on all of the hadrons, leptons and bastons on the x1x2x3 space. Then, from the equations of E_B=9.866 $10^{-8}/x_r$ (eV) (x_r: m) and m = E_B/c^2 obtained from uncertainty principle of $\Delta E \Delta t \geq \hbar/2$, the xi-xj graviton has roughly the mass (m_g) around 3.19735 10^{-31} eV/c^2. The graviton is the boson with the zero charge and spin of 2. Mass (m_p) of Planck size xi-xj boson (xi-xj b-bson) which is calculated by using the equations of E_P (xi-xj)= 8.1365 10^{38} x_p^2 (eV) (Planck radius (x_p) : m) and m_p = E_p/c^2 is 2.1248 10^{-31} eV/c^2. The mass (m_p=2.1248 10^{-31} eV/c^2) of Planck size xi-xj b-boson is remarkably in a good agreement with the mass (~ 3.19735 10^{-31} eV/c^2) of the xi-xj graviton. The force range (x_r) of a xi-xj graviton obtained from 2.1248 10^{-31} = 9.866 $10^{-8}/x_r$ is 4.6433 10^{23} m which is consistent with the largest diameter around 10 Mpc = 3.08568 10^{23} m. Therefore, in the present work, it is presumed that the xi-xj graviton can be called as the Planck size boson with the boson base which has the spin of 2. Therefore, the mass and force range of the massive xi-xj graviton are taken as m_g=2.1248 10^{-31} eV/c^2 and x_r = 4.6433 10^{23} m = 15.0479 Mpc. The masses of the xi and xi-xj-xk gravitons are 1/2 and 3/2 of the xi-xj graviton masses, respectively. See Figs. 46 and 91 for the dark matters. Generally, the b-bosons of the fermions have the spin of 0 or 1in Figs. 11 and 12. The inner and outer shells of the bosons except the photon and graviton can have spin of 0 or 1 in Figs. 14 and 15, too. Therefore, the boson system with the inner and outer shell can have the spin of 0, 1 and 2 by the spin addition rule. The Z/W/Y bosons have the spin of 1. The graviton with one Planck size b-boson has the spin of 2 and the photon has the spin of 1. Because of the massive graviton, the gravitational potential needs to be changed to $U = -\frac{Gm_1m_2}{r}e^{-m_g r}$ following the Yukawa force effect. Here, m_g is E_g/c^2. This graviton has the zero charge.

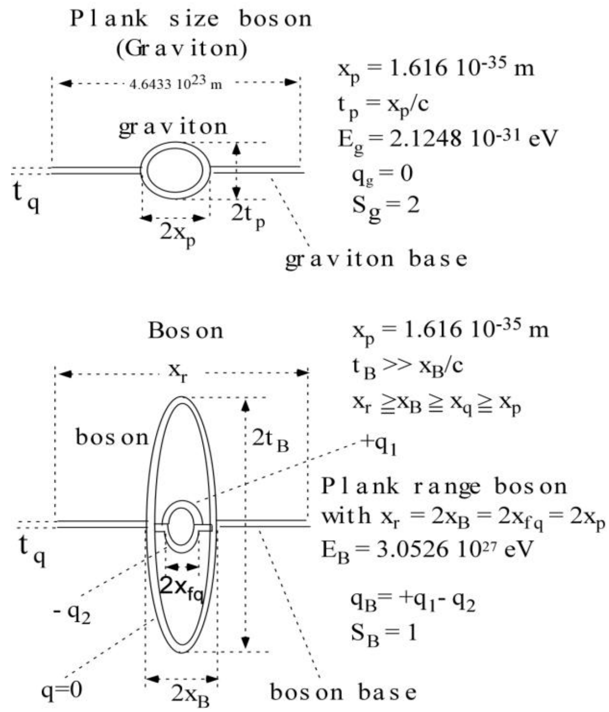


Fig. 15. Massive xi-xj graviton and Planck range xi-xj boson are compared.

A xi-xj graviton can be expressed as a graviton of g(EC,LC) = g(0,0) which is observed in the x0y0z0 and x1x2x3 spaces because it has the zero charges of EC=LC=0. The gravitons including g(xi-xj-xk) = g(0,0,0) and g(x1x2x3-x4x5x6-x7x8x9) = g(0,0,0) have the zero EC, LC and CC charges along all space axes. This means that all gravitons can be transfered to each other on the x0y0z0, x1x2x3 and x4x5x6 spaces. It indicates that the gravitons can be exchanged between two matters with the diffrent dimensions. Because of this property of the graviton, all matters have the gravitional effects on other dimensional matters by exchanging the gravitons (see Figs. 46, 91 and 93). Unlike the graviton, photons including γ(xi) = γ(0), γ(xi-xj) = γ(0,0), γ(xi-xj-xk) = γ(0,0,0), γ(x1x2x3) = γ(0), γ(x1x2x3-x4x5x6) = γ(0,0) and γ(x1x2x3-x4x5x6-x7x8x9) = γ(0,0,0) have the non-zero +q and –q charges which vibrate along the space axes even though the toal charges are zero as shown Figs. 11, 21 and 24. Space dimension of the photon is the space dimension of the +q and –q charges. Because of the non-zero +q and –q charge fluctuation along the space axes, the photons have the dependence on the space dimensions. This means that all photons cannot be transformed to other dimensional photons. It indicates that the photons cannot be exchanged between two matters with the diffreent dimensions. Because of this property of the photon, all matters do not have the EC, LC and CC charge interaction effects on other dimensional matters. The EC, LC and CC charge interactions can be carried out by exchanging the photons between two matters with the same dimensions. It can be applied to the particles, too. See Figs. 46, 91 and 93 for the dark matters.

The xi-xj Planck range boson is compared with the xi-xj Planck size graviton in Fig. 15. Planck range boson has the force range of $2x_p$ and particle sizes of $2x_B = 2x_p$ and $2t_B >> 2x_B/c$ as can be shown in Figs. 14 and 15. The energy of the xi-xj Planck range boson with $x_r=2x_p$ is 3.0526 10^{27} eV from the equation of E_B=9.866 $10^{-8}/x_r$ (eV) which comes from the uncertainty principle of $\Delta E \Delta t \geq \hbar/2$. This large energy indicates that the large outer space shell has the large warping of $2x_B = 2x_p$ and $2t_B >> 2x_B/c$. But the inner space shell has the relatively smaller warping which can give the charge of q_B. The equation of E_b = 8.1365 10^{38} x^2 (eV) with the condition of t=x/c cannot be used to calculate the energy of the xi-xj Planck range boson because $t_B >> x_B/c$.

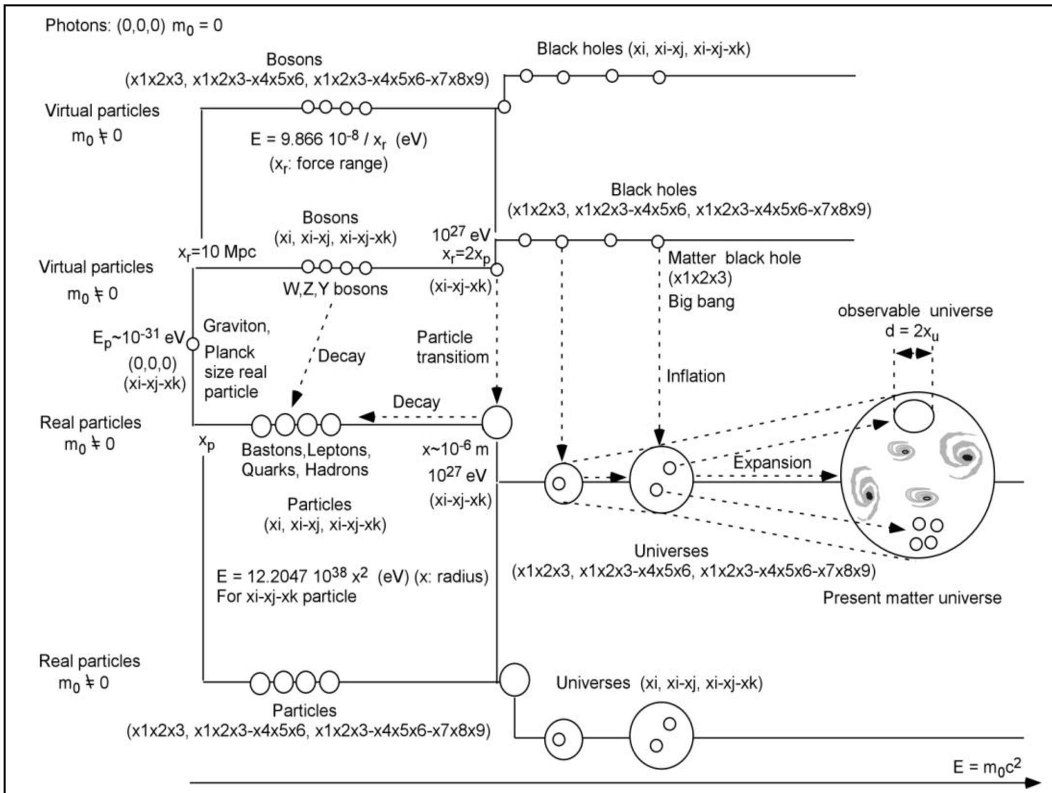


Fig. 16. The virtual particles (bosons and black holes) and real particles (particles and universes) are shown. See Figs. 2, 25 and section 21.

The virtual particles (bosons and black holes) and real particles (particles and universes) are shown in Fig. 16. The bosons and particles are the low energy virtual particles and low energy real particles, respectively. And it is thought in the present work that the black holes and universes are the high energy virtual particles and high energy real particles, respectively.

9. Majorana particle and the neutrinoless double β decay

Majorana particle is the imaginary elementary particle that the particle and anti-particle are identical. Traditionally the particle and antiparticle are separated from the different sign of the electric charge. Therefore, in order to be the candidate of the Majorana particle the particle should have the zero electric charge (EC=0). The only elementary fermions with the zero electric charge are the neutrinos of electron neutrino, muon neutrino and tau neutrino. In order to confirm whether the neutrino is the Majorana particle or not, the neutrinoless double β decay experiments have been carried out for a long time. However, this has never been clearly confirmed. Now I will discuss this neutrinoless double β decay experiments on the basis of the present model. The neutrinos have the zero electric charge (EC = 0). However, the neutrinos have the non-zero lepton charges ($LC \neq 0$) of LC=-2/3 for electron neutrino, LC=-5/3 for muon neutrino and LC=-8/3 for tau neutrino. Therefore, the neutrino and the antineutrino should have the opposite sign of the non-zero lepton charge (LC). For example the electron-neutrino (ν_e) has the charge configuration of (EC,LC) = (0, -2/3) and the electron-anti-neutrino ($\bar{\nu}_e$) has the charge configuration of (EC,LC) = (0, 2/3). This means that the neutrino and the antineutrino cannot be identical and cannot be the Majorana particle. I think that this is the reason why the sharp peak of the double β decay without emitting the neutrino or antineutrino has never been clearly observed. This indicates that the (anti)neutrinoless double β decay is impossible as shown in Fig. 17. Therefore, all of elementary fermions are not the Majorana particles.

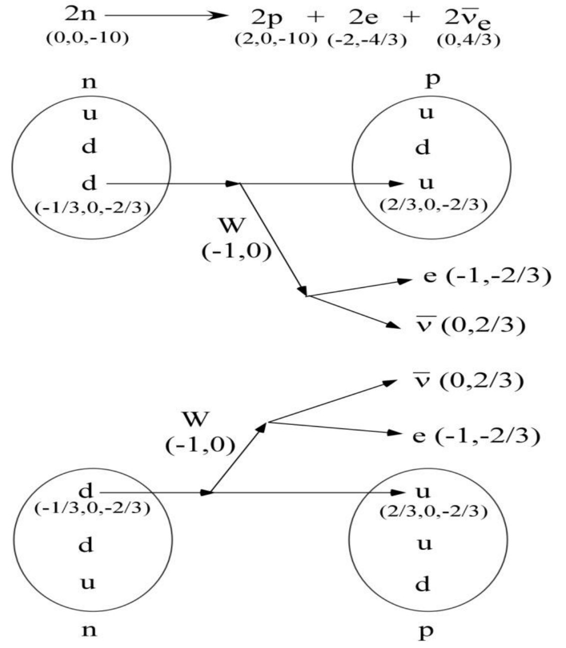


Fig. 17. Double beta decay which should have two electron anti-neutrinos. The neutrino is not the Majorana particle because of the non-zero lepton charge (LC).

10. Impossible proton decay

All of force carrying bosons have the integer charges but not the fractional charges. However, the elementary fermion particles can have the fractional charges. This is very important in order to understand why the proton decay is impossible. One example (p (1,0,-5) → π^0 (0,0,0) + e^+ (1,2/3)) of several suggested proton

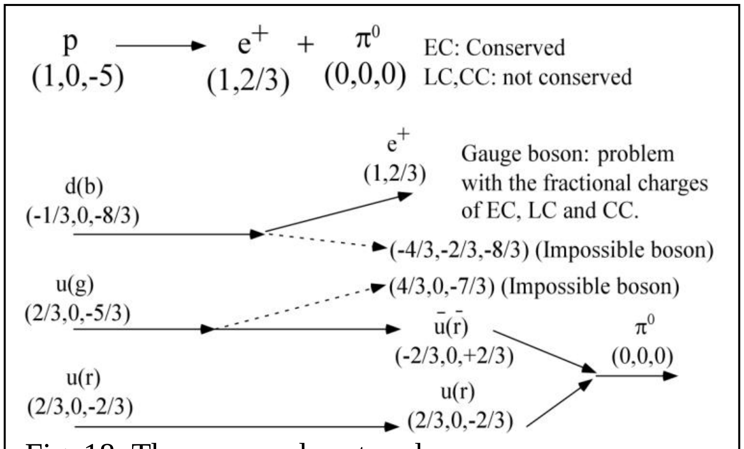


Fig. 18. The proposed proton decay.

decay modes is shown in Fig. 18. First, this proton decay mode cannot be right because the CC charge cannot be conserved before and after the proposed proton decay in Fig. 18. Baryons and antibaryons have CC = -5 and 5, respectively. All of mesons including the antimesons have CC = 0. Then, the Z and W bosons with the charge configurations of (EC,LC) and (EC,LC,0) can decay to mesons or antimesons with CC=0 but not to the baryons with CC=-5 or antibaryons with CC=5. Also, the baryons with CC=-5 cannot decay to the mesons with CC=0 without including the baryons with CC=-5. In the proposed proton decay of Fig. 18, the lepton charges (LC) are not conserved before and after the proposed proton decay. Only the EC charges are conserved. Secondly, in order for the proton decay to take place, two force carrying bosons of (4/3,0,-7/3) and (-4/3,-2/3,-8/3) in Fig. 18 must exist. This means that this boson should have the fractional charges. These kinds of the force carrying bosons with the fractional charges do not exist in the present model. Also, to make the π^0 meson, one of three quarks has to experience the EC and CC charge changes. For example, u(g) = (2/3,0,-5/3) has to be changed into $\bar{u}(\bar{r})$ = (-2/3,0,2/3) in Fig. 18. Three quarks of u(r), d(b), and u(g) are within the proton. In the present model, all of the force carrying bosons should have the integer charges. The same explanation given to the example in Fig. 18 can be applied to all of other proposed proton decay modes. And a baryon with color charge of -5 should decay to another baryon with color charge of -5 because of the color charge conservation. It is the reson why the free proton is permanently stable because there is no baryon with CC=-5 with the rest mass smaller than the proton.

11. Three-dimensional quantized space and quantum mechanics

11.1. Charges (EC, LC and CC) and quantum wave function (see sections 4 and 20)

In quantum mechanics, Schrodinger equation is $E\psi = H\psi = \left(\frac{p^2}{2m} + V\right)\psi$ and $E = \int E(x)dx = \int E|\psi(x)|^2 dx$. In the present work, $E = \int ct(x)dx$. Therefore, ct(x) = E(x) = $E|\psi(x)|^2$. Therefore, $|\psi(x)|^2$ = ct(x)/E where t(x) is the time function of the warped space (see Figs. 19 and 52). It is the real meaning of the wave function introduced in the quantum mechanics. The flat space can be explained by using the plane wave functions of x and t. The flat space means that the rest mass (m_0) is zero and it can be described only as the wave. The flat x1x2x3 space with the time width of Δt is shown in Fig. 19 (see Figs. 52 and 4, too). In the present work, this flat space with the positive energy ($E_0>0$) is described by using the plane waves with the $p_t = E_0/c > 0$ (along the +t direction) and $p_x>0$ (along +x direction) momenta. The plane wave functions are $\psi(x) = Ae^{\frac{i}{\hbar}P_x x}$ and $\psi(t) = Be^{\frac{iE_0}{\hbar c}ct}$. Then, $p_x = -i\hbar\frac{d}{dx}$ and $P_t = E_0/c = -i\hbar\frac{d}{cdt}$. From these equations, $E_0 = cP_t = -i\hbar\frac{d}{dt}$ and $\Psi(x,t) = \psi(x)\psi(t)$. And $p_x = \hbar k_x$ and $E_0 = cP_t = \hbar\omega$. Note that $\psi(t) = Be^{-\frac{i}{\hbar}Et}$ and $E = i\hbar\frac{d}{dt}$ which have been given and used in the well-known quantum mechanics are different in the sign from those given from the present study. p_x is the non-relativistic operator because the plane wave does not warp the x1x2x3 space.

In Fig. 19, $p_{total}^2 = E^2/c^2 = p_x^2 + E_0^2/c^2$, $\overrightarrow{p_{total}} = p_x\hat{\imath} + p_t\hat{t}$, $\overrightarrow{x_{total}} = x\hat{\imath} + ct\hat{t}$, and $E_0 = \Delta xc\Delta t$.

Then $\psi(x,t) = ABe^{\frac{i}{\hbar}\overrightarrow{p_{total}}\cdot\overrightarrow{x_{total}}} = Ae^{\frac{i}{\hbar}P_x x}Be^{\frac{iE_0}{\hbar c}ct}$, and $dE = cdxdt$.

$\iint |\psi(x,t)|^2 dxcdt = A^2B^2\Delta xc\Delta t = 1$. Then $A^2 = 1/\Delta x$ and $B^2 = 1/(c\Delta t)$. Therefore, $A^2B^2 = 1/(\Delta xc\Delta t)$, and $\psi(x,t) = \frac{1}{\sqrt{\Delta xc\Delta t}}e^{\frac{i}{\hbar}P_x x}e^{\frac{iE_0}{\hbar c}ct}$.

For the 3-dimensional flat space,

$\psi(x,t) = \frac{1}{\sqrt{\Delta x_1 \Delta x_2 \Delta x_3 c\Delta t}} e^{\frac{i}{\hbar}\overrightarrow{p_x}\cdot\vec{x}} e^{\frac{iE_0}{\hbar\, c}ct}, \vec{x} = x_1\hat{\imath} + x_2\hat{\jmath} + x_3\hat{k}.$

The same procedure can be applied for the x4x5x6 and x7x8x9 flat spaces and this explanation can be extended easily to the x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 flat spaces.

The warped version of the x1x2x3 flat space with the time width of $\Delta t = t_q$ is shown in Fig. 19. This warped space has the rest mass of $m_0 = E_0/c^2$, time momentum of E_0/c and space momentum of p_x. One-dimensional space case along the x axis is shown for the purpose of the explanation. If the warped space has the space momentum of p_x with the velocity of v and is moving within the x1x2x3 flat space, this space can be considered to be relativistic (see Fig. 48). Then, the mass should be increased from the rest mass m_0 to the relativistic mass of $m=m_0/(1-v^2/c^2)^{0.5}$ which is caused by the space momentum. The energy (E) is increased from E_0 to $(1-v^2/c^2)^{-0.5}E_0$. Then the space momentum of p_x makes the kinetic energy of E_k. In the present work, this kinetic energy corresponds to additional warped space in Fig. 19. Therefore, additional energy of E_k means an additional warped space in Figs. 19 and 23 (see Figs. 54, 62 and 63). The relativistic momentum is $E^2/c^2 = m^2c^2 + p_x^{/2}$. In the relativistic warped space, the space momentum of $p_x^{/}$ is zero because all of the space momentum of p_x makes the warped space energy of E_k. (see Figs. 54, 62 and 63) The relativistic energy is $E = mc^2 = E_k + E_0$ from the relation of $m=m_0/(1-v^2/c^2)^{0.5}$.

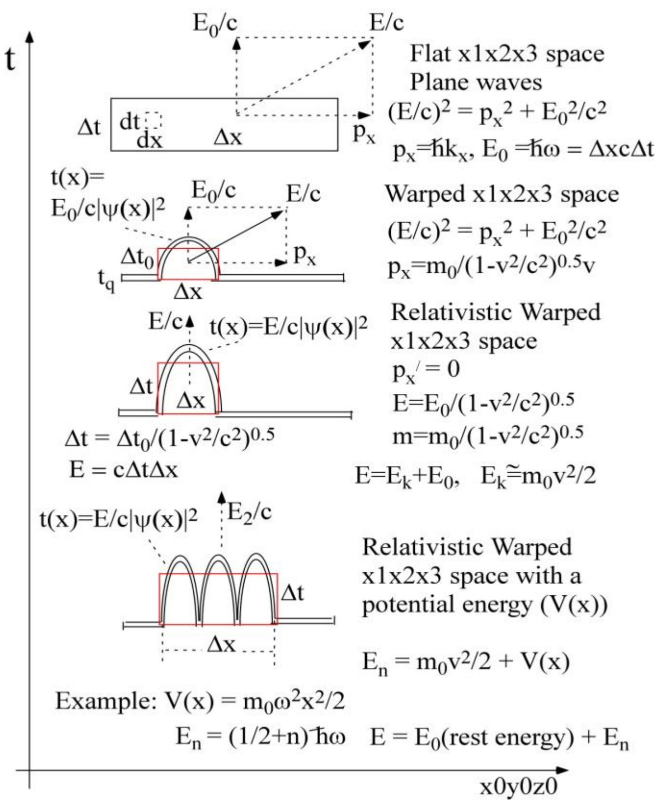


Fig. 19. Quantum harmonic oscillation and charges. See Figs. 23, 61-63, 48 – 54 and section 20. The red box is the flat space approximation.

If there is the harmonic oscillator potential energy of $V(x) = m_0(\omega x)^2/2$, the energy of $E_s = E - E_0$(rest energy) is quantized as $E_n = (\frac{1}{2} + n)\hbar\omega$ by solving the Schrodinger equation of $(E - E_0(rest\ energy))\psi = (\frac{p_x^2}{2m_0} + \frac{m_0\omega^2x^2}{2})\psi$ where non-relatisvistic momentum of $p_x = m_0v$ is used (see section 20). The non-relativistic space momentum of p_x has the non-relativistic operator form of $p_x = -i\hbar\frac{d}{dx}$ which can be derived from the plane wave analysis. This operator has been used in the well-known Schrodinger equation. The warped space with $t(x) = E(x)/c = E|\psi(x)|^2/c$ and n=2 is shown as one example in Fig. 19. The un-observable rest energy (E_0(rest energy)) smaller than the Planck size energy is added in Fig. 19 and is disregarded in the present analysis (see section 20). In the present work, the warped space toward the +t direction has +q>0 and the warped space toward the –t direction has –q<0. Therefore, the n=2 warped space with +q >0 is shown and the n=2 warped space with –q<0 is the horizontally flipped one of the warped shape with +q>0. In the present work, it is assumed that the warped space is harmonic-oscillating within the short x range of the Planck distance ($2x_p$) to give the charges to the fermions. Then, the electronic charges (EC) of all fermions can be added or subtracted because these fermions have the same harmonic oscillating frequency of ω. Also, lepton charge and color charges of all fermions can be added or subtracted like the electric charges do. Under this assumption, the relation of the charges (EC, LC and CC) and the harmonic oscillation quantum number (n) is shown in Table 6. Also, see Tables 1 and 3 for the charge assignments. Then, the energy of E_q for the fermion in Fig. 10 corresponds to the harmonic oscillation energy of $E_n = (\frac{1}{2} + n)\hbar\omega$.

As shown in Table 6, the charge (q) represents the charges based on EC=-1 of an electron. Because of this, there are the fractional charges for the EC of quarks. But if the new charge system (q_{new}) is used based on EC=-3 of an electron, all of fermion charges have the integer values. Therefore, I want that the new charges of q_{new} are taken instead of the old charges (q). The minimum observable space and time ranges with n=0 are the same to Planck space and time ranges. Therefore, the minimum energy of E_0 with n=0 and |q|=1/3 corresponds to the half of a xi Planck size energy (E_p(xi)). The xi-xj Planck size energy (E_p(xi-xj)) is calculated by using the

Table 6. It is assumed that the warped space is harmonic-oscillating within the Planck scale $x=2x_p$ range to give the charges to the fermions. Under this assumption, the relation of the charges (EC, LC and CC) and the harmonic oscillation quantum number (n) is shown. $\left(\frac{1}{2} + n\right) = \left(3|q| - \frac{1}{2}\right)$. See Tables 1 and 3 for the charge assignments, too.

	ν_e (0,-2/3)	d (-1/3,0,-2/3)	u (2/3,0,-5/3)	e (-1,-2/3)					
$\lvert q_{new}\rvert$	0	1	2	3	4	5	6	7	8
$\lvert q\rvert$	0	1/3	2/3	1	4/3	5/3	2	7/3	8/3
n+1/2	x	0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5
n	x	0	1	2	3	4	5	6	7

equation of $E_p(\text{xi-xj})=8.1365\ 10^{38}\ x_p^2$ (eV) $=2.1248\ 10^{-31}$ eV. Then the xi Planck size energy (E_p(xi)) is a half of $E_p(\text{xi-xj})=2.1248\ 10^{-31}$ eV. Therefore, $E_0 = \frac{1}{2}\hbar\omega$ = E_p(xi-xj)/4 = 0.5312 10^{-31} eV. For simplicity, E_p is defined as E_p(xi-xj) in the following sentences. Therefore, $E_n = \left(\frac{1}{2} + n\right) E_p/2$ and $E_q = \left(3|q| - \frac{1}{2}\right) E_p/2$ for |q|≥1/3 and $E_q = 0$ for q=0. Therefore, generally for quarks with charges of (EC,LC,CC), $E_q = \left(3|EC| + 3|LC| + 3|CC| - \frac{3}{2}\right) E_p/2$. For quarks with charges of (EC,0,CC), $E_q = \left(3|EC| + 3|CC| - \frac{2}{2}\right) E_p/2$. For the electron neutrino with the charges of (0,-2/3), $E_q = \left(3|LC| - \frac{1}{2}\right) E_p/2 = 1.5E_p/2$. Generally for leptons like an electron with the charges of (EC,LC), $E_q = \left(3|EC| + 3|LC| - \frac{2}{2}\right) E_p/2$. For an electron of (-1,-2/3), E_q = (3-0.5)E_p/2+ (2-0.5)E_p/2= 2E_p. Because energies (E_q) of all particles caused by the charges of EC, LC and CC are the excitation of the constant Planck size energy (E_p), the EC, LC and CC charges of particles can be added to or subtracted from the EC, LC and CC charges of other particles, respectively. I think that this is the possible origin of the quantized charges. For the Schrodinger equation, see section 20.

11.2. Magnetic Charges (MEC, MLC and MCC), magnetic particles and quantum wave function

In the present work, the charges of EC, LC and CC are explained to be originated from the warped three-dimensional quantized x1x2x3, x4x5x6 and x7x8x9 spaces with the quantum time of $\Delta t \rightarrow t_q$ which are based on the three-dimensional quantized x0y0z0 space with the infinite time-space ranges. We can observe the EC and LC charges of leptons because we are living within the x1x2x3 three-dimensional quantized space. Therefore, electric charges (EC) (electric monopoles) are observed in our x1x2x3 universe. Unlike the electric charges, even though the magnetic dipole moments are observed for example as the electric current loop, the magnetic monopoles (q_m) have never been observed yet. Therefore, in the present work, I am going to explain the reason why the magnetic monopole have never been observed or may not be present in our x1x2x3 universe which are connected to the warped three-dimensional quantized x1x2x3, x4x5x6 and x7x8x9 spaces with the quantum time width of $\Delta t \rightarrow t_q$ (quantum time) (see Fig. 4B).

Basically, it is proposed that the magnetic monopole (q_m) is originated from the warped one-dimensional time with the quantum space ranges of $\Delta x \rightarrow x_q$ for the x1x2x3, x4x5x6 and x7x8x9 spaces (see Fig. 4C) which are based on the three-dimensional quantized x0y0z0 space with the infinite time-space ranges as shown in Figs. 20-22. One example shown for the x1x2x3 space-time in Figs. 20-22 and 4C can be easily applied to the x4x5x6 and x7x8x9 spaces. The elementary magnetic fermion particles are listed in Table 7 by using the magnetic electric charge (MEC), magnetic lepton charges (MLC) and magnetic color charges (MCC). The elementary magnetic fermions in Table 7 can be compared with the elementary fermions in Table 3.

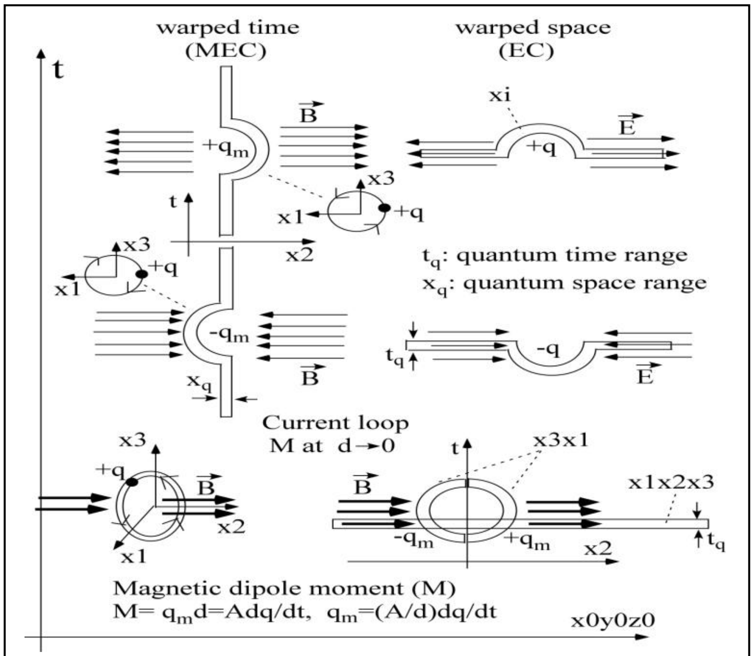


Fig. 20. The magnetic electric charge (q_m, MEC) of the x1x2x3 space-time is described as an example and compared with the electric charge (EC). In these figures, q>0 and q_m>0. See Figs. 4, 11, 21, 22 and 24.

In Figs. 20 and 22, the magnetic electric charge (q_m, MEC) of the x1x2x3 space-time is described as an example and compared with the electric charge (EC). Magnetic monopole exists in the warped one-dimensional time (warped time) with the quantum space ranges of $\Delta x \rightarrow x_q$ for the x1x2x3 space as shown in Figs. 20-22. Because we are in the warped three-dimensional quantized x1x2x3 space with the quantum time of $\Delta t \rightarrow t_q$, this kind of magnetic charges cannot exist within our x1x2x3 universe. However, the magnetic fields caused by the magnetic dipole moment of the electric current loop in our x1x2x3 space can be observed by us. As shown in Fig. 20, the current loop is on the x3x1 plane and the electric current rotates in the counter-clockwise direction from the front view. This corresponds to the magnetic electric charge of $+q_m>0$. When we look at the back side of the electric current loop, the electric current rotates in the clockwise direction from the back side view. This corresponds to the magnetic charge of $-q_m<0$. The space distance (d) between two charges is nearly zero. Therefore, this magnetic dipole builds the magnetic dipole moment with the nearly zero space distance. The magnetic dipole moment (M) is expressed as $M = q_m d = Adq/dt$. If the sign of the electric charge (q, EC) is changed, the sign of the magnetic electric charge (q_m, MEC) is changed, too, as shown in Fig. 22. Also our universes can have the magnetic charges which are created by the pair production of q_m and $-q_m$ from the background fluctuation as shown in Fig. 21 (see Fig. 11, too.). As shown in Figs. 21 and 24, the background fluctuations can make the magnetic wave (magnetic field), electric wave (electric field) and electromagnetic wave (electromagnetic field, light, photon). But if the background fluctuation is excited by adopting the extra energy, a pair of particle and antiparticle and a pair of magnetic-particle and magnetic-antiparticle can be coincidently created by the disappearance of the electromagnetic wave.

Therefore, in the present work, positive magnetic charges ($q_m>0$) and negative magnetic charges ($-q_m<0$) are defined to have the counter-clockwise and clockwise rotations, respectively as shown in Figs. 20, 21 and 22. The front view and back view of the magnetic charges (monopoles) have the same counter-clockwise rotations for the positive magnetic charges and the same clockwise rotations for the positive magnetic charges. This front and back view symmetry can be broken by the direction of the charge flow (current) along the current loop which makes the magnetic dipole of the q_m and $-q_m$ as shown in Figs. 20, 21 and 21. The $x1'$, $x2'$ and $x3'$ axes in the back view coordinates correspond to the $-x1$, $-x2$ and $x3$ axes, respectively, in the front view coordinates in Fig. 22.

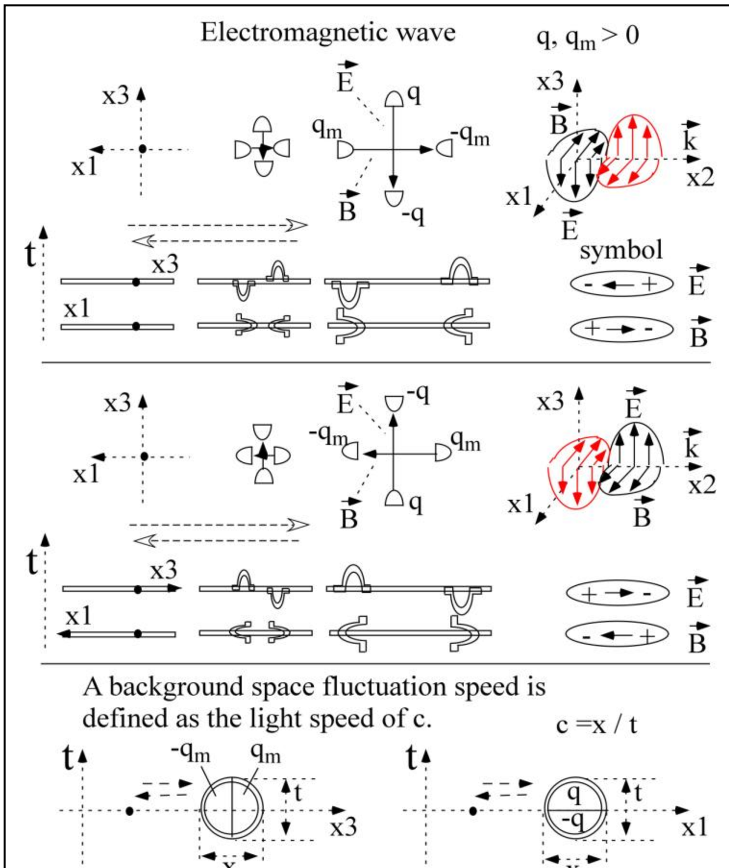


Fig. 21. The x1x2x3 space electromagnetic wave (xi photon) and background space fluctuation are closely related. See Figs. 11, 22, 24 and 45. In these figures, $q>0$ and $q_m>0$.

Also, there is a similarity between the magnetic electric charge and electric charge. The minimum electric charge (EC) has the charge of 1/3 and $E_q = E_p/2$. Therefore, the minimum magnetic electric charge (MEC) has the charge of 1/3 and $E_{qm} = E_p/2$. But the magnetic electric charge does not oscillate because the time momentum ($p_t = E/c > 0$) has only one +t direction while the electric charge oscillate because the space momentum (p_x) can oscillate between the +x and –x directions. The quantized charges are originated by the quantum harmonic oscillation in Planck space range of $2x_p$. But the quantized magnetic charges are originated by the space rotation on the x1x2, x2x3 or x3x1 surface as shown for the x3x1 surface case in Figs. 20, 21 and 22. The number of rotations (n_r) of 1, 2, 3, 4 … in the quantized magnetic charges within the Plank time scale of $2t_p$ correspond to the harmonic oscillation quantum number (n) of 0, 1, 2, 3 …, respectively in the quantized charges shown in Table 6. The magnetic charges in Fig. 22 are the same to the corresponding charges in Table 6.

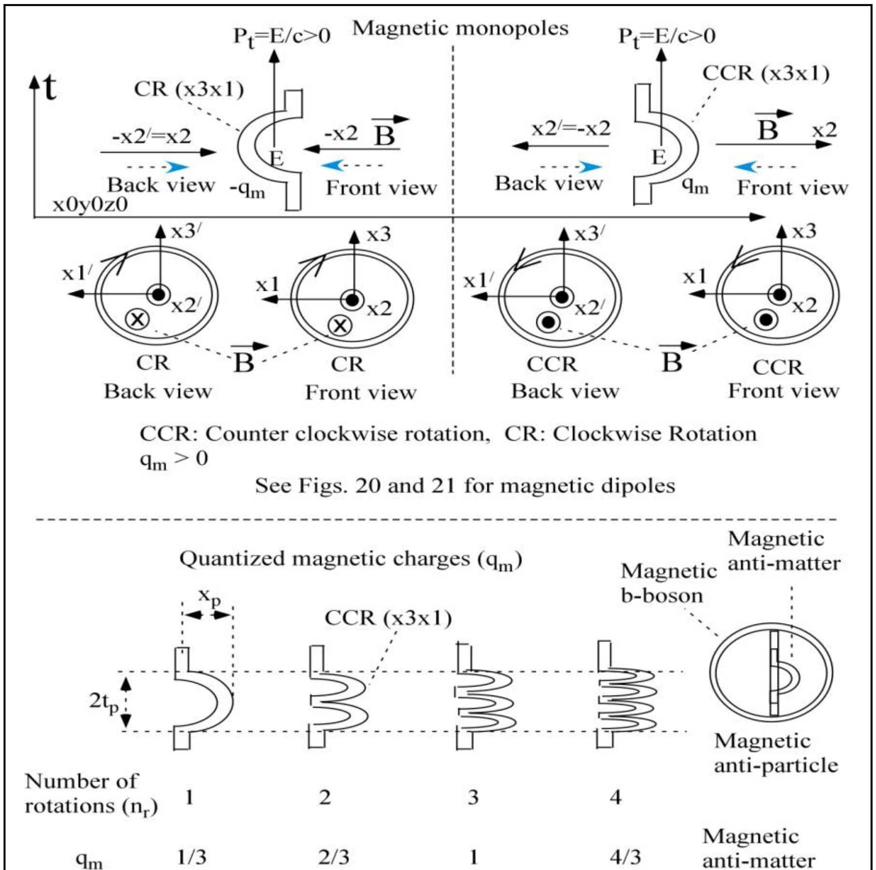


Fig. 22. Quantized magnetic charges. See Figs. 12, 20 and 21.

Therefore, quantized magnetic electric charges (MEC) have three magnetic electric charge states caused by three space rotations on the x1x2, x2x3 and x3x1 surfaces. Also, the quantized magnetic lepton charges (MLC) have three magnetic lepton charge states caused by three space rotations on the x4x5, x5x6 and x6x4 surfaces. And, the quantized magnetic color charges (MLC) have three magnetic color charge states caused by three space rotations on the x7x8, x8x9 and x9x7 surfaces. Therefore, a magnetic x3x1 anti-particle consists of a magnetic x3x1 anti-matter and a magnetic x3x1 b-boson as shown in Fig. 22. From the possible symmetry of charges and magnetic charges, a magnetic particles and magnetic anti-particles are treated in the same way as the particles and anti-particles. Therefore, the elementary magnetic fermions are listed in Table 7 in the same way as the elementary fermions are listed in Table 3. For the three dimensional space, q_m =5 for the magnetic antimatter and q_m=-5 for the magnetic matter in Table 7. The same thing can be applied to x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 space magnetic matter and antimatter. Therefore, the magnetic fermions can be defined as three magnetic bastons, nine magnetic leptons and 27 magnetic quarks by adding the magnetic b-boson energies of E_b caused by the background fluctuation. For example, a magnetic x1x2 baston of MB1 can be expressed as (-2/3) and a magnetic x2x3-x5x6 lepton of Mμ is (-1,-5/3). And a magnetic x2x3-x5x6-x9x7 quark of Ms(Mb) is (-1/3,-1,-8/3). And there are three force carrying magnetic MZ/MW/MY bosons with the spin of 1 can be easily understood by adding M (magnetic) to the Z/W/Y bosons in Table 4 and assigning the charge flavors the same to those in Table 7. Also, the magnetic baryons and magnetic mesons can be discussed easily in the same way as the baryons and mesons are discussed in the present work.

These magnetic particles cannot be made from the black hole expansions of our universes. But the magnetic fermions and magnetic anti-fermions can be created from the pair production caused by the background fluctuations. All fermions and anti-fermions created by the pair production caused by the background fluctuation right after the big bang disappeared soon because of the pair annihilation of the fermion and anti-fermion in our universes. By the same reason, all magnetic fermions and magnetic anti-fermions created by the background fluctuation right after the big bang disappeared soon because of the pair annihilation of the magnetic fermion and magnetic anti-fermion within our universes. But some magnetic particles and magnetic anti-particles can exist around the black holes at the present time from the pair production caused by the background fluctuation. In other words, when the electron-positron pair is created from the electromagnetic wave (light, photon) at the present time, the magnetic lepton-

Table 7. Magnetic electric charges (MEC), magnetic lepton charges (MLC) and magnetic color charges (MCC) for the elementary magnetic fermion particles. Mu(Mr) = (2/3.0,-2/3) = (MEC,MLC,MCC). See Table 3 for the elementary fermions.

MEC flavor	x1x2x3	x1x2x3	x1x2x3
x1x2	-2/3(MB1)	0($M\nu_e$,$M\nu_\mu$,$M\nu_\tau$)	2/3(Mu,Mc,Mt)
x2x3	-5/3(MB2)	-1(Me,$M\mu$,$M\tau$)	-1/3(Md,Ms,Mb)
x3x1	-8/3(MB3)	-2(MLe,$ML\mu$,$ML\tau$)	-4/3(MM1,MM2,MM3)
Total MEC	-5	-3	-1
MLC flavor		x4x5x6	x4x5x6
x4x5		-2/3($M\nu_e$,Me,MLe)	0(Mu,Md,MM1)
x5x6		-5/3($M\nu_\mu$,$M\mu$,$ML\mu$)	-1(Mc,Ms,MM2)
x6x4		-8/3($M\nu_\tau$,$M\tau$,$ML\tau$)	-2(Mt,Mb,MM3)
Total MLC		-5	-3
MCC flavor			x7x8x9
x7x8			-2/3(Mr)
x8x9			-5/3(Mg)
x9x7			-8/3(Mb)
Total MCC			-5

magnetic anti-lepton pair can be produced. These magnetic leptons and magnetic anti-leptons may be alive within our x1x2x3 universe. It will be interesting to search for those magnetic particles and magnetic anti-particles. From the non-observance of the magnetic particles with the magnetic charges, I think that the mass of the magnetic particle may be smaller than the electron-neutrino mass of $\sim 10^{-3}$ eV or these magnetic particles may be everywhere but may be hard to be detected because of no charge interaction with the fermions or baryons within our x1x2x3 universe. Or magnetic particles could be rare or absent in our universe. The gravitational force should be working between these magnetic particles and normal particles (fermions and baryons). If the masses of the magnetic lepton and magnetic antilepton are similar to or larger than the electron mass, the magnetic particles could be discovered at the place where the normal matters like the leptons and baryons are found within our universe. The possible magnetic particles might belong to the dark matters.

11.3. Modified relativity theory and quantum wave function

Wave function in the quantum mechanics is considered to be closely related to the kinetic energy caused by warping of the space as shown in Fig. 19. In Fig. 23, it is shown that the special relativity theory and quantum wave function are closely related with each other. An elementary xi particle or xi hadron is assumed to be moving to the +x direction with the speed of v and the space momentum of p_x (see Fig. 48). Then, the additional kinetic energy (E_k) is transformed to the warping energy (E_k) of the x1x2x3 space. The warped shape of the x1x2x3 space can be described as the squared quantum wave function of $2ct(x) = E|\psi(x)|^2$ as shown in Fig. 23. t(x) is the time function of the warped space. In Fig. 23, ct(x) and –ct(x) correspond to the +q>0 and –q<0 warping spaces, respectively. In quantum mechanics, Schrodinger equation is $E\psi = H\psi = \left(E_0 + \frac{p^2}{2m} + V\right)\psi$ *and* $E = \int E(x)dx = \int E|\psi(x)|^2 dx$ (see Figs. 52, 54, 62 and 63 and section 20). Therefore, in Fig. 23, $E = 2\int ct(x)dx$. The relativistic mass (m) is expressed as $m_0/(1-v^2/c^2)^{0.5}$. When the particle is moving with the velocity of v, the moving distance of the particle is changed from $\Delta x'$ to $\Delta x = \Delta x'/\sqrt{1 - v^2/c^2}$ by the momentum transition (see Figs. 54 and 61-63). The quantum mechanics and modified relativity theory can be established based on the same concept of the warped spaces. See Figs. 61 – 63 for the modified relativity theory which has the momentum and energy transitions.

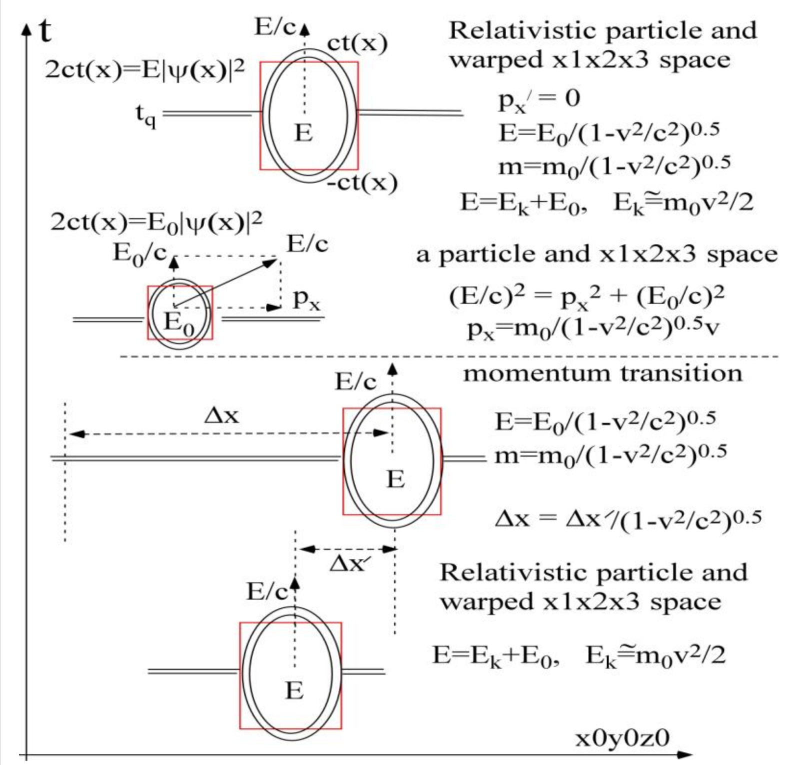


Fig.23. Quantum wave function and modified relativity theory. See Figs. 19, 61-63 and 48 - 54. The red box is the flat space approximation. See sections 18 and 20.

When we detect the particle, a particle stops and does not warp the space any more by the energy transition of the particle (see Figs. 43, 54 and 61-63). It means that the warped space disappears by being flat at the instance when it is detected. A particle can be detected anywhere in the warped space because the E_0 and E_k are closely intertwined. A particle can be detected with the more probability at the position of x with the higher E(x) value (see sections 18 and 20). It means that the squared quantum wave function of $|\psi(x)|^2$ can be treated as the probability density of the particle as a function of x (see Fig. 52). This explanation can be extended easily to the x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 spaces by the same way of the interpretation.

12. Electromagnetic waves and background fluctuations

The background space fluctuation can take place by creation and annihilation of the q and –q charge pair in our universe. This electric dipole can make the electric field, the strength of which can build the electric wave in Figs. 24 and 21. The background fluctuation also can oscillate between the creation and annihilation of the q_m and $-q_m$ magnetic charge pair as shown in section 11.2. This magnetic dipole can make the magnetic field, the strength of which can build the magnetic wave in Figs. 24 and 21. The magnetic charges of q_m and $-q_m$ are called as the magnetic monopole. Therefore, magnetic monopoles cause the magnetic wave. The correlation of the electric and magnetic waves will make the electromagnetic wave (light, photon) as shown in Figs. 21 and 24. Magnetic monopoles in our universes exist only from the pair creation of q_m and $-q_m$ by the background fluctuation. In Figs. 21 and 24, the background fluctuations of the x1x2x3 (EC and MEC) space are shown to make the xi photon with the charge configurations of electric wave (EC)=(0) and magnetic wave (MEC)=(0). Also, the electric field is the electric wave and magnetic field is the magnetic wave as shown in Fig. 24. In the present work, the electric field, magnetic field and electromagnetic field are defined as the three kinds of the photons with the same wave velocity equal to the light velocity of c (see Fig. 45 for the symbols of these three photons).

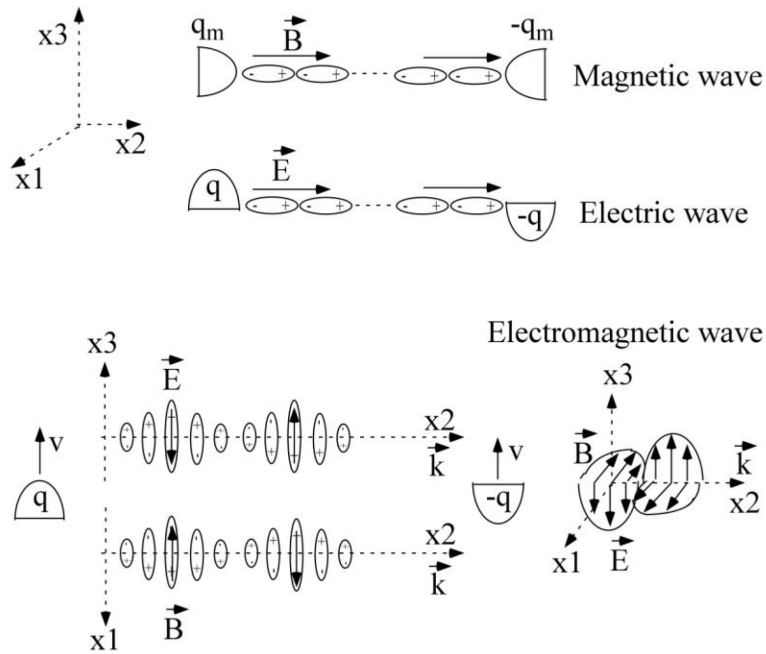


Fig. 24. The electric field between two static charges is originated from the propagation of the polarized electric waves along the moving direction and the magnetic field between two static magnetic charges is originated from the propagation of the polarized magnetic waves along the moving direction. See Figs. 11, 21, 22 and 45. Here, q>0 and q_m>0.

The electromagnetic wave concept in Figs. 21 and 24 can be easily applied to the x4x5x6 (LC and MLC) and x7x8x9 (CC and MCC) space, too. Therefore, the xi-xj photon of the electromagnetic wave has the charge configurations of electric wave (EC,LC) = (0,0) and magnetic wave (MEC,MLC) = (0,0) and the xi-xj-xk photon of the electromagnetic wave has the charge configurations of electric wave ((EC,LC,CC) = (0,0,0)) and magnetic wave ((MEC,MLC,MCC) = (0,0,0)). Also, the electric field between two static charges is originated from the propagation of the polarized electric waves along the moving direction of the electric field and the magnetic field between two static magnetic charges is originated from the propagation of the polarized magnetic waves along the moving direction of the magnetic field as shown in Fig. 24. The static magnetic charges can be made from the magnetic dipole moment of the electric current loop. Also the electromagnetic waves perpendicular to the moving direction of the electromagnetic wave are propagated between two moving electric charges. The light is originated from the electromagnetic wave. In summary, the electric and magnetic waves are the background fluctuation parallel to the wave moving direction and electromagnetic wave is the background fluctuation perpendicular to the wave moving direction. The background fluctuation velocity is called as the phase velocity and the wave velocity is called as the group velocity in the vacuum. The phase velocity is the same as the wave velocity defined as the light velocity of c in the vacuum.

13. Black hole, dark matter and Higgs boson

The black hole has been proposed for a long time (see Fig. 16 and section 21). The x1x2x3-x4x5x6 matter with the large warping can be treated as the black hole in Figs. 2 and 25. There are two kinds of black holes such as the x1x2x3 and x1x2x3-x4x5x6 black holes which develop the x1x2x3-x4x5x6 galaxies(normal matters) and bastons (dark matters) as shown in Fig. 25. We live in the x1x2x3 space and are made of leptons and baryons. Therefore, what we observe through the gravitational and electromagnetic force is the x1x2x3-x4x5x6 galaxies (normal matters) and bastons (dark matters) as shown in Fig. 25 (see Fig. 46). In the present work, the bastons are proposed to be the dark matters. The black hole will warp the x1x2x3 space around it. The warped x1x2x3 space around the black hole will resist the space expansion of the black hole through the gravitational force. When the space expansion of the black hole and the resistance of the warped space around the black hole are balanced, the black hole becomes stable like the black holes located in the center of the galaxy. Then the galaxy with the bulge, inner shell with the leptons, baryons and bastons and outer shell with the bastons in Fig. 25 is developed (see section 24).

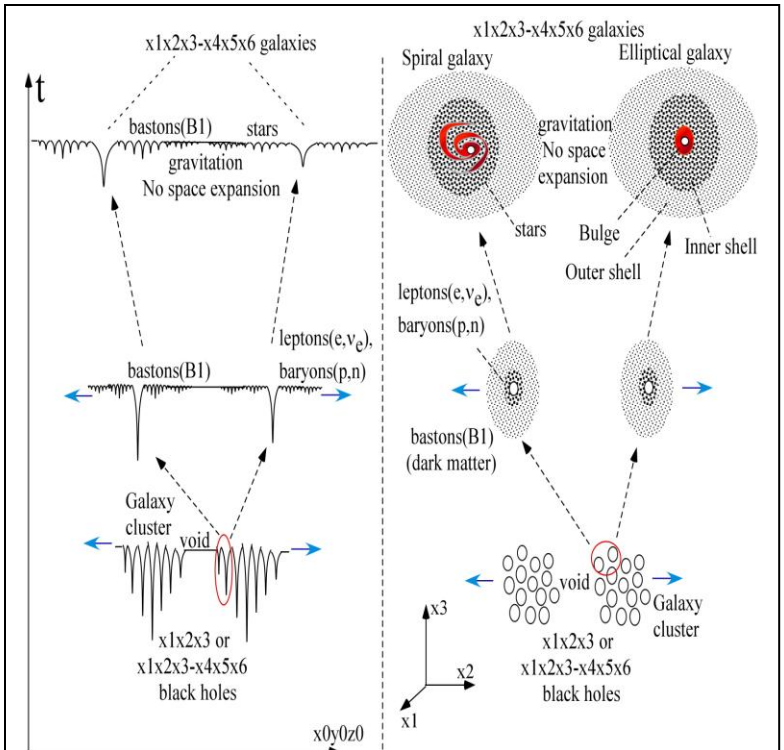


Fig. 25. The x1x2x3-x4x5x6 galaxies made from the black holes. The group of black holes becomes the galaxy cluster. See Figs. 2, 75 and 80. See section 24.

The bastons interacts with the leptons, mesons and baryons by the gravitational force because the g(0,0) gravitons can be exchanged between the bastons and normal matters(leptons, mesons and baryons) (see Figs. 46 and 91). The bastons cannot interact with the leptons and hadrons by the electromagnetic force because the γ(0) and γ(0,0) photons cannot be transformed to each other because the non-zero +q and -q lepton charges in γ(0,0) are vibrating along the space axis as shown in Figs. 11, 21 and 24 unlike the b-boson and graviton which always keep the zero charges along the space axis while vibrating. Therefore, the bastons can be observed only through the gravitational effect on the normal matters such as the leptons, mesons and baryons but not by the EC and LC charge interactions due to the exchanging of the photons (see section 8, Figs. 46 and 91). In the present work, the bastons are proposed as the dark matters connected to the hadrons located in the x1x2x3 space. Note that the bastons cannot be observed directly by us because the bastons are the xi particle and we are made of the xi-xj (e) and hadronized xi-xj-xk (p,n) particles and live in the x1x2x3 space. And the light can move along the curved line of the warped space around the galaxies (see Fig. 89). It has been called as the gravitational lensing effect. Within the galaxy size scale, it is thought that the gravitational interaction is dominating over the electromagnetic interaction. Note that if we are made of the xi-xj-xk (u,d quarks) particles and live in x1x2x3-x4x5x6 space, then the leptons become the dark matter and quarks become the normal matter (see Fig. 46). The baston, lepton and quark cannot interact with each other by the electric, lepton and color charge interactions because those have the different charge configurations (see section 8 and Fig. 46). But the baston, lepton and quark can interact with each other gravitationally by exchanging the g(0), g(0,0) or g(0,0,0) gravitons (see Figs. 46 and 91).

The bastons, leptons, mesons and baryons are expected to be produced from the excitations of the spaces around the black hole and the decays of the black holes because of the H energy in Fig. 6. Because the black holes are located on the x1x2x3 space, there are much more bastons such as B1 (dark matter) than the normal matters such as the leptons, mesons and baryons. These bastons are spread over the wider region than the leptons and baryons most of which are near the black holes in Fig. 25. Therefore, we on the earth can observe the leptons, baryons and mesons coming out of those areas. This is the factory producing the normal matters like the electrons, neutrinos and protons, and dark matters like the bastons. Because the x1x2x3 and x1x2x3-x4x5x6 black holes are the matters, only the matter particles can be produced through the H energy. The antimatter particles cannot be produced from the black holes. The black holes have the gravitational effects but not the electromagnetic charge interaction effects with the dark matters of the bastons and the normal matters of leptons and baryons. Of course, the black holes have the gravitational effects with other black holes, too. It is thought that these normal matters around the black holes become the stars and planets at the beginning time of the black hole in Figs. 2 and 25. Therefore, the much more bastons (so called as dark matter) than the leptons and baryons are expected to exist within and around the galaxy cluster as observed in wide-field lensing mass maps from DES science verification data (V. Vikram et al., arXiv:1504.03002 (2015)). Because the B1 baston is most stable and lightest one of three B1, B2 and B3 bastons, it is thought that the dark matter is mostly the B1 baston. In our x1x2x3 universe, the normal matter, dark matter and dark energy (+ H energy) are taking about 4.9 %, 26.8 % and 68.3 % of whole universe energy-matter, respectively (see Fig. 85). The 26.8 % dark matters are the bastons. It is thought that the bastons, leptons, baryons and mesons have been made around the black hole located at the center of the galaxy since the birth of this black hole. Therefore, the very high energy cosmic rays and high energy x-rays may be originated by the leptons and baryons including protons produced around the black holes which are located around the center of the galaxy.

The universes start from the birth of the black hole universes which can be called as the big bang as shown in Figs. 2 and 16. The peaks shown in Figs. 2 and 24 can be treated as the black holes. Therefore, all matters including the stars and galaxies were made from the black holes. It is possible that the big black holes are found at the earlier time right after the big bang. The hugely warped space with the Planck size space width and the huge time length (so called a huge black hole) can experience the fast expansion of the space from the Planck size of the space along with the fast decreasing of the huge time length which can be called as the inflation and acceleration of the universe through the H energy. The huge black holes can be separated into several smaller sized black holes with the expansion of the spaces around those (see Figs. 2, 24 and 83). Then, each black hole is separated into the group of smaller black holes which might be developed to the group of galaxy clusters with the various sizes. This group of galaxy clusters can be called as the super-cluster in Fig. 2. The spaces between the black holes developed to the super-clusters are flat and are called as the void. A consistent motion of the galaxy clusters within the same super-cluster is called as the dark flow. In the present work, the possible dark flow is explained as the red arrows in Fig. 2. All galaxy clusters within the same super-cluster have the same consistent velocity caused by the space expansion of the earlier black hole through the H energy which decays to many super-clusters as shown in Fig. 2. The velocities of two super-clusters are called as v_A and v_B in Fig. 2. If v_A and v_B are vectors with the same direction, the speed difference of the super-clusters A and B might be small and difficult to be measured. But if v_A and v_B are vectors with the different direction, the speed difference of the super-clusters A and B might be more easily measured. The flat or nearly flat space between two super-clusters is called as the void as shown in Fig. 2. Therefore, I think that the dark flow and the void can be explained in the present work.

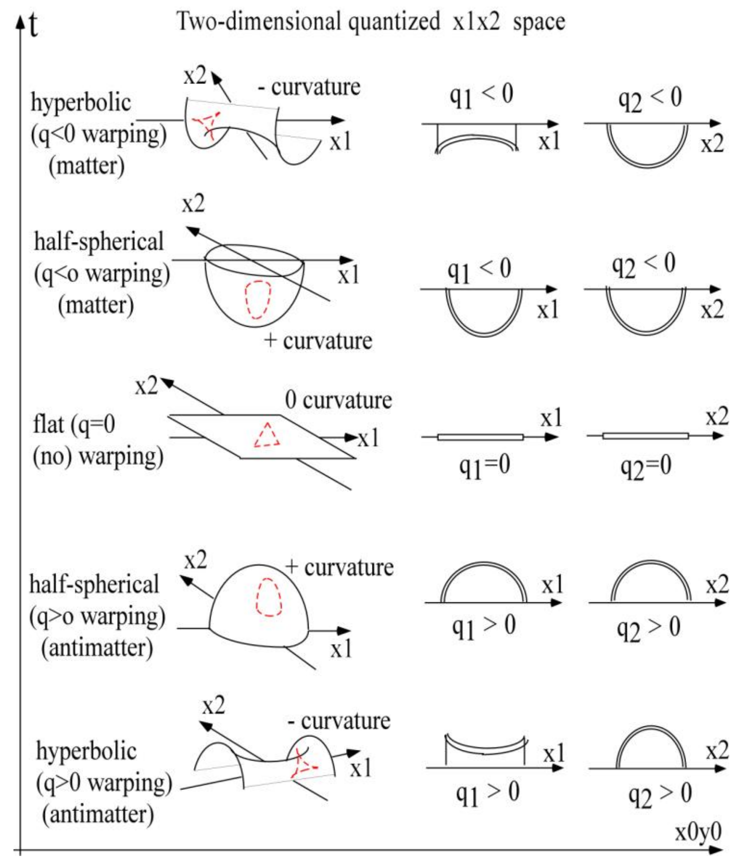


Fig. 26. Examples of two-dimensional quantized x1x2 spaces for the simple version of the x1x2x3 spaces. See section 20 for more details. See Fig. 58.

The normal matters and dark matters can coexist in Fig. 25(see Fig. 46). The photons are responsible for the electromagnetic interactions. In the same three-dimensional quantized space, the photons for the charge interactions of the normal matters are different from those for the charge interactions of the dark matters (see Fig. 46). For example, the dark matters in the x1x2x3 space are bastons connected to the γ(0) photon and the normal matters in the x1x2x3 space are leptons, mesons and baryons connected to the γ(0,0) photon. And the dark matters in the x4x5x6 space are leptons connected to the γ(0,0) photon and the normal matters in the x4x5x6 space are quarks connected to the γ(0,0,0) photon (see Fig. 46). The x4x5x6 spaces are expected mostly in and around the x1x2x3-x4x5x6 black holes. But it is thought that the x4x5x6 spaces are very rare within our universes. The black holes are distributed evenly in all directions. It is thought that most black holes are the x1x2x3 balck holes and a smaller number of the x1x2x3-x4x5x6 balck holes exist. But the x1x2x3-x4x5x6-x7x8x9 black holes whicg can be seen on the x4x5x6 space would be very rare. Also, some of galaxies have bigger ratios of bastons (dark matters) to the leptons and baryons (normal matters) than other galaxies. The photons (γ(0)) emitted from the bastons cannot be observed but the photons (γ(0,0)) emitted from the leptons and baryons can be observed, for example, as the cosmic microwave background radiation. Therefore, if the galaxy clusters with the much larger ratios of dark matters to normal matters exist, the areas of those galaxy clusters may be observed as the super void or the large cooler spot in the cosmic microwave background radiation map. These galaxies with the larger ratios of the dark matters to normal matters can be called as the dark matter galaxies and the galaxies like our milky way galaxy with the smaller ratios of the dark matters to normal matters can be called as the normal matter galaxies. The mixed matter galaxies between the dark matter galaxies and normal matter galaxies can explain the so called dying galaxies without the normal matter clouds and the normal matter galaxies can explain the so called active galaxies with the normal matter clouds. All of the galaxy clusters within the same super-cluster are originated from the decay of the same black hole following the expansion of the space. Therefore, the galaxy clusters within the same super-cluster are receding from each other because of the H energy in Fig. 6. All of the galaxies within the same galaxy cluster are coming from the decay of the same black hole. All of the galaxies within the same galaxy cluster are bound by the gravitational attractions which block the space expansion in Figs. 2 and 25. The galaxy cluster is the largest gravitational structures in the universe (see section 24 for more details).

All of particles (see Fig. 44) were created from the expansions of the black holes in the early universe as shown in Fig. 25. And the particle and antiparticle pairs were created by the pair creations made from the photons in the early universe. These particles and antiparticles created by the pair creations from the photons in the early universe were annihilated into the photons in the early universe. Therefore, only the particles created from the expansions of the black holes in the early universe by the H energy have been present until the present time. At the present time, the stable black holes are located at the center of the galaxy. It is expected that some particles are created and some particles are annihilated around these stable black holes. If any xi, xi-xj or xi-xj-xk particle is attracted by the gravitional force into the black hole, the xi, xi-xj or xi-xj-xk b-boson of this particle will be destroyed first near the black hole and the remaining xi, xi-xj or xi-xj-xk matter of this particle will be absorbed into the space of the black hole. This is the reverse process of the particle creation made from the black hole as shown in Fig. 25. Therefore, if we are gravitationally attracted into the stable x1x2x3 or x1x2x3-x4x5x6 black holes, all xi-xj and xi-xj-xk b-bosons of our body will be destroyed and all remaining xi-xj and xi-xj-xk matters of our body will be absorbed into the space of the black holes (see Fig. 55). Therefore, nothing will be left from our body because of this space merging process.

General relativity theory can be applied to each three-dimensional quantized space if possible as shown in section 20.2. Because we live in the x1x2x3 space, it is thought that the general relativity theory has been applied to the shape description of the x1x2x3 space including the x1x2x3 black hole by using the Einstein field equation under the condition of the invariant interval between two events which is $\Delta s^2 = c^2\Delta t^2 = c^2\Delta t_l^2 - \Delta x^2$ (see section 20.2 for more details). Then, the flat, spherical and hyperbolic shapes of the universe have been proposed. In Fig. 26, the flat, half-spherical and hyperbolic shape examples of the two-dimensional quantized x1x2 space-time are newly described according to the present interpretation of the space warping on the time axis. The shape examples of the three-dimensional quantized x1x2x3 space-time can, also, be visualized from this description of the two-dimensional quantized x1x2 spaces shown in Fig. 26. In general relativity theory, the matter makes the space around it to be curved by its own gravitational effect. However, in the present work, the matter is the warped space itself. So, the matter with the relatively larger space warping can warp or curve the space around it by the vibration, rotation and linear motion related closely to the gravitational effect. The universes like our x1x2x3 universe begin with the hugely warped space with Planck size space width and huge time length, and it will end up with the flat space with the huge space width and quantum time length (see Fig. 83 and section 15). Gravitation is the local force which works only within the distance limit of 4.6433 10^{23} m which is very small relative to the whole universe scale as shown in section 8. The general relativity theory can be applied to the shape description of the x1x2x3 space. Then, the general relativity theory might need to be re-interpreted and modified according to the results of the present model (see section 20.2). The x1x2x3 space warping can be caused by the x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 matters according to the present model.

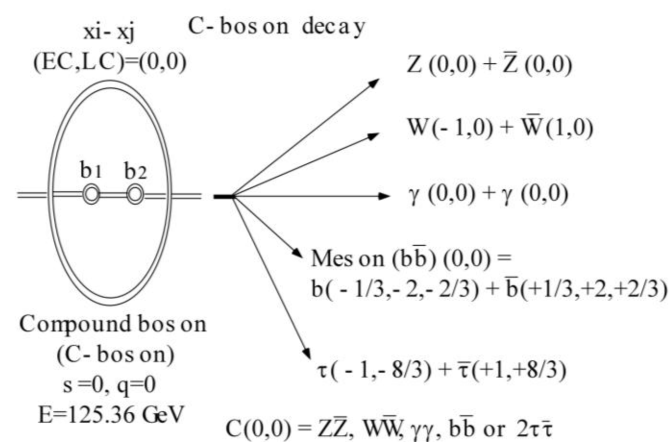


Fig. 27. The observed Higgs boson in terms of the standard model is explained as the compound boson (C-boson). See Figs. 14 and 15.

There are the gravitational force, electromagnetic force, weak and strong forces in the universe. Time momentum is P_t =E/c and space momentum is p_x. The space momentum can be varied with changing of the velocity and the relativistic mass along the space axes. But the time momentum is constant along the time axis because E and c for the particles is not varied along the time axis. There is no effect on the time momentum such as the relativistic mass effect on the space momentum. Therefore, all of the forces can be only applied along the space axes but not along the time axis. So the time distance between two positive energy universes or between two negative energy universes is always fixed once they are born by the pair productions of the E and –E universes. And the time distance between the positive energy and negative energy universes is increased by 2Δt when the time is flowing by Δt once they are born by the pair productions of the E and –E universes.

The best candidate of the Higgs boson was discovered by ATLAS collaboration by using Large

Hadron Collider in CERN (Phys. Rev. **D90**, 052004 (2014)). This new particle has the mass of 125.36 GeV/c^2. This particle has the zero spin, zero EC and zero LC. This particle decays to the two gamma rays, two Z(0,0) and two W(1/-1,0) bosons. The Higgs boson proposed in the standard model is not needed in the present model. In the present work, the new compound boson called as C-boson with (EC,LC)= (0,0) is introduced to explain the boson with s=0 and q=0 observed at 125.36 geV as shown in Fig. 27. The C- boson in Fig. 27 has the two internal structures of b1(0,0) and b2(0,0) while the normal boson has one internal structure as shown in

Table. 8. Comparison between the experimental and calculated meson energies. The calculated meson energies are obtained by using the effective quark excitation energies associated with mesons in Fig. 28.

Mesons	$q\bar{q}$	(EC,LC,CC)($\overline{EC},\overline{LC},\overline{CC}$)	Exp. (MeV)	Calc. (MeV)
π^0	$u\bar{u}$	(2/3,0,-2/3) (-2/3,0,2/3)	135.0	135.0
η	$u\bar{u}$	(2/3,0,-5/3) (-2/3,0,5/3)	547.3	547.3
f_1(1285)	$u\bar{u}$	(2/3,0,-83) (-2/3,0,8/3)	1285	1281.4
π^+	$u\bar{d}$	(2/3,0,-2/3) (1/3,0,2/3)	139.6	139.6
f_0(550)	$u\bar{d}$	(2/3,0,-5/3) (1/3,0,5/3)	550	551.9
η(1295)	$u\bar{d}$	(2/3,0,-8/3) (1/3,0,8/3)	1295	1286.0
K^+	$u\bar{s}$	(2/3,0,-2/3) (1/3,1,2/3)	493.7	493.7
$K^*(892)^+$	$u\bar{s}$	(2/3,0,-5/3) (1/3,1,5/3)	891.7(3)	906
K_1(1650)	$u\bar{s}$	(2/3,0,-8/3) (1/3,1,8/3)	1650	1640
K^0	$d\bar{s}$	(-1/3,0,-2/3) (1/3,1,2/3)	497.7	498.3
$K^+(892)^0$	$d\bar{s}$	(-1/3,0,-5/3) (1/3,1,5/3)	896.1(3)	910.6
K_2(1780)	$d\bar{s}$	(-1/3,0,-8/3) (1/3,1,8/3)	1776(7)	1644.7
D^+	$c\bar{d}$	(2/3,-1,-5/3) (1/3,0,5/3)	1869.3(5)	1869.1
D^0	$c\bar{u}$	(2/3,-1,-5/3) (-2/3,0,5/3)	1864.5(5)	1864.5
D_s^+	$c\bar{s}$	(2/3,-1,-2/3) (1/3,1,2/3)	1968.6(6)	1810.9
B^+	$u\bar{b}$	(2/3,0,-5/3) (1/3,2,5/3)	5279.0(5)	5210.0
B_s^0	$s\bar{b}$	(-1/3,-1,-2/3) (1/3,2,2/3)	5369.6(24)	5156.4
B_c^+	$c\bar{b}$	(2/3,-1,-2/3) (1/3,2,2/3)	6276(4)	6114.9
η_c	$c\bar{c}$	(2/3,-1,-2/3) (-2/3,1,2/3)	2979.8(18)	2749.4
J/ψ	$c\bar{c}$	(2/3,-1,-5/3) (-2/3,1,5/3)	3096	3171.7
X(3872)	$c\bar{c}$	(2/3,-1,-8/3) (-2/3,1,8/3)	3872	3905.8
γ	$b\bar{b}$	(-1/3,-2,-2/3) (1/3,2,2/3)	9460.3(3)	9460.4

Figs. 14 and 15. When a pair of Z/W boson-antiboson is produced from the decay of C-boson, the C-boson needs to take the additional energy from the background fluctuations. And many kinds of compound bosons (C-bosons) with the two and more internal structures are expected at the higher energies than 125.36 GeV.

14. Charge configurations of mesons and particle decays

Now I am trying to predict the energies of the mesons associated with the charges as shown in Fig. 28. By using the EC, LC and CC charges of the quarks I determined the effective quark energy difference within the meson. Of course these effective quark energy states are seen as the meson masses. These effective quark energy differences are shown in Fig. 28. The calculated

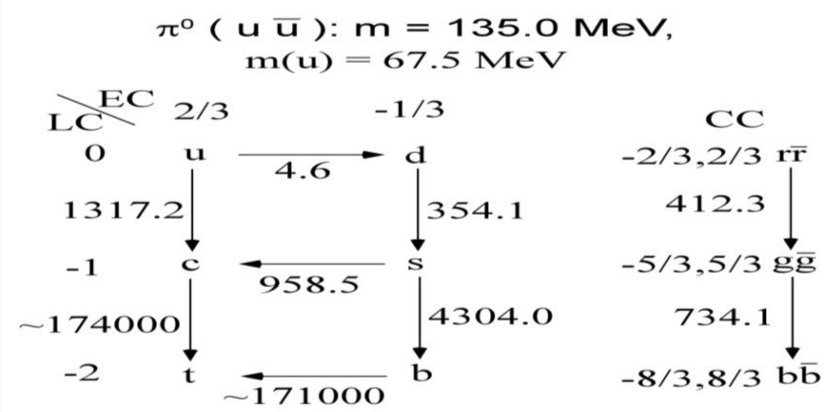


Fig. 28. Quark excitation energies associated with the mesons.

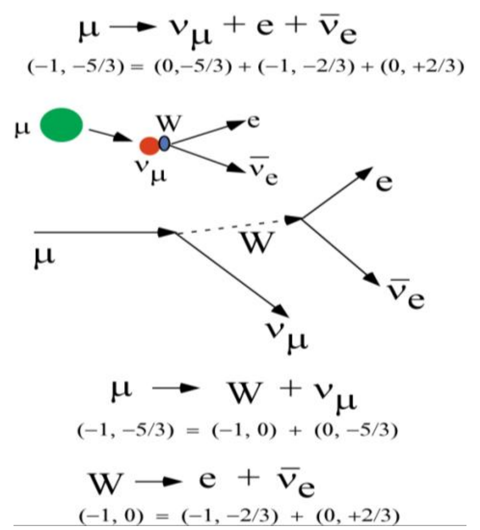


Fig. 29. Lepton decay.

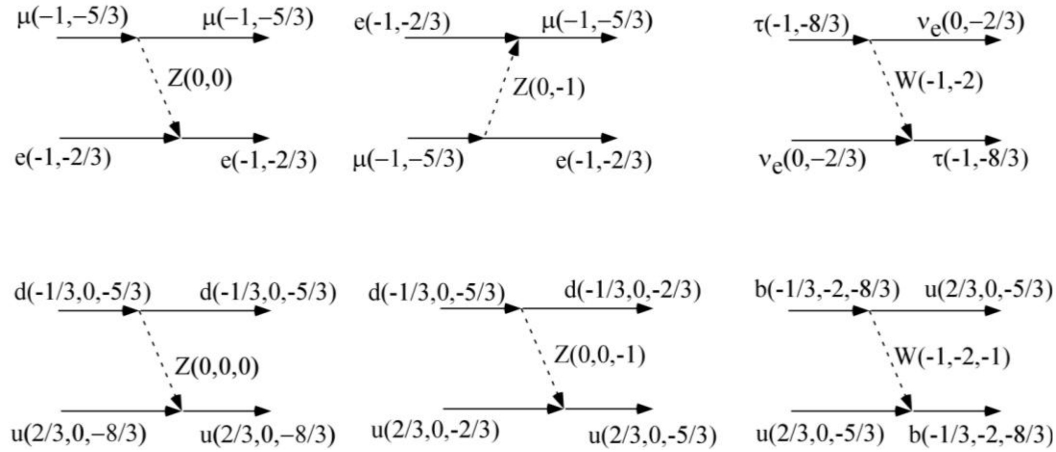


Fig. 30. Weak and strong interactions. Here, Z(0,0) and Z(0,0,0) can be replaced with γ(0,0) and γ(0,0,0), respectively. See Fig. 47 and page 127 for more

meson energies and experimental meson energies (particle data group, Physics Letters **B592**, 1

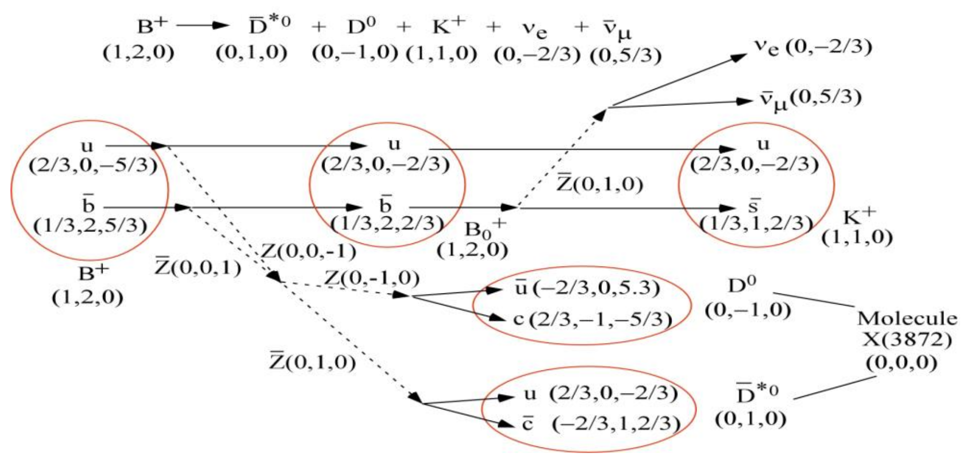


Fig. 31. Decay scheme of B$^+$ meson with the x(3872) meson proposed as the $D^0\overline{D}^{*0}$ molecule. See page 127 for more examples.

(2004)) are compared in Table 8. As seen in Table 8, the calculated meson energies are in a good agreement with the measured ones. From this agreement, the charge configurations are assigned tentatively to several mesons. Several particle decay schemes are shown as some examples in Figs. 29-34. The new meson or hadron state of X(3872) has been observed by Belle,

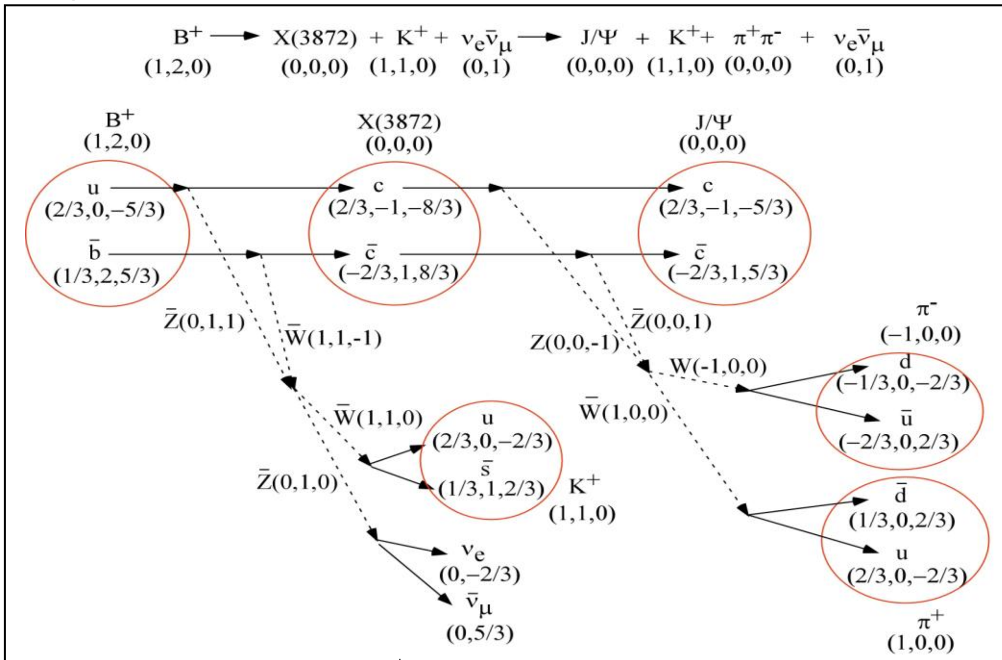


Fig. 32. Decay schemes of B$^+$ meson with the X(3872) meson proposed as the charge configuration ((2/3,-1,-8/3) (-2/3,1,8/3))of the $c\bar{c}$ quarks.

BABAR, CDF and D0 collaborations in the invariant mass spectrum of $J/\psi\pi^{+}\pi^{-}$ in the decay of $B^{+} \rightarrow J/\psi\pi^{+}\pi^{-}K^{+}$ (K. Abe et al., Belle collaboration, arXiv:hep-ph/0505037 (2005)). The $D^{0}\overline{D}^{*0}$ molecule has been the possible explanation of X(3872) state in Fig. 31 and alternative interpretation has been still tried. In the present work, we try to understand this X(3872) state as

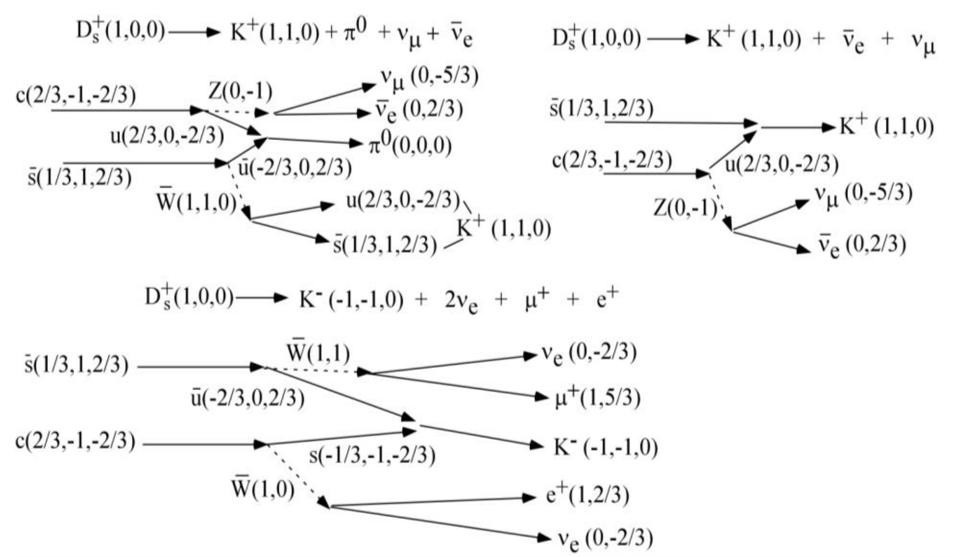


Fig. 33. D_s^{+} decay modes. See Fig. 47 and page 127 for more examples.

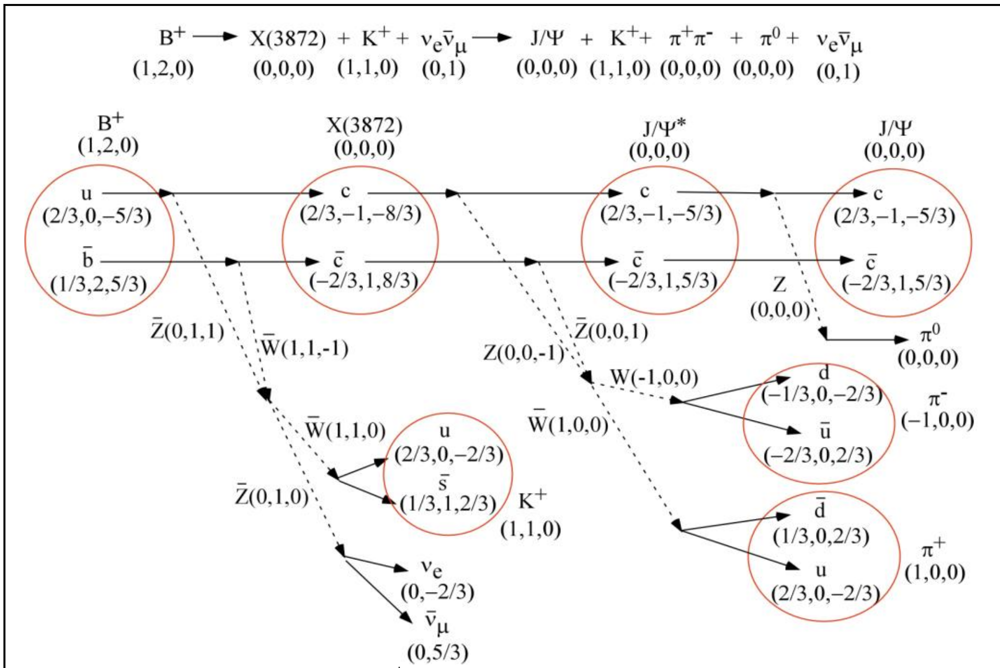


Fig. 34. Decay schemes of B^{+} meson with the X(3872) meson proposed as the charge configuration ((2/3,-1,-8/3) (-2/3,1,8/3))of the $c\bar{c}$ quarks.

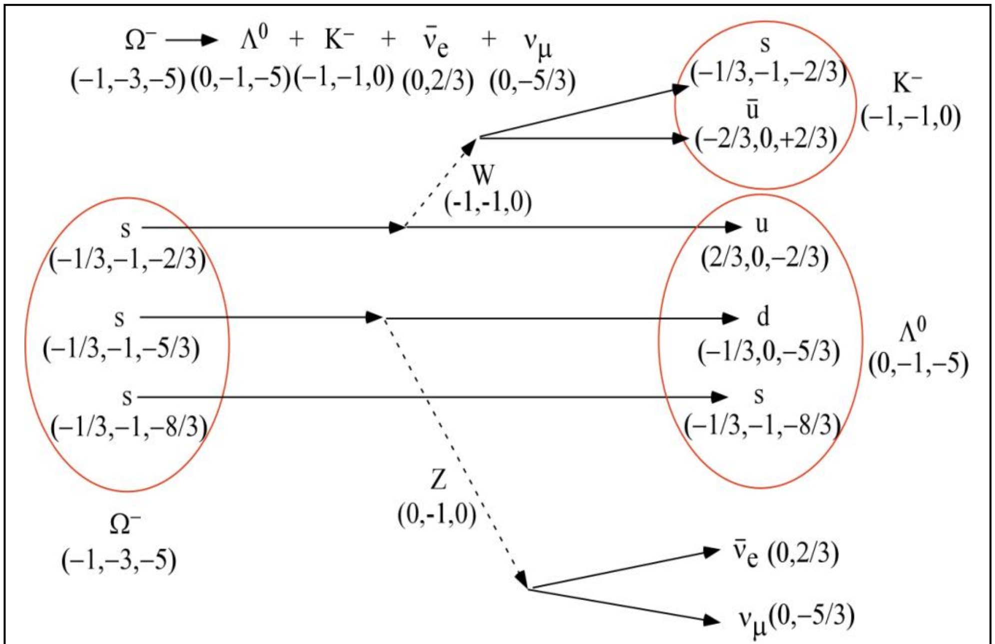


Fig. 35. Decay scheme of the Ω^- baryon.

the new meson with the charge configuration ((2/3,-1,-8/3) (-2/3,1,8/3)) of the $c\bar{c}$ quarks as proposed in Table 8. Also, in Table 8, the meson of J/ψ has the charge configuration of (2/3,-1,-5/3) (-2/3,1,5/3). The possible decay scheme is plotted in Figs. 32 and 34. The decay schemes of X(3872) into J/ψ + $\pi^+ \pi^-$ and J/ψ + $\pi^+ \pi^- \pi^0$ are shown in Figs. 32 and 34. The possible decay mode of B^+ into $K^+ + \overline{D}^{*0}$ is plotted in Fig. 34. Also, a molecule of $D^0\overline{D}^{*0}$ can be formed in the decay of B^+ as shown in Fig. 31. In the present work, it is concluded that a X(3872) state can be explained by a meson with the charge configuration ((2/3,-1,-8/3) (-2/3,1,8/3)) of the $c\bar{c}$ quarks as proposed in Table 8 and also by a $D^0\overline{D}^{*0}$ molecule. The sizes (x) of the mesons can be calculated from the equation of E_b(xi-xj-xk)=12.2047 10^{38} x^2 (eV) (x: m) in Table 2. Then the calculated size (x) of a π^o meson is 3.326 10^{-16} m. The decay scheme of the Ω^- baryon is shown in Fig. 35. See page 127 for more reaction and decay schemes.

15. Calculation of quantum length, Planck length and space sizes

In the present work, the quantum length (x_q) and quantum time (t_q) with the relation of $t_q = x_q/c$ are defined for the three-dimensional quantized spaces in Fig. 3. The quantum length is smaller than the Planck length (x_p). If the matter with E>0 is given, the time momentum (P_t = E/c) is constant and positive. Therefore, the time of the matter is increasing constantly along the positive time axis. It is because all of the three dimensional quantized spaces are made up of the quantum spaces with the constant quantum space fluctuation time of $t_q = x_q/c$ as shown in Fig. 3. The quantum time of t_q is the minimum size of the time. Also, the observable time increase of $\Delta t_l = \Delta x/v$ can be indirectly measured by the non-zero velocity of the matter. For example, $\Delta t_l = \Delta x/c$ from the photon movement with the constant velocity of c. The space momentum of ($P_x = Ev/c^2$) is changing according to the velocity of v and the space position of the matter can be increasing or decreasing depending on the direction of the velocity. And the time of the three-dimensional quantized spaces is originated from the constant fluctuation velocity ($c=x_q/t_q$) of the space quantum. Also, the mother universe has the infinite quantum time which means the stable mother universe because it takes the infinite time to fluctuate. It indicates that the mother universes are present permanently with the infinite quantum times and their daughter universes are fluctuating within the finite quantum times. Therefore, the quantum time fluctuation is the origin of the time we on the earth have experienced.

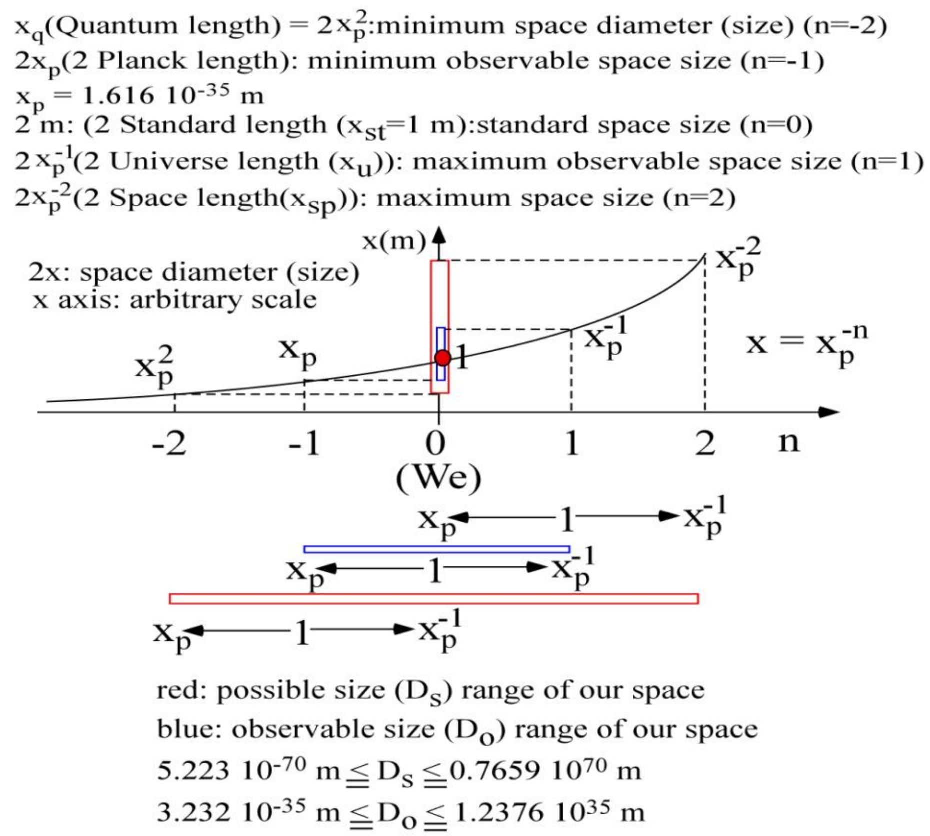


Fig. 36. The possible sizes of our x1x2x3, x4x5x6 and x7x8x9 universes are proposed.

Now, I am trying to calculate the quantum length from the Planck length of 1.616 10^{-35} m. Minimum observable space length is defined by the Planck length and minimum space size is the quantum length in Fig3. 3 and 36. The space length which we stand on is defined as the standard length (x_{st}) as shown in Fig. 36. Then, x_{st} is defined to be 1 m for our universe. The minimum observable length measured from any point inside the universe with the standard length of 1 m is Planck length of x_p = 1.616 10^{-35} m as shown in Figs. 36 and 37. Generally speaking, the equation of $x=ax_p^{-n}$ can be used to calculate the quantum length, Planck length, universe length and space length. For our universe case, a = 1 in Fig. 36. In general, when the quantum length is $2ax_p^2$ m, the standard length, Planck length, universe length and space length needs to be multiplied by a. For example, if a is 10^{10}, the quantum length, Planck length, standard length, universe length and space length are 5.2 10^{-60}, 1.616 10^{-25}, 10^{10}, 6 10^{44} and 3.8 10^{79} m, respectively. If a = x_p, the observable space with the smallest length seen from the space with x_p m is the space with the length of x_p^2 m in Fig. 36. This means that the quantum length seen from the space with x_{st}=1 m is $2x_p^2$ in Figs. 36 and 37. If a = x_p^{-1}, the observable space with the smallest length seen from the space with $x_{st} = x_p^{-1}$ m is the space with the length of 1 m in Figs. 36 and 37. This means that reversely the space with the length of x_p^{-1} m is the observable space with the largest length seen from the space with the length of 1m. Then the length of x_p^{-1} m is called as the universe length with the maximum observable length. Then the space with the length of x_p^{-2} m is the space with the largest length seen from the space with the length of 1 m. Then the length of x_p^{-2} m is called as the space length with the maximum space length. Therefore, the three-dimensional quantized space has the minimum size of quantum length and the maximum size of the space size as defined in Figs. 36 and 37.

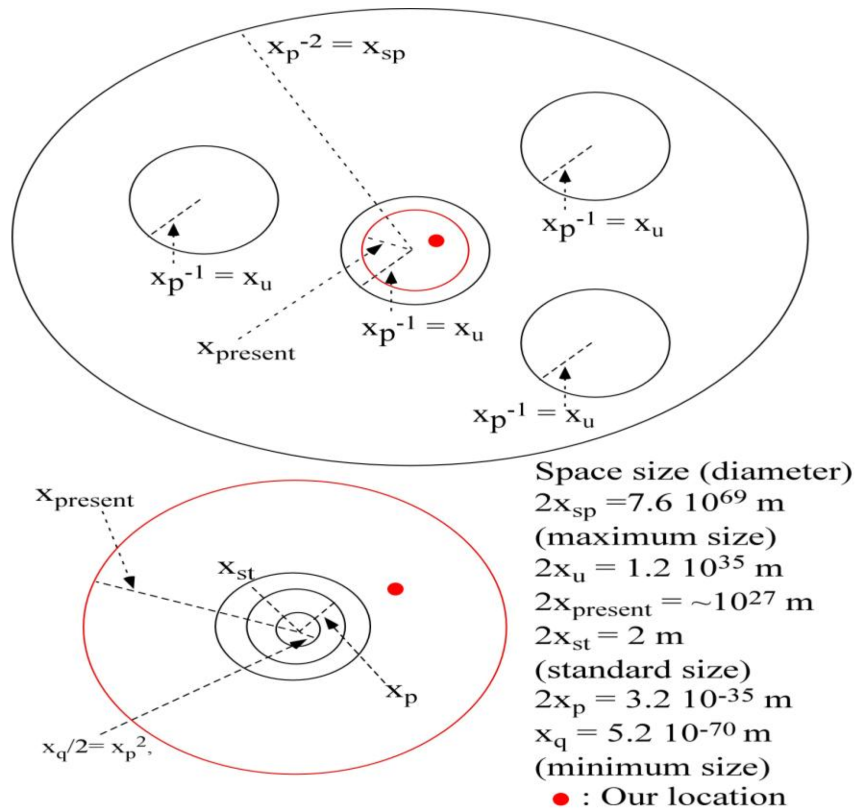


Fig. 37. The x1x2x3 space sizes are compared on the arbitrary scale. Present size (red circle) of our universe is assumed as ~10^{27} m. Our possible location is assumed here.

Therefore, the possible size (diameter, D_s) range of our space is $2x_p^2 \leq D_s \leq 2x_p^{-2}$. The observable size (diameter, D_o) range of our universe is $2x_p^1 \leq D_s \leq 2x_p^{-1}$ as shown in Figs. 36 and 37. Then, the quantum length (x_q) is $2x_p^2$ = 5.223 10^{-70} m. And the quantum time (t_q) is x_q/c = 1.7422 10^{-78} s which give the present masses of the elementary particles. Different quantum time will give the different masses of the elementary particles. The energy of the minimum space quantum shown in Fig. 3 is $E_q(x1x2x3) = ct_q x_q^3 = 2.7278\ 10^{-139}\ x_q^2 Tms = 2.7278\ 10^{-139} \times 2.2950\ 10^{38}\ eV = 6.2603\ 10^{-101} eV$.

The flat space is described as the plane waves as shown in section 11.1. The matter and particle means the warped spaces as discussed in the present work. The energies of the matter and particle are the warping energies of the space added to the space energies. The warped space can be described by using the wave functions of the quantum mechanics as shown in section 11. Generally, the warping energy of the elementary particle is mostly the b-boson energy. In Fig. 38, the energy of the warped space and the energy of the flat space with the xi=10^{-15} m length are compared in order to show that the energy (E_{warp}) of the warped space can be much larger than the energy (E_{flat}) of the flat space,

$E_{warp}(xi) = \pi \frac{(xi)^2}{2} = 3.1415\ 10^{-30}\ x_q^2 Tms = 3.1415\ 10^{-30} \times 2.2950\ 10^{38} = 7.2097\ 10^8\ eV$, $E_{flat}(xi) = 2\ 10^{-15} \times 1.7422\ 10^{-78}\ cx_q^2 Tms = 2 \times 1.7422\ 10^{-93} \times 2.2950\ 10^{38} c =$ $2.3973\ 10^{-46}\ eV$. Here, xi = 10^{-15} m.

The warped space with the sizes of $x \geq x_p\ and\ \Delta t \geq t_p$, is observable but the flat space with the sizes of $x \geq x_p\ and\ \Delta t = t_q$, is unobservable and is just the empty space.

Our universe was born as the hugely warped space with the quantum time (t_q) of x_q/c = 1.7422 10^{-78} s as shown in Figs. 2, 25 and 38. This hugely warped space has been expanding through the inflation and the accelerated space expansion toward the flat space as shown in Figs. 2, 25, 38 and 83. Now because our universe is thought to be flat or nearly flat, the present space length of

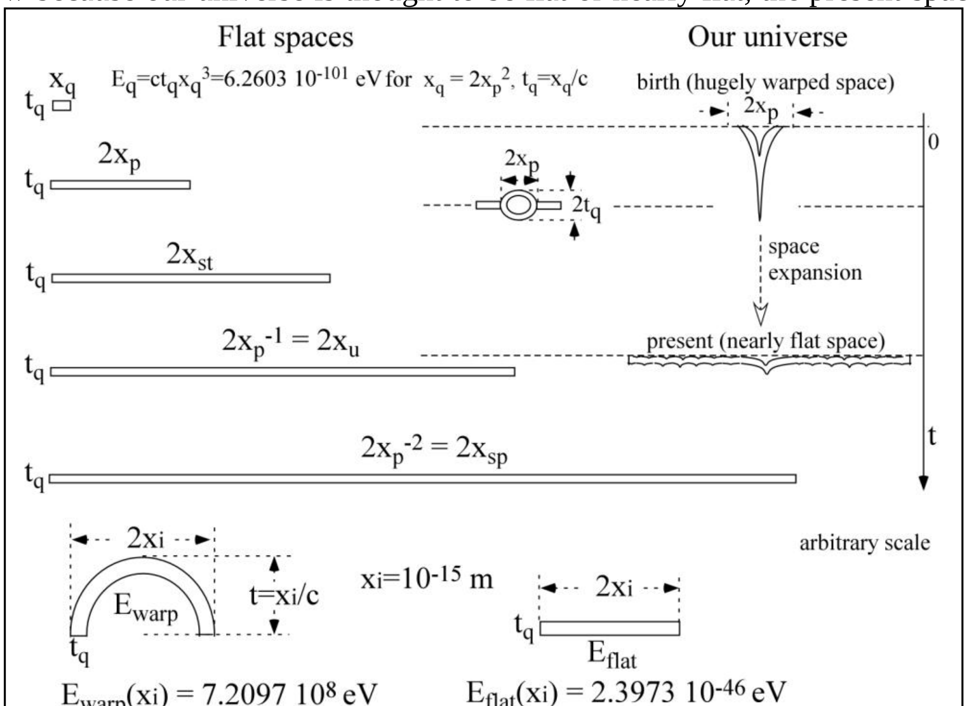


Fig. 38. The x1x2x3 space sizes are compared on the arbitrary scale. The energies of the warped and flat spaces are compared.

our universe may be between x_u and x_{sp} as shown in Fig. 38. The final and maximum length of our universe will be x_{sp}. The present size of our universe with the age of 13.8 10^9 years old is assumed as ~10^{11} ly = ~10^{27} m, which was proposed by Bars and Terning (I. Bars and J. Terning, *Extra dimensions in space and time*, Springer, 2009, p. 27), in Figs. 37 and 38. Generally speaking, the elementary particles in Fig. 12, Planck length and quantum length are closely connected to each other. Actually the x1x2x3 universe can have any size of the quantum time. Therefore, the x1x2x3 universe can have any size of the quantum length. Here, $x_q = ct_q$. Once the quantum time is set in any x1x2x3 universe, the Planck length is set in that x1x2x3 universe and the following daughter universes. Then, the energies of the elementary particles are dependent on the sizes of the quantum time and Planck length and the energies of the b-bosons. Because our universes have the present quantum time (t_q) of 1.7422 10^{-78} s, the elementary particles have the present energies and masses. The elementary particles are shown in Fig. 12. For other universes with the quantum time different from the quantum time in our universes, the elementary particles in other universes should have the energies and masses different from the energies and masses of the present elementary particles seen in our universes. It means that the matters seen in other universes should be different from those seen in our universes if the quantum time is different between other universes and our universes. The matters consisting of the elementary particles are including the animals and humans.

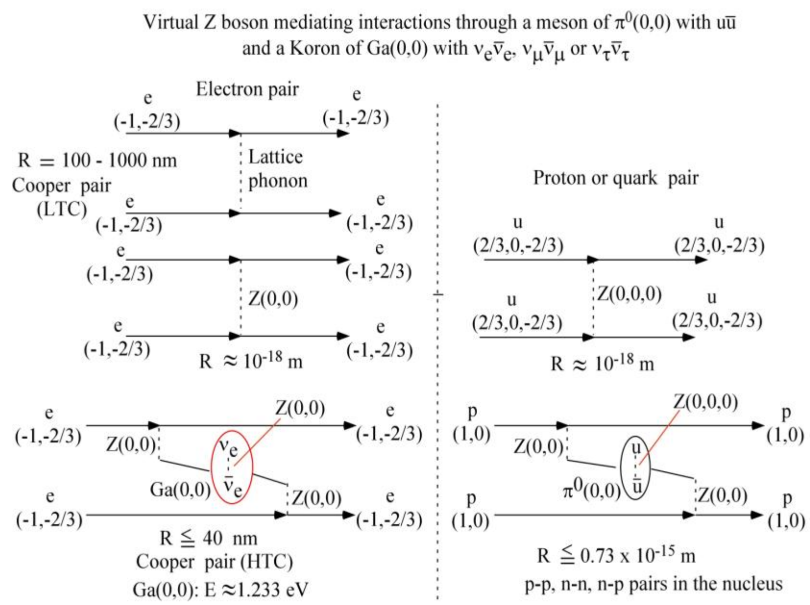


Fig. 39. Weak interactions for the proton pair and electron pair. (LTS) and (HTS) mean (low temperature superconductor) and (high temperature superconductor), respectively. Interaction ranges (R) of other cases except the lattice phonon case are calculated from the uncertainty principles.

16. Electron pairs and high temperature superconductor

The quarks can experience the strong interactions through the virtual bosons of Z(0,0,0) around the very short range of R ≈10^{-18} m in Table 4. A pair of the quark and antiquark can make the mesons by exchanging the Z(0,0,0) bosons. And the protons and neutrons are bound by exchanging the pions of $\pi^{0,+,-}$. This force is very strong and has been called the (residual) strong force, which is originated from the quarks inside the nucleons. This strong interaction range is R ≤ 0.73 10^{-15} m which is similar to the nucleon size as shown in Fig. 39. Similarly the leptons can experience the weak interactions through the virtual bosons of Z(0,0) around the very short range of R ≈ 10^{-18} m as shown in Fig. 39 This means that the weak interaction between two electrons through the Z(0,0) boson may be the main force to form the electron pairs in the electron orbitals of the atomic shell model because the attractive weak interaction can be larger than the Coulomb repulsive force in the very short range of R ≈ 10^{-18} m. This electron pair consists of the up spin electron and down spin electron.

Also, two leptons can be bound by exchanging the koron of Ga(0,0) with the neutrino pair of $\nu_e\overline{\nu_e}, \nu_\mu\overline{\nu_\mu}, or\ \nu_\tau\overline{\nu_\tau}$ as defined in Figs. 38 and 44 (see Figs. 91 and 93). The Ga(0,0) koron is made of a pair of lepton and antilepton (see Fig. 39). This Ga(0,0) koron can be seen in the x1x2x3 space because it has the EC=0 and LC=0 charges. The weak interaction can be larger than the Coulomb force between two electrons around the force range of R $\leq$ 40 nm for the high temperature superconductor (HTS). The force range of R $\leq$ 40 nm for the high temperature superconductor (HTS) is shown in Fig. 40. Then, the bound state of two electrons may be a Cooper pair (electron pair) responsible for the high temperature superconductor (HTS). HTS starts taking place at T_c > 30 K. HTS has been one of the big challenges in physics because no theory can explain this effect fully while the low temperature superconductor (LTS) or Type I superconductor has been well interpreted by using the electron and lattice phonon interactions of the BCS theory. LTS has the range of R = 100 – 1000 nm between two electrons.

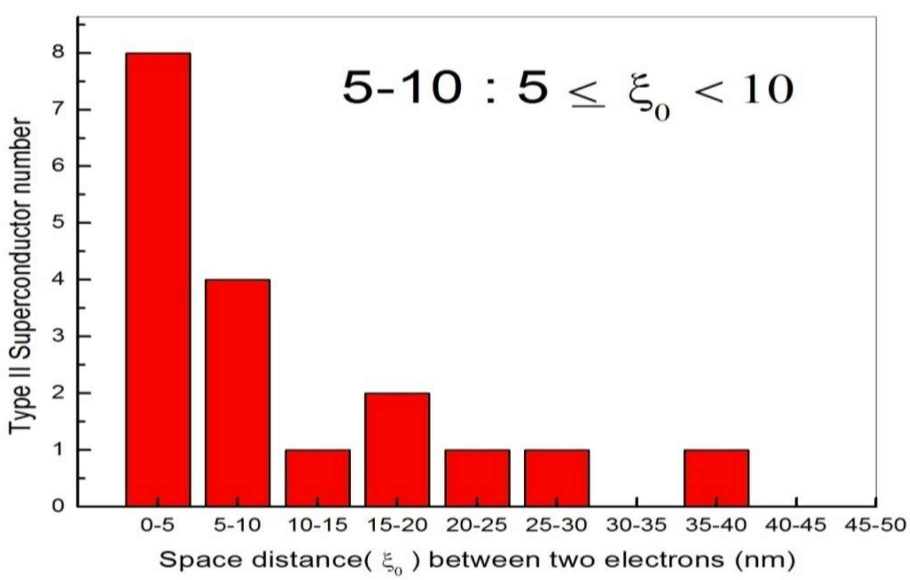


Fig. 40. Numbers of type II superconductors versus the space distances (coherence length at T = 0 ^{o}K, ξ_0) (1.3 – 38 nm) between two electrons. Data are obtained from the book written by A. Mourachkine (A. Mourachkine, *Room-Temperature Superconductivity* (Cambridge International Science Publishing, Cambridge, UK, 2004)).

The electron pair coupled with the bosons of Z(0,0) and the koron of Ga(0,0) with the neutrino pair of $\nu_e\overline{\nu_e}, \nu_\mu\overline{\nu_\mu}, or\ \nu_\tau\overline{\nu_\tau}$ as shown in Fig. 39 may be the possible candidate of the electron pair responsible for HTS. Then the possible energy of the Ga(0,0) koron can be calculated by using the equation of E_B(xi-xj) = 9.866 10^{-8}/R with R= 40 nm obtained from the uncertainty principle. The obtained energy of Ga(0,0) is 1.233 eV which comes mostly from the b-boson energy of the Ga(0,0) koron. The calculated size (x) of Ga(0,0) is x=3.893 10^{-20} m from the equation of E_b(xi-xj) = 8.1365 10^{38} x^2 (eV) (x: m). The energy (1.233 eV) of Ga(0,0) is thought to be much larger than the assumed neutrino energy of ~10^{-4} eV because of the added b-boson energy.

Therefore, the high temperature superconductor (HTS) is explained by using the neutrino and antineutrino pair in the present work. The upper limit of the space distance between two electrons needed in order to form the HTS status is taken to be about 40 nm. All HTS superconductors are type II superconductors. So in Fig. 40, number of type II superconductors versus the space distance (coherence length, ξ_0) between two electrons is plotted. The maximum observed ξ_0 of the type II superconductor is 38 nm for Nb. The minimum observed ξ_0 of the type II superconductor is 1.3 nm for $HgBa_2Ca_2Cu_3O_{10}$. Therefore, I propose that all type II superconductors can be explained through the exchanging of the neutrino and antineutrino pair. In order to make the room temperature superconductor in the future, I think that we need the new concept of the electron pair other than the neutrino and antineutrino pair.

17. Space, time and charge symmetries

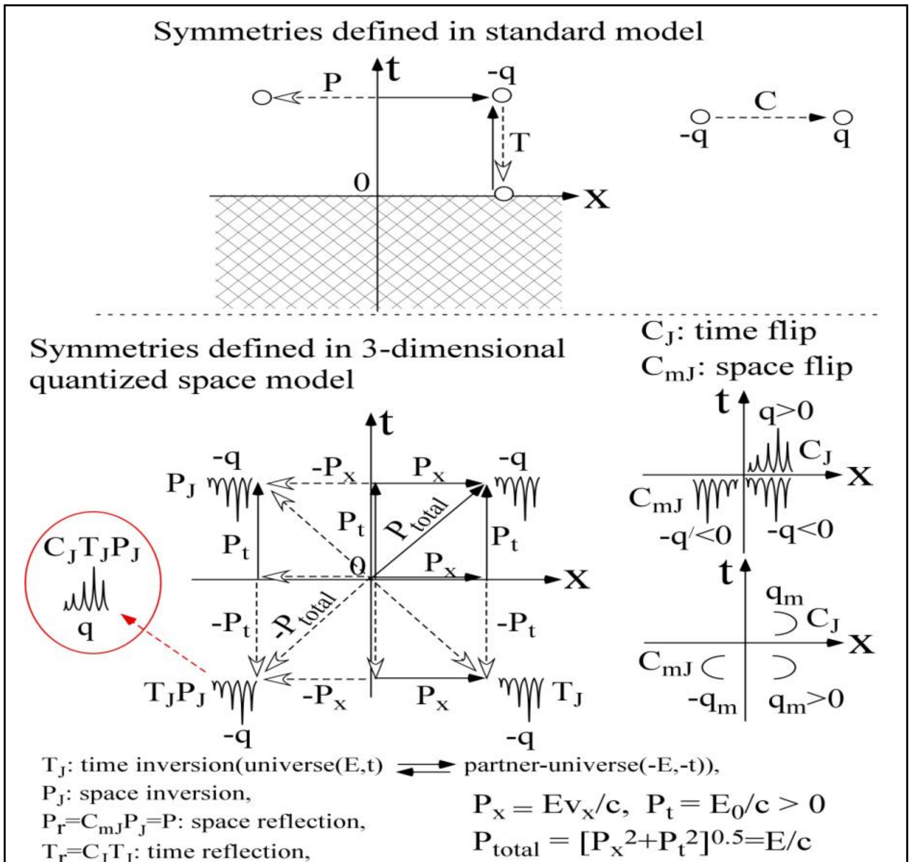


Fig. 41. Space, time and charge symmetries defined in the present work.

There is mathematically the infinite number of n-dimensional quantized spaces because the number (n) of dimensions has the infinite range in Fig. 1. Because we live in the 3-dimensional quantized spaces composed of the x0y0z0, x1x2x3, x4x5x6 and x7x8x9 spaces, I am talking about the 3-dimensional spaces in the present work. The same explanation can be applied to all of other n-dimensional cases. The uncertainty principles are$\Delta t\Delta E_0 \geq \frac{\hbar}{2}$ and $\Delta x\Delta p_x \geq \frac{\hbar}{2}$. Then, a space momentum is p_x and the corresponding time momentum is E_0. The p_x value is positive along the +x axis and negative along the –x axis. The E_0 value is positive along the +t axis and negative along the –t axis. The time momentum has the zero space change and non-zero time change ($\Delta x = 0\ and\ \Delta t \neq 0$) and the space momentum has the non-zero space and non-zero time change ($\Delta x \neq 0\ and\ \Delta t \neq 0$). Therefore, the velocity can be defined only for the space momentum but not for the time momentum. To match the units of the space and time momenta, we need the scale factor of the constant light velocity (c). So the uncertainty principle of $\Delta t \Delta E_0 \geq \frac{\hbar}{2}\ and\ \Delta x \Delta p_x \geq \frac{\hbar}{2}$ can be changed into $\Delta ct \Delta \frac{E_0}{c} \geq \frac{\hbar}{2}\ and\ \Delta x \Delta p_x \geq \frac{\hbar}{2}$ by adding the scale factor of c (light velocity) to match the units of the time (t) and space (x) terms. Then, the corrected time momentum is $P_t=E_0/c$. And the space momentum associated with the velocity of v_x can be defined as $P_x = Ev_x/c^2$. The space momentum (P_x) of the matter is defined as the mv_x and the rest mass (m_0) corresponds to E_0/c^2. Because we are in the positive energy ($E_0>0$) spaces flowing along the +t axis, the rest mass (m_0) is always positive. The zero time momentum corresponds to the zero energy. The zero space momentum corresponds to the zero velocity ($v_x=0$) or zero energy (or zero rest mass). The 3-dimensional quantized spaces have the minimum space quantum with t_q and x_q and the minimum background space fluctuation with t_p and x_p in Fig. 3. The light velocity (c) has been defined as $c = x_q/t_q = x_p/t_p$ in the present work. The photons are originated from the background space fluctuation with the light velocity (c) in Fig. 11.

The x0y0z0 mother space with the infinite energy is the infinite 3-dmensional quantized space with the minimum space quantum of $t_q = \infty\ and\ x_q = \infty$. There are many finite 3-dimensional quantized spaces with the minimum space quantum of $t_q \neq \infty\ and\ x_q \neq \infty$. These finite spaces are within the x0y0z0 mother space and are called as the daughter spaces. The daughter spaces which have the minimum space quantum with the same quantum sizes of $t_q \neq \infty\ and\ x_q \neq \infty$ can be intertwined by the space interactions. These intertwined daughter spaces are called as the x1x2x3, x4x5x6 and x7x8x9 spaces in the present work in order to describe our universes in Fig. 1.

Three symmetries of P, C and T in the physics have been defined in the standard model. These are shown in Fig. 41. In the standard model, the negative time and its associated negative energy are not defined. So only the positive time direction is applied. Then as shown in Fig. 41, the antiparticle and particle are separated by the C (charge conjugate) operator in the standard model. And the TPC symmetry is conserved in the standard model. Now I am introducing the space and time symmetries newly defined in the present 3-dimensional quantized space model. In Fig. 41, the space axis of x stands for three-dimensional x0y0z0 space and the particle (or matter) stands for any one of the x1x2x3, x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 particles (or matters). Four symmetries of P_J, C_J, Cm_J and T_J are introduced and newly defined as shown in Fig. 41. P_J and T_J represent the space and time inversion symmetries, respectively. C_J and C_{mJ} stand for the time and space flips, respectively, as shown in Fig. 41. C_J corresponds to the charge conjugate symmetry (C) even though the definition of the charge is different between present model and standard model. The C_J and C_{mJ} symmetry operators change the signs of the charges and magnetic charges, respectively, as shown in Fig. 41. The particle and antiparticle are connected by the charge symmetry operator or the time flip symmetry operator of C_J. The space reflection symmetry ($P_r = P_JCm_J$) defined in the present model is the same as the space reflection symmetry (P) defined in the standard model. In the present work, the new time inversion symmetry operator (T_J) changes the particle configuration from (E_0/c, t, P_x, -q) in the universe to (-E_0/c, -t, P_x, -q) in the partner universe in Fig. 41. The P_J symmetry operator changes x to –x. The P_J symmetry operator connects two particles with the configurations of (E_0/c, t, P_x, -q) and (E_0/c, t, -P_x, -q). Therefore, the T_JP_J symmetry operator changes the configuration of the particle from (E_0/c, t, P_x, -q) to (-E_0/c, -t, -P_x, -q). Then, the $C_JT_JP_J$ symmetry operator changes the configuration of the particle from (E_0/c, t, P_x, -q) to (-E_0/c, -t, -P_x, q) as shown in Fig. 41. A particle with a configuration of (E_0/c, t, P_x, -q) and its antiparticle with a configuration of (-E_0/c, -t, -P_x, q) can be annihilated to nothing of $\Delta t=0$ and $\Delta x=0$ which means zero energy, zero space momenta and zero charges. Those two particles are defined as partners which can be created from nothing or annihilated to nothing. For example, a particle (or matter) with ($E_0/c>0$, t, P_x, -q) can be totally annihilated with a partner antiparticle or (or partner antimatter) with ($-E_0/c<0$, -t, -P_x, q) to make nothing of $\Delta t=0$ and $\Delta x=0$ which has zero energy, zero space momenta and zero charges. In other words, this is called as the partner relation by the symmetry operator of $C_JT_JP_J$. Our matter universe and its partner antimatter universe can be created from the big bang of the

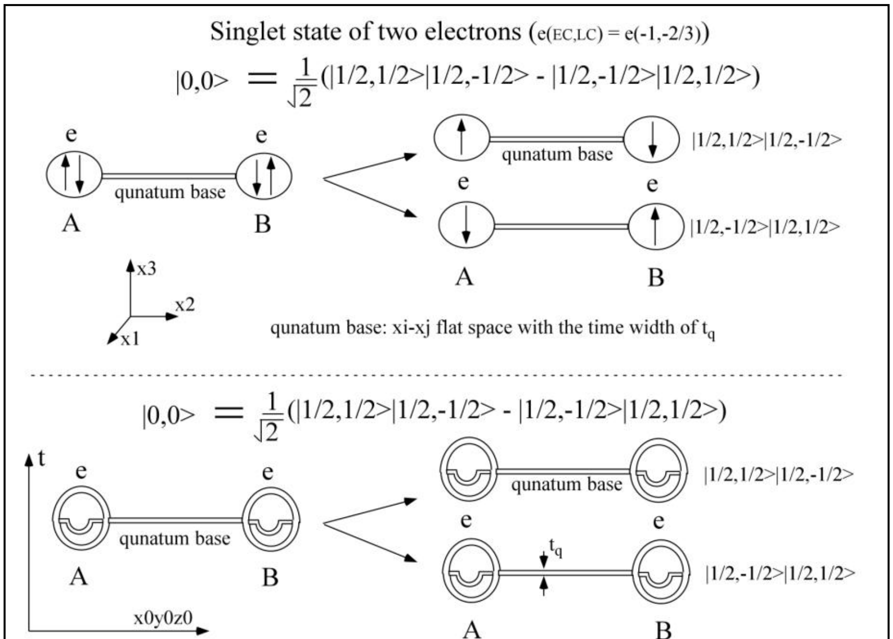


Fig. 42. Example of the quantum entanglement.

matter and its partner antimatter as shown in Figs. 2, 4 and 5. Therefore, the antimatters missing within our x1x2x3 universe full of the matters exist as the partner antimatters within the partner x1x2x3 universe. This partner x1x2x3 universe with the negative energy is full of the partner antimatters. These partner antimatters within the partner x1x2x3 space are the partner antimatters in the viewpoint of the matters within our x1x2x3 space. Note that the time inversion symmetry operator of T_J cannot be applied within the x1x2x3 or x4x5x6 matter universe which has been always fixed to the positive energy and positive time momentum. The time inversion symmetry operator of T_J can be applied to all matters and particles in the viewpoint of the x0y0z0 space which can have both of positive and negative time momenta. But the P_J, C_J and C_{mJ} symmetry operators can be applied locally within the x1x2x3 and x4x5x6 spaces without changing the sign of the energy.

18. Quantum entanglement and quantum wave function collapse

Quantum entanglement has never been explained successfully. In Fig. 42, one example of the quantum entanglement is shown. Two electrons marked as A and B are entangled in the singlet state (|0,0>). If we detect the A electron with the spin up state (|1/2,1/2>), the B electron should have the spin down state (|1/2,-1/2>) regardless of the distance between two electrons. Also, if we detect the A electron with the spin down state (|1/2,-1/2>), the B 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.

The interactions between two elementary fermions are explained by the exchanges of the massive Z/W/Y bosons through the boson bases as shown in section 6. And the gravitational interaction between two elementary fermions is explained by the exchanges of the graviton through the graviton base as shown in section 8. 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 A electron with the spin up state (|1/2,1/2>) is connected to the B electron with the spin down state (|1/2,-1/2>) through the quantum base and the A electron with the spin down state (|1/2,-1/2>) is connected to the B electron with the spin up state (|1/2,1/2>) through the quantum base as shown in Fig. 42. 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 width of the quantum time (t_q). Whenever we detect the A electron with the spin up state (|1/2,1/2>), the B 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 A electron with the spin down state (|1/2,-1/2>), the B 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 (t_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.

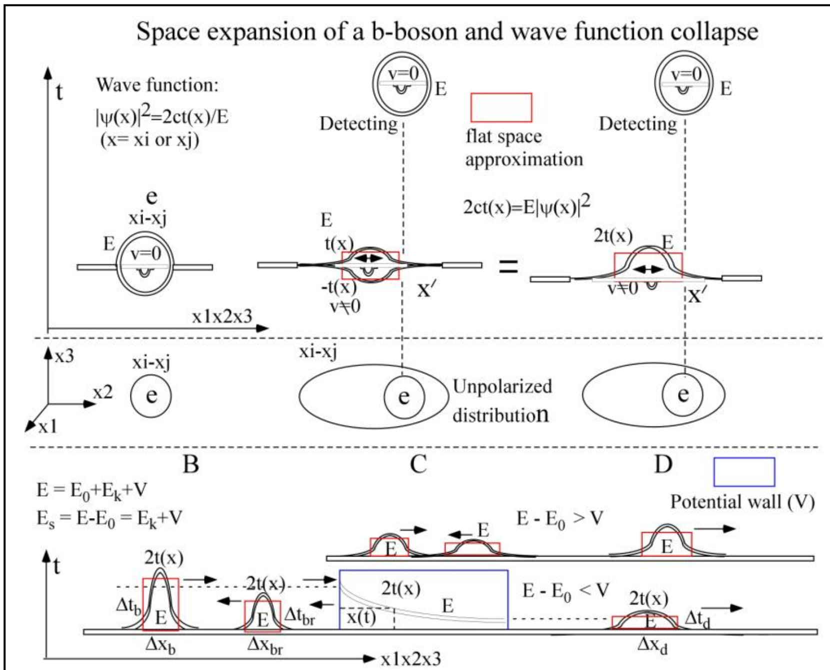


Fig. 43. Quantum wave function collapse and particle tunneling effect through the potential wall are explained by the space expansion of a b-boson (see section 20).

Now I am going to talk about the quantum wave function collapse effect and particle tunneling effect through the potential wall (see section 20.1). The wave function, Ψ(x), of an elementary fermion like an electron is related to the function, t(x), of the space (x). For example, let's assume that the wave function of the electron is expressed as Ψ(x). When we detect the electron at $x=x^{/}$, $|\Psi(x)|^2 = 0$ at $x \neq x^{/}$ and $|\Psi(x)|^2 = 1$ at $x = x^{/}$. This is called as the quantum wave function collapse. This wave function collapse effect has never been explained successfully. In the present work, the quantum wave function collapse is explained by using the space expansion of the b-boson. And the corresponding matter within the b-boson (see Fig. 12) makes the internal vibration ($v \neq 0$) as shown in Fig. 42. The xi-xj matter of the electron (see Fig. 12) with the Planck size is oscillating within the xi-xj b-boson of the electron and the xi-xj b-boson of the electron is usually expanded along the xi axis in the x1x2x3 space and the xj axis in the x4x5x6 space as shown in Fig. 43. In general, the deformed shape ($|\Psi(x)|^2$) of the electron b boson having the non-zero potential energy is obtained by using the Schrodinger equation of the quantum mechanics (see section 20). The space-time shape of this b-boson can be expressed as t(x) and –t(x). Then, 2ct(x)/E corresponds to the quantum wave function, $|\Psi(x)|^2$, for the electron. In the present work, the wave function, $|\Psi(x)|^2$, in the quantum mechanics, is defined to be the same as the 2ct(x)/E as shown in Fig. 43 (see sections 11 and 20.1).

The quantum wave function collapse of an electron is shown as an example in Fig. 43. When the oscillation speed (v) of the xi-xj (or x2-x4) matter is 0 which means the matter detection, an electron has the b boson with the spherical space-time shape. And when the electron b-boson is moving with the velocity v, the space width of the electron b-boson is relativistically expanded and the time width is decreased with the increasing of the electron velocity because the electron energy is conserved (see Figs. 43 and 62). Also, when the electron is detected at $x=x^{/}$, instantly the electron has the xi-xj (or x2-x4) matter with v=0 at $x=x^{/}$. Then the xi-xj (or x2-x4) b-boson becomes the spherical space-time shape at $x=x^{/}$. This quantum wave function collapsing time of an electron is $\Delta t \leq 2r_e/c = 1.6718\ 10^{-25}$ sec which is very short. The electron b boson radius of $r_e = 2.2506\ 10^{-17}$ m is obtained from Table 2. Here x is xi (or x2) or xj (or x4). In order words, detecting an electron at $x=x^{/}$ means stopping the xi-xj matter of an electron at $x=x^{/}$. Therefore, whenever we detect the electron at $x=x^{/}$, $|\Psi(x)|^2 = 0$ at $x \neq x^{/}$ and $|\Psi(x)|^2 = 1$ at $x = x^{/}$. It is the quantum wave function collapse. Therefore, the quantum wave function collapse can be generally explained by the space expansion of the electron b-boson along with the internal vibration ($v \neq 0$) of the corresponding matter within the b-boson (see Fig. 12).

The double slit experiment of an electron can be explained by using the space deformation of the b-boson when an electron gets through the two slits. The only option is that the b-boson should be connected between two slits so that the xi-xj matter of the electron can oscillate within the b-boson. Now the electron tunneling through the potential wall barrier is explained by using the space expansion of the electron b-boson as shown in Fig. 43 and section 20.1. Within the wall the electron cannot exist in the viewpoint of the classical mechanics. But in the viewpoint of the quantum mechanics the electron can exist within the potential wall with the reduced probability density at x obtained from the space expansion of the electron b-boson (see Fig. 52 and section 20.1). After tunneling the potential wall, the electron wave function keeps the expanded space width and reduced time width which means the reduced probability density at x (see Fig. 52 and section 20.1). Also, in Fig. 43, it should be noted that the b-boson shape is additionally expanded into the space direction because of the energy increase by the relativistic effect when the electron is moving with a non-zero velocity (see Fig. 52 and section 20.1). And the interference between two electron wave functions is the interference between two deformed space-time shapes of two electron b-bosons.

19. List of particles, summary and relativistic space and time momenta

19.1. List of particles and summary

In the present work, the x2-x4 one-dimensional particle is defined as the particle with the size of

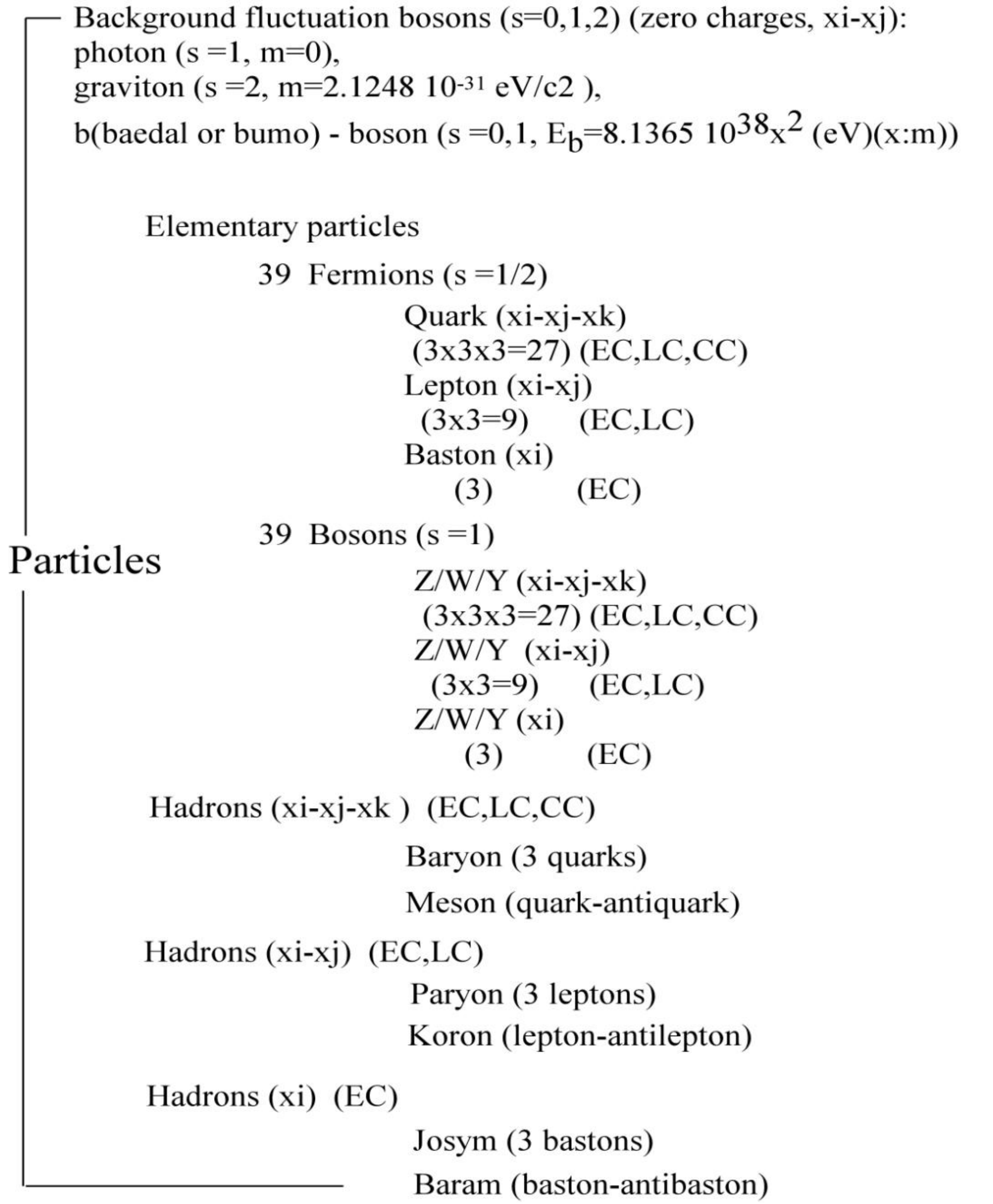


Fig. 44. List of the particles (see Fig. 93 and section 11.2).

$\Delta x2 \geq 2x_p$, $\Delta x4 \geq 2x_p$ and $\Delta x1=\Delta x3=\Delta x5=\Delta x6=x_q$. And the x1x2x3-x4x5x6 three-dimensional particle is defined as the particle with the size of $\Delta x1 \geq 2x_p$, $\Delta x2 \geq 2x_p$, $\Delta x3 \geq 2x_p$, $\Delta x4 \geq 2x_p$, $\Delta x5 \geq 2x_p$ and $\Delta x6 \geq 2x_p$ (see Figs. 10-14 and Table 3). Here x_p and x_q are the Planck length and quantum length, respectively, in Fig. 3. And the x2 one-dimensional particle is defined as the particle with the size of $\Delta x2 \geq 2x_p$ and $\Delta x1=\Delta x3=x_q$. It is shown that the quantum length (x_q) and the quantum time (t_q) of our universes are $2x_p^2$ = 5.223 10^{-70} m and x_q/c = 1.7422 10^{-78} s, respectively, which give the present masses of the elementary particles. Different quantum time will give the different masses of the elementary particles (see section 15).

Generally speaking, the elementary particles in Fig. 12, Planck length and quantum length are closely connected to each other. Actually the x1x2x3 universe can have any size of the quantum time. So the x1x2x3 universe can have any size of the quantum length. Here, $x_q = ct_q$. Once the quantum time is set in any x1x2x3 universe, the Planck length is set in the x1x2x3 universe and the following daughter universes. Then, the energies of the elementary particles are dependent on the sizes of the quantum time and Planck length and the energies of the b-bosons.

Because our universes have the present quantum time (t_q) of 1.7422 10^{-78} s, the elementary particles have the present energies or masses. For other universes with the quantum time different from the quantum time in our universes, the elementary particles in other universes should have the energies or masses different from the energies or masses that the present elementary particles seen in our universes have. The elementary particles are shown in Fig. 12. It means that the matters seen in the other universes should be different from those seen in our universes in the masses. The matters consisting of the elementary particles are including the animals and humans. The particles are listed in Fig. 44.

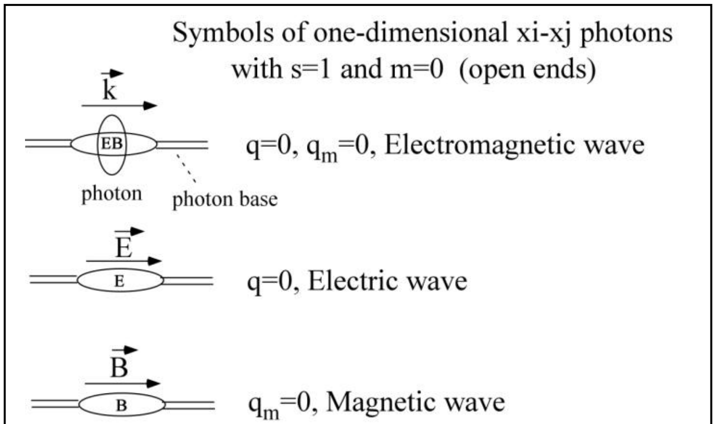


Fig. 45. Symbols of one-dimensional xi-xj photons with s = 1 and m (rest mass) =0. The same symbols can be used for the xi and xi-xj-xk photons. See Figs. 21 and 24.

The background fluctuation quantum is called as the b-boson (Baedal (Bumo) boson) in Fig. 44. New compound nuclei made up of two and three leptons are listed as the paryon and koron, respectively, in Fig. 44 and the magnetic paryon and magnetic koron can be defined in the same way. New compound nuclei of the paryons and korons can be seen in the x0y0z0 space like the bastons. Therefore, this can be called as the bastonization or hadronization. Also, the paryons and korons can be seen in x1x2x3 space because these have the EC and LC charges. First koron called as a Ga(0,0) is proposed to explain the Cooper pair in the high temperature superconductor. The search for the paryons and korons are needed for the further study. New compound nuclei made up of two and three bastons are listed as the josym and baram, respectively, in Fig. 44.

New compound nuclei of the josyms and barams can be seen in the x0y0z0 space like the bastons. And the relation of the W/Z bosons with the mesons and leptons is shown in Table 9. The mass of a $d\bar{d}$ meson in Table 9 is expected to be 144.1 MeV/c^2 from Fig. 28 and Table 8. It would be interesting to search for this meson, experimentally.

Also, several examples of the particle decay schemes using the new charge system proposed in the present work are shown. And it is shown that the quantum mechanics and special relativity theory are closely connected to each other. The observable minimum excitation energy of the x1x2x3 space is caused by the x1x2x3 Planck size b-boson with the energy of E_p(x1x2x3) = 3E_p(xi) = E_p(x1x2x3-x4x5x6)/2 = 3.1872 10^{-31} eV. Also, symbols of one-dimensional xi-xj photons with s = 1 and m (rest mass) = 0 are shown in Fig. 45.

All gravitons including the one-dimensional gravitons of g(xi-xj-xk) = g(0,0,0) and the three-dimensional gravitons of g(x1x2x3-x4x5x6-x7x8x9) = g(0,0,0) have the zero EC, LC and CC charges along all space axes. It indicates that the gravitons can be exchanged between two matters with the diffrent dimensions. Because of this property of the graviton, all matters have

Table 9. Relations between W/Z(EC,LC) bosons and mesons/leptons(EC,LC).

W and Z	Quarks(Mesons)	Leptons
W(-1, -2)	$b\bar{u}(B^-)$	$\tau\bar{\nu}_e$
W(-1, -1)	$s\bar{u}(K^-), b\bar{c}(B_c^-)$	$\mu\bar{\nu}_e, \tau\bar{\nu}_\mu$
W(-1, 0)	$d\bar{u}(\pi^-), s\bar{c}(D_s^-), b\bar{t}$	$e\bar{\nu}_e, \mu\bar{\nu}_\mu, \tau\bar{\nu}_\tau$
Z(0, -2)	$b\bar{d}(\bar{B}^0), t\bar{u}$	$\nu_\tau\bar{\nu}_e$, τe^+
Z(0, -1)	$s\bar{d}(\bar{K}^0), c\bar{u}(D^0), b\bar{s}(\bar{B}_s^0), t\bar{c}$	$\mu e^+, \tau\mu^+, \nu_\mu\bar{\nu}_e, \nu_\tau\bar{\nu}_\mu$
Z(0, 0)	$u\bar{u}(\pi^0), d\bar{d}, c\bar{c}, s\bar{s}, b\bar{b}$	$\nu_\tau\bar{\nu}_\tau, \nu_e\bar{\nu}_e, \nu_\mu\bar{\nu}_\mu,$ $ee^+, \mu\mu^+, \tau\tau^+$
W(-1, 1)	$d\bar{c}(D^-),\ s\bar{t}$	$e\overline{\nu_\mu},\ \mu\overline{\nu_\tau}$
W(-1, 2)	$d\bar{t}$	$e\overline{\nu_\tau}$

the gravitional effects on other dimensional matters by exchanging the gravitons. Unlike the graviton, photons including the one-dimensional photons of γ(xi) = γ(0), γ(xi-xj) = γ(0,0) and γ(xi-xj-xk) = γ(0,0,0) and the three-dimensional photons of γ(x1x2x3) = γ(0), γ(x1x2x3-x4x5x6) = γ(0,0) and γ(x1x2x3-x4x5x6-x7x8x9) = γ(0,0,0) have the non-zero +q and –q charges which vibrate along the space axes even though the toal charges are zero as shown Figs. 11, 21, 22 and 24. Space dimension of the photon is the space dimension of the +q and –q charges. Because of the non-zero +q and –q charge fluctuation along the space axis, the photon has the dependence on the space dimensions. This means that all photons cannot be transformed to other dimensional photons. It indicates that the photons cannot be exchanged between two matters with the diffrent dimensions. Because of this property of the photon, all matters do not have the EC, LC and CC charge interaction effects on other dimensional matters. The EC, LC and CC charge interactions can be carried out by exchaging the photons between two matters with the same dimensions. Here the matter includes the particles. See section 8. Also, the space, time and charge symmetry operators are newly defined (see section 17).

The possible normal matters and dark matters are lsted in Fig. 46. The photons responsible for the electromagnetic charge interactions are shown in Fig. 46. In the same three-dimensional quantized space, the photons for the charge interactions of the normal matters are different from those for the charge interactions of the dark matters as shown in Fig. 46 and section 13. For

Normal and dark particles (matters) in each space

	x0y0z0	x1x2x3(our space)	x4x5x6	x7x8x9
Normal matters	baston, josym, baram, paryon(EC) koron(EC)	lepton, paryon, koron, baryon(EC,LC) meson(EC,LC)	quark, baryon meson	No normal matters
Photons	γ(0)	γ(0,0)	γ(0,0,0)	
Graviton	g(0)	g(0,0)	g(0,0,0)	
Dark matters		baston, josym, baram	lepton, paryon, koron	quark, baryon meson
Photons		γ(0)	γ(0,0)	γ(0,0,0)
Graviton		g(0)	g(0,0)	g(0,0,0)

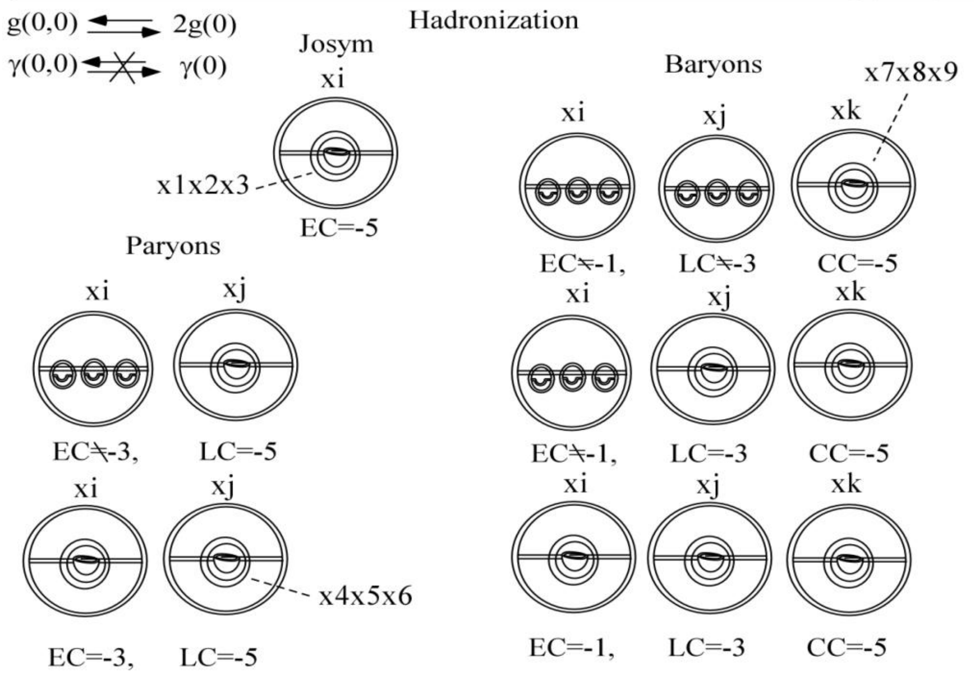


Fig. 46. Normal and dark matters (see Figs. 13, 91, 93 sections 7 and 13). The baryon(EC) and meson(EC) can be added as the normal matters in x0y0z0 space. (see Fig. 93)

example, the dark matters in the x1x2x3 space are bastons connected to the γ(0) photon and the normal matters in the x1x2x3 space are leptons, baryons and mesons connected to the γ(0,0) photon. And the dark matters in the x4x5x6 space are leptons connected to the γ(0,0) photon and the normal matters in the x4x5x6 space are quarks connected to the γ(0,0,0) photon. And the hadrons of josyms, paryons and baryons are shown in Figs. 46 and 43. The x4x5x6 spaces are expected mostly in and around the x1x2x3-x4x5x6 black holes. But it is thought that the x4x5x6 spaces are very rare within our universes. The black holes are distributed evenly in all directions. It is thought that most black holes are the x1x2x3 balck holes and small number of the x1x2x3-x4x5x6 balck holes exist. But the x1x2x3-x4x5x6-x7x8x9 black holes would be very rare. Also, some of galaxies have bigger ratios of bastons (dark matters) to the leptons and hadrons (normal matters) than other galaxies. The photons (γ(0) emitted from the bastons cannot be observed but the photons (γ(0,0)) emitted from the leptons and hadrons can be observed, for example, as the cosmic microwave background radiation. Therefore, if the galaxy clusters with the much larger ratios of dark matters to normal matters exist, the areas of those galaxy clusters may be observed as the super void or the cooler spot in the cosmic microwave background radiation map. These galaxies with the larger ratios of the dark matters to normal matters can be called as the dark matter galaxies and the galaxies like our milky way galaxy with the smaller ratios of the dark matters to normal matters can be called as the normal matter galaxies. And the very high energy cosmic rays and high energy x-rays observed by us at the earth in the x1x2x3 universe may be originated by the normal matters like the leptons and hadrons including protons produced around the black holes which are located at the center of the galaxy. The mixed matter galaxies between the dark matter galaxies and normal matter galaxies can explain the so called dying galaxies without the normal matter clouds and the normal matter galaxies can explain the so called active galaxies with the normal matter clouds. And the quantum entanglement is explained by using the quantum base. The quantum wave function collapse is explained by the space expansion of the b-boson caused by the internal vibration ($v \neq 0$) of the corresponding matter within the b-boson (see Fig. 12).

The baryons with CC=-5 and LC=-3 are described and can be called as the hadronization in Figs. 44 and 46 (see Fig. 93). This baryon can be described as the charge configuration of (EC). Also, the baryons with CC=-5, LC=-3 and EC=-1 are described in Fig. 46. This baryon can be desribed as the combination of the x1x2x3-x4x5x6-x7x8x9 particle and the xi-xj-xk b-boson. Here, x1x2x3-x4x5x6-x7x8x9 particle is within the xi-xj-xk b-boson. The paryons with LC=-5 and EC=-3 are described in Fig. 46 (see Fig. 93). This paryon can be desribed as the combination of the x1x2x3-x4x5x6 particle and the xi-xj b-boson. Here, x1x2x3-x4x5x6 particle is within the xi-xj b-boson. And the josyms with EC=-5 are described in Fig. 44. This josym can be desribed as the combination of the x1x2x3 particle and the xi b-boson (see Fig. 93). Here, x1x2x3 particle is within the xi b-boson. A baryon with color charge of -5 should decay to another baryon with color charge of -5 because of the color charge conservation. It is the reson why the free proton is stable because there is no baryon with CC=-5 with the rest mass smaller than the proton.

All of particles in Fig. 44 were created from the expansions of the black holes in the early universe as shown in Fig. 25. And the particle and antiparticle pairs were created by the pair creations from the photons in the early universe. These particles and antiparticles created by the pair creations from the photons in the early universe were annihilated into the photons in the early universe. Therefore, only the particles created from the expansions of the black holes in the early universe have been present until the present time. At the present time, the stable black holes are located at the center of the galaxy. It is expected that some particles are created and some particles are annihilated around these stable black holes. If any xi, xi-xj or xi-xj-xk particle is attracted by the gravitional force into the black hole, the xi, xi-xj or xi-xj-xk b-boson of this particle will be destroyed first near the black hole and the remaining xi, xi-xj or xi-xj-xk matter of this particle will be absorbed into the space of the black hole. This is the reverse process of the particle creation made from the black hole as shown in Fig. 25. Therefore, if we are gravitationally attracted into the stable x1x2x3 or x1x2x3-x4x5x6 black holes, all xi-xj and xi-xj-xk b-bosons of our body will be destroyed and all remaining xi-xj and xi-xj-xk matters of our body will be absorbed into the space of the black holes. Therefore, nothing will be left from our body.

The leptons (Le,Lμ,Lτ) with EC=-2 and the quarks (M1,M2,M3) with EC=-4/3 have never been observed so far because those leptons and quarks might be very heavy with the energies of the TeV scale or might be produced by the very rare decays. The elementary fermions and bosons are observable because those particles have the observable space lengths larger than the Planck length and observable time widths larger than the Planck time. The boson bases and quantum bases are not observable because those bases have the unobservable time widths of the quantum time smaller than the Planck time even though those bases have the observable space lengths larger than the Planck length. The presence of those bases is indirectly proposed through the observable interactions on the elementary fermions and bosons. Also, many particle decay modes published by particle data group need to be reviewed and modified a little bit, if needed, by

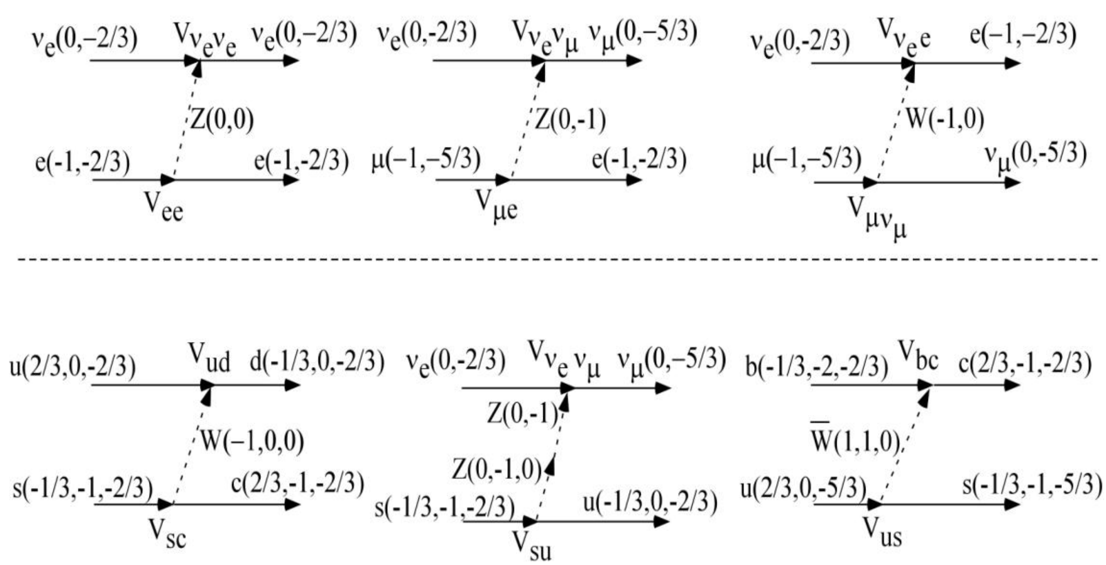


Fig. 47. Several examples of the particle interactions. Symbols of V_{lilj} and V_{qiqj} stand for the matrix elements of the lepton interactions and quark interactions, respectively. See Figs. 30-34 and pages 91 and 127 for more examples.

adding or subtracting the particles like photons, leptons and mesons in order to complete the particle decay modes from the three charge conservations of the electric (EC), lepton (LC) and color (CC) charges. I think that it is an important project for the particle physics. In Fig. 47, several examples of the particle interactions are shown. The EC, LC and CC flavors of the particles and antiparticles can be changed by these kinds of the particle interactions. In Fig. 47, of V_{lilj} and V_{qiqj} stand for the matrix elements of the lepton interactions and quark interactions, respectively. More examples can be seen in Figs. 30-34. I think that the experimental data like the solar neutrino problem and the CP violation of the K meson can be explained by these kinds of the particle interactions. Therefore, the lepton and quark oscillations or mixing might not be the right intepretation. The 45 P_{lilj} interaction probabilties are possible for the leptons under the symmetry of $P_{lilj} = P_{ljli}$ and the 388 P_{qiqj} interaction probabilities are possibe for the quarks under the symmetry of $P_{qiqj} = P_{qjqi}$. These probabilities could be calculated in terms of the standard model. The CKM quark mixing matrix elements of V_{ij} can be still useful for the calculations of the corresponding P_{qiqj} interaction probabilities in terms of the standard model. Also, the PMNS lepton mixing matrix elements of U_{ij} can be still useful for the calculations of the corresponding P_{lilj} interaction probabilities in terms of the standard model.

19.2. Relativistic space and time momenta

The time momentum and space momenta of the positive energy x1x2x3 matter moving within the x0y0z0 mother universe are explained in Fig. 48. A pair of the positive and negative energy x1x2x3 spaces produced from the nothing with the zero energy is shown. The energy (E>0) of the x1x2x3 matter is defined as the x1x2x3ct four-dimensional volume (V_4(x1x2x3ct)) which

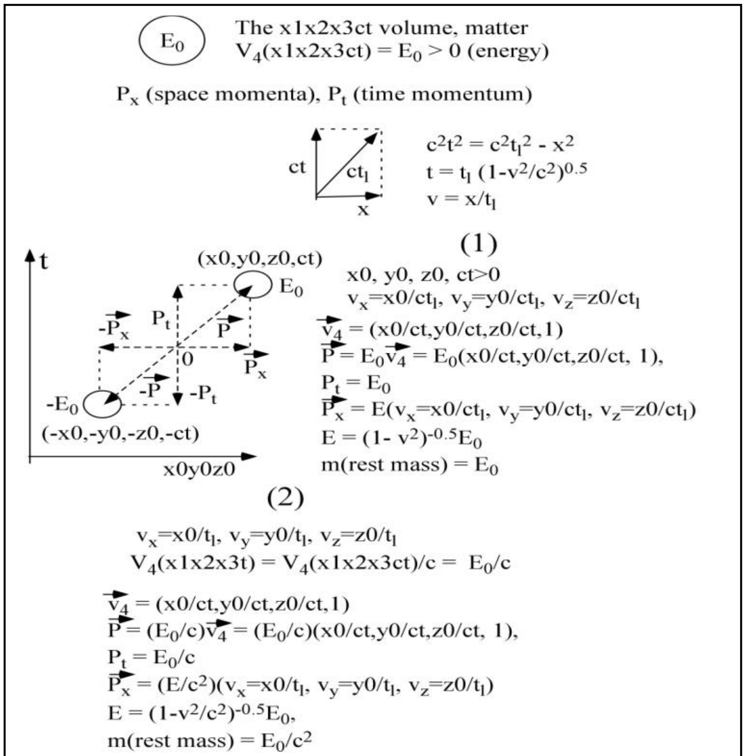


Fig. 48. Space and time momenta for the x1x2x3 matter with the positive energy. A pair of the positive and negative energy x1x2x3 spaces produced from the nothing with zero energy is shown. See Figs. 19, 23, 50 and 63, too.

corresponds to the rest energy or rest mass. First, see the definition (1) in Fig. 48. The observable velocities are defined as $v_x = x0/ct_l$, $v_y=y0/ct_l$ and $v_z=z0/ct_l$. The four-dimensional velocity is defined as $\overrightarrow{v_4} = \left(\frac{x0}{ct}, \frac{y0}{ct}, \frac{z0}{ct}, 1\right) = \left(\frac{x0}{ct_l}\frac{1}{\sqrt{1-v^2}}, \frac{y0}{ct_l}\frac{1}{\sqrt{1-v^2}}, \frac{z0}{ct_l}\frac{1}{\sqrt{1-v^2}}, 1\right)$. Then the space and time momenta are expressed as $\overrightarrow{P_x} = \frac{E_0}{\sqrt{1-v^2}}(v_x, v_y, v_z) = E(v_x, v_y, v_z)\ and\ P_t = E_0$, respectively.

Then the rest mass (m(rest mass)=m_0) is E_0. Therefore, the particle energy is increased from E_0 to $E = \frac{E_0}{\sqrt{1-v^2}}$. This effect is called as the relativistic effect as shown in Figs. 19 and 23.

Now I will discuss the definition (2) in Fig. 48. When the observable velocities are defined as $v_x = x0/t_l$, $v_y=y0/t_l$ and $v_z=z0/t_l$ (see Fig. 63), the four-dimensional velocity is defined as $\overrightarrow{v_4} = \left(\frac{x0}{ct}, \frac{y0}{ct}, \frac{z0}{ct}, 1\right) = \left(\frac{x0}{ct_l}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}, \frac{y0}{ct_l}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}, \frac{z0}{ct_l}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}, 1\right)$. Then the space and time momenta are expressed as $\overrightarrow{P_x} = \frac{E_0}{c^2\sqrt{1-\frac{v^2}{c^2}}}\left(v_x, v_y, v_z\right) = \frac{E}{c^2}\left(v_x, v_y, v_z\right)$ *and* $P_t = \frac{E_0}{c}$, respectively. Then the rest mass (m(rest mass)=m_0) is E_0/c^2. Therefore, the particle energy is increased from E_0 to $E = \frac{E_0}{\sqrt{1-\frac{v^2}{c^2}}}$. This effect is called as the relativistic effect as shown in Figs. 19 and 23. In other words, when the matter with the positive energy is moving with the velocity, v, the space momentum is

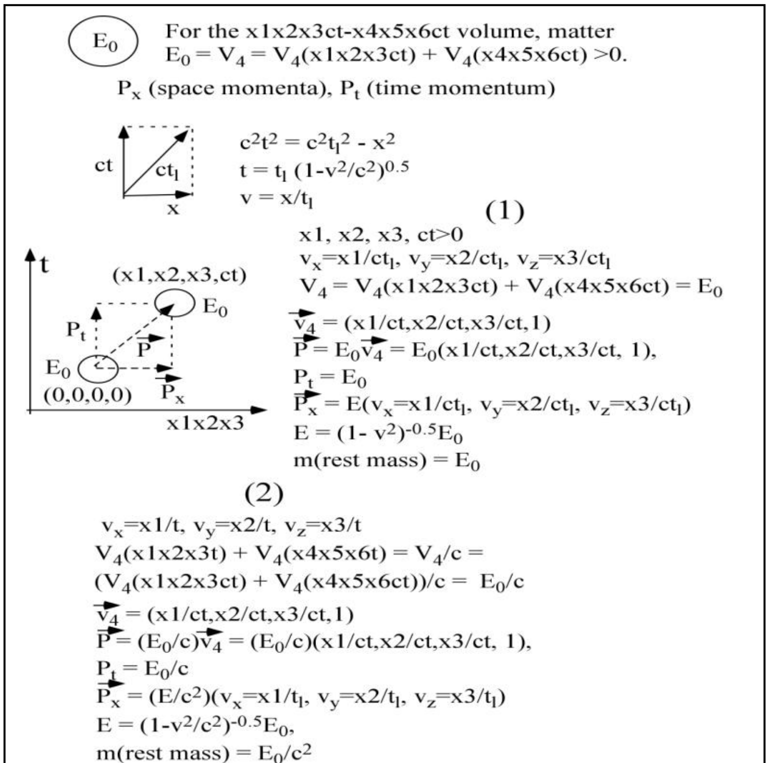


Fig. 49. Space and time momenta for the x1x2x3-x4x5x6 matter with the positive energy. See Figs. 19 and 23, too.

$P_x = Ev/c^2$ (see Figs. 48-51). Then, $E = (1-v^2/c^2)^{-0.5}E_0 \approx E_0\,(1+ v^2/(2c^2)+ 3v^4/(8c^4)) \approx E_0 + m_0v^2/2 = E_0 + E_k$ (see Fig. 53). Here, E_k is the kinetic energy of $p_x^2/(2m_0)$ where p_x is m_0v. The definition (2) can be used for the space and time momenta of not only the matter with the positive energy but also the antimatter with the positive energy. The same discussions can be applied for the xi (anti)particles like the (anti)bastons with the positive energy. See Figs. 19 and 23, too.

The discussions made for the x1x2x3 matter with the positive energy in Fig. 48 can be equally applied for the x1x2x3-x4x5x6 matter with the positive energy (E>0) as shown in Fig. 49. It is assumed that in Fig. 49, the x1x2x3-x4x5x6 matter is seen on the x1x2x3 space. The energy (E_0) of the x1x2x3-x4x5x6 matter is defined as the x1x2x3ct-x4x5x6ct four-dimensional volume ($V_4 = V_4(x1x2x3ct) + V_4(x4x5x6ct)$) which corresponds to the rest energy or rest mass. First, see the definition (1) in Fig. 49. The observable velocities (see Fig. 63) are defined as $v_x = x1/ct_l$, $v_y=x2/ct_l$ and $v_z=x3/ct_l$. The four-dimensional velocity is defined as $\overrightarrow{v_4} = \left(\frac{x1}{ct}, \frac{x2}{ct}, \frac{x3}{ct}, 1\right) = \left(\frac{x1}{ct_l}\frac{1}{\sqrt{1-v^2}}, \frac{x2}{ct_l}\frac{1}{\sqrt{1-v^2}}, \frac{x3}{ct_l}\frac{1}{\sqrt{1-v^2}}, 1\right)$. Then the space and time momenta are expressed as $\overrightarrow{P_x} = \frac{E_0}{\sqrt{1-v^2}}\left(v_x, v_y, v_z\right) = E\left(v_x, v_y, v_z\right)\ and\ P_t = E_0$, respectively. Then the rest mass (m(rest mass)=m_0) is E_0. Therefore, the particle energy is increased from E_0 to $E = \frac{E_0}{\sqrt{1-v^2}}$. This effect is called as the relativistic effect as shown in Figs. 19 and 23.

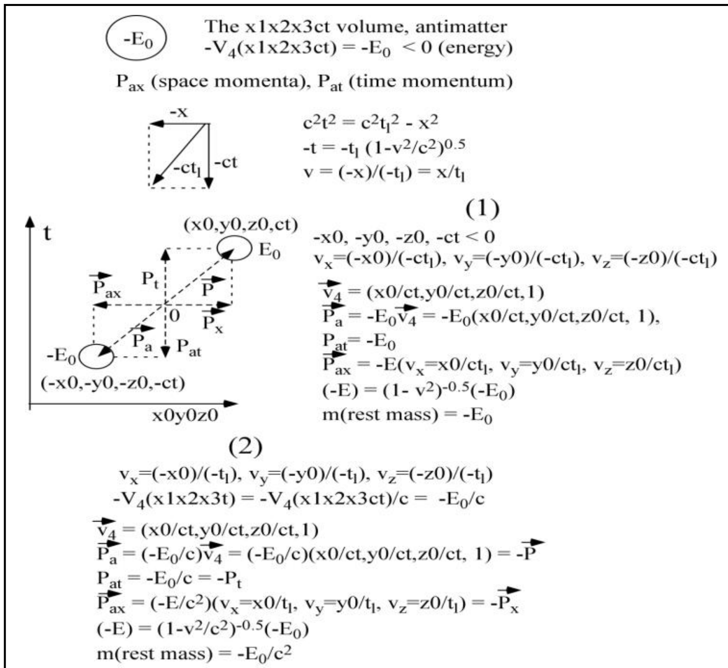


Fig. 50. Space and time momenta for the x1x2x3 antimatter with the negative energy. A pair of the positive and negative energy x1x2x3 spaces produced from the nothing with zero energy is shown. See Figs. 19 and 23.

Now I will discuss the definition (2) in Fig. 49. When the observable velocities (see Fig. 63) are defined as $v_x = x1/t_l$, $v_y=x2/t_l$ and $v_z=x3/t_l$, the four-dimensional velocity is defined as $\overrightarrow{v_4} = \left(\frac{x1}{ct}, \frac{x2}{ct}, \frac{x3}{ct}, 1\right) = \left(\frac{x1}{ct_l}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}, \frac{x2}{ct_l}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}, \frac{x3}{ct_l}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}, 1\right)$. Then the space and time momenta are expressed as $\overrightarrow{P_x} = \frac{E_0}{c^2\sqrt{1-\frac{v^2}{c^2}}}\left(v_x, v_y, v_z\right) = \frac{E}{c^2}\left(v_x, v_y, v_z\right)\ and\ P_t = \frac{E_0}{c}$, respectively. Then the rest mass (m(rest mass)=m_0) is E_0/c^2. Therefore, the particle energy is increased from E_0 to $E = \frac{E_0}{\sqrt{1-\frac{v}{c^2}^2}}$. This effect is called as the relativistic effect as shown in Figs. 19 and 23. In other words, when the matter with the positive energy is moving with the velocity, v, the space momentum is $P_x =$ Ev/c^2 (see Figs. 48-51). Then, $E = (1-v^2/c^2)^{-0.5}E_0 \approx E_0\,(1+ v^2/(2c^2)+ 3v^4/(8c^4)) \approx E_0 + m_0v^2/2 = E_0 + E_k$ (see Fig. 53). Here, E_k is the kinetic energy of $p_x^2/(2m_0)$ where p_x is m_0v. The definition (2) can be used for the space and time momenta of not only the matter with the positive energy but also the antimatter with the positive energy. We can use two definitions (1) and (2) in 49 for both of the antimatter and the matter with the positive energy because we are on the x1x2x3 space. The same discussions can be applied for the xi-xj (anti)particles like the (anti)leptons and the xi-xj-xk (anti)particles like the (anti)quarks, (anti)baryons and (anti)mesons with the positive energy moving with the velocity of v on the x1x2x3 flat space. See Figs. 19 and 23, too.

The time momentum and space momenta of the negative energy x1x2x3 antimatter moving within the x0y0z0 mother universe are explained in Fig. 50. A pair of the positive and negative energy x1x2x3 spaces produced from the nothing with the zero energy is shown. The energy ($-E_0<0$) of the x1x2x3 antimatter is defined as the x1x2x3ct four-dimensional volume ($-V_4$(x1x2x3ct)) = $-E_0$ which corresponds to the rest energy or rest mass. First, see the definition (1) in Fig. 50. When the observable velocities (see Fig. 63) are defined as $v_x = (-x0)/(-ct_l)$, $v_y=(-y0)/(-ct_l)$ and $v_z=(-z0)/(-ct_l)$, the four-dimensional velocity is defined as $\overrightarrow{v_4} = \left(\frac{x0}{ct}, \frac{y0}{ct}, \frac{z0}{ct}, 1\right) = \left(\frac{x0}{ct_l}\frac{1}{\sqrt{1-v^2}}, \frac{y0}{ct_l}\frac{1}{\sqrt{1-v^2}}, \frac{z0}{ct_l}\frac{1}{\sqrt{1-v^2}}, 1\right)$. Here a stand for the antimatter with the negative energy. Then the space and time momenta are expressed as $\overrightarrow{P_{ax}} = \frac{-E_0}{\sqrt{1-v^2}}\left(v_x, v_y, v_z\right) = -E\left(v_x, v_y, v_z\right) = -\overrightarrow{P_x}\ and\ P_{at} = -E_0 = -P_t$, respectively. Then the rest mass (m(rest mass)=m_0) is $-E_0$. Therefore, the particle energy is increased from $-E_0$ to $-E = \frac{-E_0}{\sqrt{1-v^2}}$. This effect is called as the relativistic effect as shown in Figs. 19 and 23.

Now I will discuss the definition (2) in Fig. 50. When the observable velocities (see Fig. 63) are defined as $v_x = (-x0)/(-t_l)$, $v_y=(-y0)/(-t_l)$ and $v_z=(-z0)/(-t_l)$, the four-dimensional velocity is defined as $\overrightarrow{v_4} = \left(\frac{x0}{ct}, \frac{y0}{ct}, \frac{z0}{ct}, 1\right) = \left(\frac{x0}{ct_l}\frac{1}{\sqrt{1-\frac{v}{c^2}^2}}, \frac{y0}{ct_l}\frac{1}{\sqrt{1-\frac{v}{c^2}^2}}, \frac{z0}{ct_l}\frac{1}{\sqrt{1-\frac{v}{c^2}^2}}, 1\right)$. Then the space and time momenta are expressed as $\overrightarrow{P_{ax}} = \frac{-E_0}{c^2\sqrt{1-\frac{v}{c^2}^2}}\left(v_x, v_y, v_z\right) = \frac{-E}{c^2}\left(v_x, v_y, v_z\right)\ and\ P_{at} = \frac{-E_0}{c}$, respectively. Then the rest mass (m(rest mass)=m_0) is $-E_0/c^2$. Therefore, the particle energy is increased from $-E_0$ to $-E = \frac{-E_0}{\sqrt{1-\frac{v}{c^2}^2}}$. This effect is called as the relativistic effect as shown in Figs. 19 and 23. The definition (2) can be used for the space and time momenta of not only the antimatter with the negative energy but also the matter with the negative energy. The same discussions can be applied for the xi (anti)particles like the (anti)bastons with the negative energy.

The discussions made for the x1x2x3 antimatter with the negative energy in Fig. 50 can be equally applied for the x1x2x3-x4x5x6 antimatter with the negative energy (-E < 0) as shown in Fig. 51. One difference is that in Fig. 51, the x1x2x3-x4x5x6 antimatter is seen on the x1x2x3 space. The energy ($-E_0$) of the x1x2x3-x4x5x6 matter is defined as the x1x2x3ct-x4x5x6ct four-dimensional volume ($-V_4 = -V_4$(x1x2x3ct) - V_4(x4x5x6ct) = $-E_0$) which corresponds to the rest energy or rest mass. First, see the definition (1) in Fig. 51. The observable velocities (see Fig. 63) are defined as $v_x = (-x1)/(-ct_l)$, $v_y=(-x2)/(-ct_l)$ and $v_z=(-x3)/(-ct_l)$. The four-dimensional velocity is defined as $\overrightarrow{v_4} = \left(\frac{x1}{ct}, \frac{x2}{ct}, \frac{x3}{ct}, 1\right) = \left(\frac{x1}{ct_l}\frac{1}{\sqrt{1-v^2}}, \frac{x2}{ct_l}\frac{1}{\sqrt{1-v^2}}, \frac{x3}{ct_l}\frac{1}{\sqrt{1-v^2}}, 1\right)$. Then the space and time momenta are expressed as $\overrightarrow{P_{ax}} = \frac{-E_0}{\sqrt{1-v^2}}(v_x, v_y, v_z) = -E(v_x, v_y, v_z)\ and\ P_{at} = -E_0$, respectively. Then the rest mass (m(rest mass)=m_0) is $-E_0$. Therefore, the particle energy is

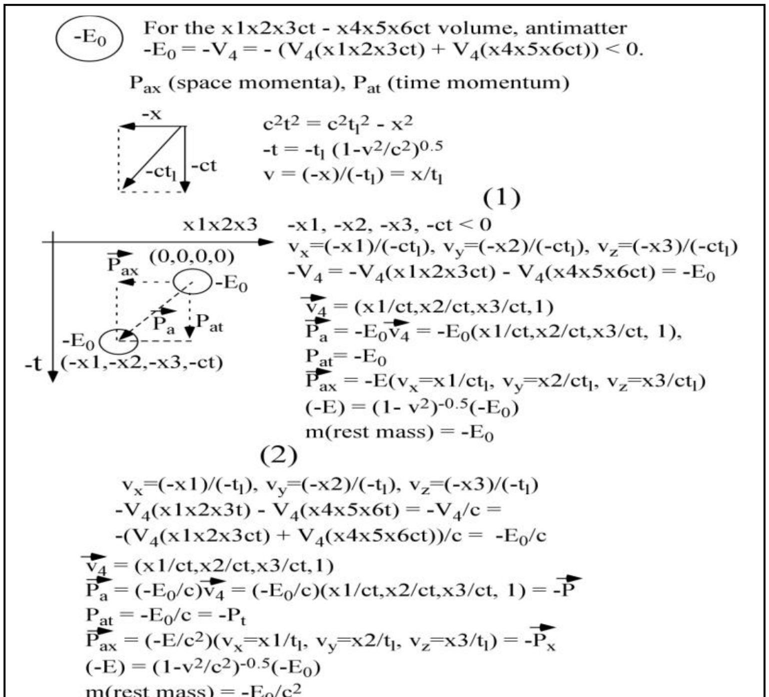


Fig. 51. Space and time momenta for the x1x2x3-x4x5x6 antimatter with the negative energy. See Figs. 19 and 23.

increased from $-E_0$ to $-E = \frac{-E_0}{\sqrt{1-v^2}}$. This effect is called as the relativistic effect as shown in Figs. 19 and 23.

Now I will discuss the definition (2) in Fig. 51. When the observable velocities (see Fig. 63) are defined as $v_x = (-x1)/(-t_l)$, $v_y=(-x2)/(-t_l)$ and $v_z=(-x3)/(-t_l)$, the four-dimensional velocity is defined as $\overrightarrow{v_4} = \left(\frac{x1}{ct}, \frac{x2}{ct}, \frac{x3}{ct}, 1\right) = \left(\frac{x1}{ct_l}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}, \frac{x2}{ct_l}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}, \frac{x3}{ct_l}\frac{1}{\sqrt{1-\frac{v^2}{c^2}}}, 1\right)$. Then the space and time momenta are expressed as $\overrightarrow{P_{ax}} = \frac{-E_0}{c^2\sqrt{1-\frac{v^2}{c^2}}}(v_x, v_y, v_z) = \frac{-E}{c^2}(v_x, v_y, v_z)\ and\ P_{at} = \frac{-E_0}{c}$, respectively. Then the rest mass (m(rest mass)=m_0) is $-E_0/c^2$. Therefore, the particle energy is increased from -E_0 to $-E = \frac{-E_0}{\sqrt{1-\frac{v^2}{c^2}}}$. This effect is called as the relativistic effect as shown in Figs. 19 and 23. The definition (2) can be used for the space and time momenta of not only the antimatter with the negative energy but also the matter with the negative energy. The same discussions can be applied for the xi (anti)particles like the (anti)bastons with the negative energy. We can use two definitions (1) and (2) in Fig. 51 for the xi-xj (anti)particles like the (anti)leptons and the xi-xj-xk (anti)particles like the (anti)quarks, (anti)baryons and (anti)mesons with the negative energy moving on the x1x2x3 flat space. See Figs. 19 and 23, too.

Our universe is the matter universe and time is flowing to the +t direction because the matter has the positive energy. This means that our universe belongs to the universe with the positive time momentum (positive energy) of $P_t = E_0/c$ and negative electric charge (matter) of $-q<0$. In this case, the space momentum of $P_x = mv_x = Ev_x/c^2$ can have positive or negative value depending on the velocity sign (see section 18). When the matter with the positive energy is moving with the velocity of $v=v_x$, the space momentum is $P_x = Ev/c^2$ (see Figs. 48-51). It is the relativistic case. Then, $E = (1-v^2/c^2)^{-0.5}E_0 \approx E_0\,(1+ v^2/(2c^2)+ 3v^4/(8c^4)) \approx E_0 + m_0v^2/2 = E_0 + E_k$ (see Fig. 53). Here, E_k is the kinetic energy of $P_x^2/(2m_0)$, where P_x is m_0v_x. As shown in Fig. 53, $E_k = m_0v^2/2$ can be used for $v < 0.6c$ within the error range of 5 %. However, for $v \geq 0.6c$, $E = (1-v^2/c^2)^{-0.5}E_0 \approx E_0\,(1+ v^2/(2c^2)+ 3v^4/(8c^4)) = E_0 + E_k$ needs to be used for the better prediction of the relativistic case. In this high velocity case, $E_k \approx \frac{p_x^2}{2m_0} + \frac{3p_x^4}{8m_0^3c^2}$ can be used.

20. Quantum mechanics (see sections 11 and 18) and modified relativity theory

20.1 Revised quantum mechanics

In quantum mechanics, Schrodinger equation is $E\psi = H\psi = \left(\frac{p^2}{2m} + V\right)\psi\ and\ E = \int E(x)dx = \int E|\psi(x)|^2 dx$. In the present work, $E = \int ct(x)dx$. Therefore, ct(x) = E(x) = $E|\psi(x)|^2$. Therefore, $|\psi(x)|^2$ = ct(x)/E where t(x) is the time function of the warped space as shown in Fig. 52. It is the real meaning of the wave function introduced in the quantum mechanics. The flat space can be explained by using the plane wave functions of x and t in Figs. 19, 23 and 52. The flat space means that the rest mass (m_0) is zero and it can be described only as the plane wave. The flat x1x2x3 space with the time width of Δt is shown in Figs. 52 and 19 (see Fig. 4, too). In the present work, this flat space with the positive energy ($E_0>0$) is described by using the plane waves with the $p_t = E_0/c > 0$ (along the +t direction) and $p_x>0$ (along +x direction) momenta. The plane wave functions are $\psi(x) = Ae^{\frac{i}{\hbar}P_x x} and\ \psi(t) = Be^{\frac{iE_0}{\hbar c}ct}$. Then, $p_x = -i\hbar\frac{d}{dx}$ and $p_t = E_0/c = -i\hbar\frac{d}{cdt}$. From these equations, $E_0 = cp_t = -i\hbar\frac{d}{dt}$ and $\Psi(x,t) = \psi(x)\psi(t)$. And $p_x = \hbar k_x$ and $E_0 = cp_t = \hbar\omega$. Note that $\psi(t) = Be^{-\frac{i}{\hbar}Et}$ and $E = i\hbar\frac{d}{dt}$ which have been given and used in the well-known quantum mechanics are different in the sign from those given from the present study. p_x is the non-relativistic operator because the plane wave does not warp the x1x2x3 space. The flat space is not changed by the space momentum of the space plane wave. Therefore, the flat space energy is $E_0 = \Delta x c \Delta t = \Delta x 1 c \Delta t$ as shown in Fig. 52.

In Fig. 19, $p_{total}^2=E^2/c^2= p_x^2 + E_0^2/c^2$, $\overrightarrow{p_{total}} = p_x\hat{\imath} + p_t\hat{t}$, $\overrightarrow{x_{total}} = x\hat{\imath} + ct\hat{t}$, and $E_0 = \Delta xc\Delta t$. Then $\psi(x,t) = ABe^{\frac{i}{\hbar}\overrightarrow{p_{total}}\cdot\overrightarrow{x_{total}}} = Ae^{\frac{i}{\hbar}P_x x}Be^{\frac{iE_0}{\hbar\, c}ct}$, $and\ dE = cdxdt = cdx_a dt_a$.
$\iint |\psi(x,t)|^2 dxcdt = A^2B^2\Delta xc\Delta t = 1$. Then $A^2 = 1/\Delta x$ and $B^2=1/(c\Delta t)$. Therefore, $A^2B^2 = 1/(\Delta xc\Delta t)$, and $\psi(x,t) = \frac{1}{\sqrt{\Delta xc\Delta t}}e^{\frac{i}{\hbar}P_x x}e^{\frac{iE_0}{\hbar\, c}ct}$.

For the 3-dimensional flat space,
$\psi(x,t) = \frac{1}{\sqrt{\Delta x_1\Delta x_2\Delta x_3 c\Delta t}}e^{\frac{i}{\hbar}\overrightarrow{p_x}\cdot\vec{x}}e^{\frac{iE_0}{\hbar\, c}ct}, \vec{x} = x_1\hat{\imath} + x_2\hat{\jmath} + x_3\hat{k}$.
The same procedure can be applied for the x4x5x6 and x7x8x9 flat spaces and this explanation can be extended easily to the x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 flat spaces.
The flat one-dimensional space with the energy of E_0 is shown in Figs. 52, 19 and 23. Then, $p_{total}^2=E^2/c^2= p_x^2 + E_0^2/c^2$ and $E_0 = \Delta x1c\Delta t$. The flat space is treated non-relativistically in Figs. 48, 52, 19 and 23 because it does not warp the space while it is moving with the light speed of v = c. The flat space with the energy of E_0 should be described by using the plane space and time wave functions of $\psi(x) = \frac{1}{\sqrt{\Delta x1}}e^{\frac{i}{\hbar}P_x x}$ and $\psi(t) = \frac{1}{\sqrt{c\Delta t}}e^{\frac{iE_0}{\hbar\, c}ct}$. From Figs. 48, 19 and 23, $p_x = E_0v/c^2 = E_0/c = p_t$ because v is equal to c for the plane waves. And from $p_x = \hbar k_x$ and $E_0 = cp_t = \hbar\omega_0$, $k_x = \omega_0/c$ is obtained. And $E^2= 2E_0^2$. Because $p_x = -i\hbar\frac{d}{dx}$ and $p_t = E_0/c = -i\hbar\frac{d}{cdt}$, $-i\hbar\frac{d}{dx}\psi(x)\psi(t) = -i\hbar\frac{d}{cdt}\psi(x)\psi(t)$. Therefore, $\frac{d}{dx}\psi(x)\psi(t) = \frac{d}{cdt}\psi(x)\psi(t)$ from $p_x = E_0/c$. And from $p_x^2 = E_0^2/c^2$, $\frac{d^2}{dx^2}\psi(x)\psi(t) = \frac{d^2}{c^2dt^2}\psi(x)\psi(t)$. This is the well-known wave equation with the wave velocity of v = c. This can be easily extended to the flat three-dimensional space with the energy of E_0.

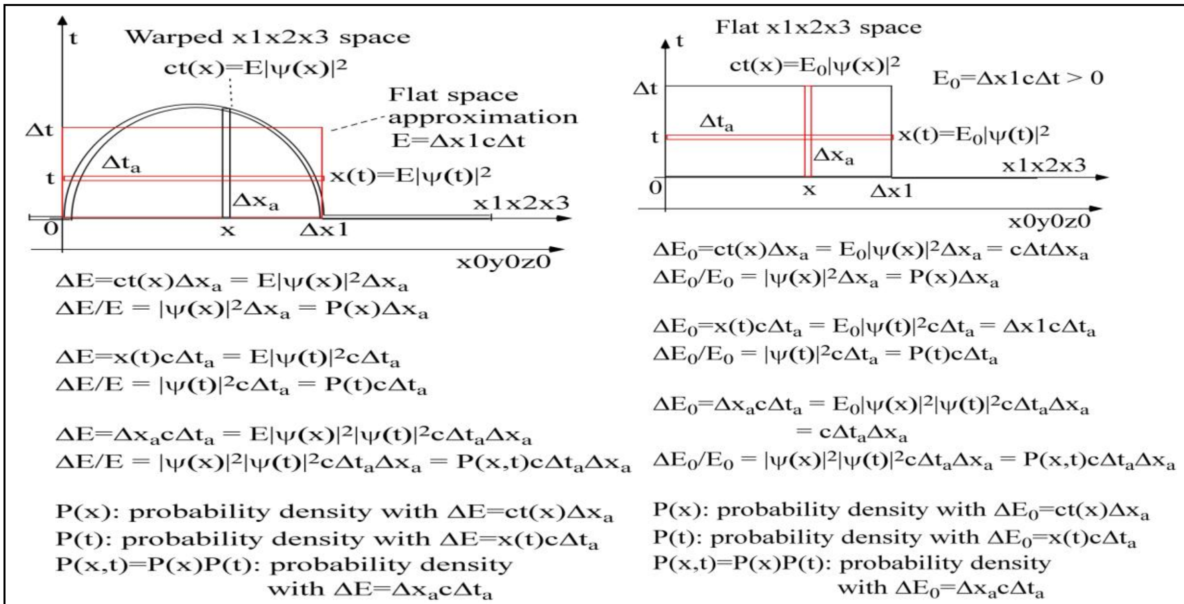


Fig. 52. $|\psi(x)|^2$, $|\psi(t)|^2$ and $|\psi(x,t)|^2 = |\psi(x)|^2|\psi(x)|^2$ considered as the probability densities.

The warped x1x2x3 space can be described by using the wave functions as shown in Figs. 52, 19 and 23. If the warped space is more warped by the space momentum of the warped matter as shown in Figs.19, 23, 48 and 52, it should be treated relativistically. Therefore, the modified warped space has the energy of $E = \Delta x_0 c\Delta t$ increased by the kinetic energy from the rest mass energy of $E_0 = \Delta x_0 c \Delta t_0$ as shown in Figs. 19 and 23 (see Fig. 54). In this case, E is positive for the flat space approximation of the warped space. Relativistically, $\psi(x) = A(x) and\, \psi(t) = B(t)$ can be used to derive the space and time wave functions of the warped space in Fig. 19. p'_x is zero because of the relativistic effect in Figs. 19 and 23 (see Figs. 54, 62 and 63). A(x) and B(t) can warp the space as the functions of x and t. The time wave function of ψ(t) for the warped space is hard to be directly calculated. Therefore, ψ(t) is indirectly calculated from the x1x2x3 flat space approximation of the warped space as seen as a red squares with the energy of E in Figs. 52, 19 and 23. This means that the plane wave function of ψ(t) is used as the approximated form of the actual ψ(t) wave function. Because the time wave function is obtained from the flat space approximation with the energy of E in Figs. 52, 19 and 23, a time wave function is taken as the plane wave function of $\psi(t) = \frac{1}{\sqrt{c\Delta t}} e^{\frac{iE}{\hbar c}ct}$. And because the space momentum of p'_x is zero for the relativistic effect, the space wave function is $\psi(x) = A(x)$. A real space wave function of ψ(x) in Fig. 52 can be obtained from the Schrodinger equation of $E\psi(x) = E_0/(1-v^2/c^2)^{0.5}\psi(x)$ as follows. In the present work, one-dimensional Schrodinger equation with $\Delta E = ct(x)\Delta x_a = E|\psi(x)|^2\Delta x_a$ along the x1 axis in Fig. 52 has been shown for the simplicity.

The warped space case with the non-zero rest mass (m_0) moving with the velocity of v within the x1x2x3 space is shown in Figs. 19 and 49. This warped space means that it has the non-zero rest mass (m_0). When the rest mass (m_0) moves with v in the flat x1x2x3 space, it warps the x1x2x3 space as shown in Figs. 19 and 23 (see Figs. 54, 62 and 63). It is the relativistic effect. This additional warped space energy is the same as the kinetic energy (E_k). The energy of the matter moving with the velocity of v within the x1x2x3 space is $E=E_0/(1-v^2/c^2)^{0.5}$ in Figs. 49, 19 and 23. Here, $E_0 = m_0c^2$. $E\psi(x)\psi(t) = E_0/(1-v^2/c^2)^{0.5}\,\psi(x)\psi(t)$ for the warped space. Then, $E \approx m_0c^2\left(1 + \frac{v^2}{2c^2} + \frac{3v^4}{8c^4}\right) = m_0c^2 + \frac{p_x^2}{2m_0} + \frac{3p_x^4}{8m_0^3c^2}$ where $p_x = m_0v$ and $E = E_0 + E_k$. Therefore, $E_k \approx \frac{p_x^2}{2m_0}$. From the equation of $E = E_k + E_0 + V(x)$ with the additional potential energy of V(x), ψ(x) can be calculated by using the Schrodinger equation of $E\psi(x) = H\psi(x) = \left(E_0 + \frac{p_x^2}{2m} + V(x)\right)\psi(x)$. And, $p_x = -i\hbar\frac{d}{dx}\, and\, E = \int E(x)dx = \int E|\,\psi(x)|^2dx$. From $E\psi(t) = -i\hbar\frac{d}{dt}\psi(t)$ and $\psi(t) = \frac{1}{\sqrt{c\Delta t}} e^{\frac{iE}{\hbar c}ct}$ obtained by the flat space approximation, the wave function of the Schrodinger equation can be expressed as $\psi(x,t) = \psi(x)\frac{1}{\sqrt{c\Delta t}} e^{\frac{iE}{\hbar c}ct}$. The same discussion can be applied for the particle moving in the x1x2x3 space as shown in Figs. 19 and 23 (see Figs. 62 and 63). The relativistic space momentum is $p_x(\text{relativistic}) = p_x/(1-v^2/c^2)^{0.5} = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}(-i\hbar)\frac{d}{dx}$. This explanation can be easily expanded in order to include all cases of Figs. 48-51.

For the high velocity case, it is thought that $E_k \approx \frac{p_x^2}{2m_0} + \frac{3p_x^4}{8m_0^3c^2}$ gives the better prediction than $E_k \approx \frac{p_x^2}{2m_0}$ as shown in Fig. 53. Therefore, for the high velocity case, the revised Schrodinger equation of $E\psi(x) = H\psi(x) = \left(E_0 + \frac{p_x^2}{2m} + \frac{3p_x^4}{8m_0^3c^2} + V(x)\right)\psi(x)$ can be used to calculate the wave function of ψ(x) rather than the Schrodinger equation of $E\psi(x) = H\psi(x) = \left(E_0 + \frac{p_x^2}{2m} + V(x)\right)\psi(x)$. Also, $\psi_s(x)$ is calculated from the well-known Schrodinger equation of $E_s\psi_s(x) = (E - E_0)\psi_s(x) = H\psi_s(x) = \left(\frac{p_x^2}{2m} + V(x)\right)\psi_s(x)$. Then, $E_s\psi_s(t) = -i\hbar\frac{d}{dt}\psi_s(t)$ and $\psi_s(t) = \frac{1}{\sqrt{c\Delta t_s}}e^{\frac{iE_s}{\hbar c}ct}$. Because E_0 is the constant energy of m_0c^2 (see Figs. 19, 54, 62 and 63)

$$\psi(t) = \frac{1}{\sqrt{c\Delta t}}e^{\frac{iE}{\hbar c}ct} = \frac{1}{\sqrt{cb\Delta t_s}}e^{\frac{i}{\hbar}\frac{(E_s+E_0)}{c}ct} = \frac{1}{\sqrt{b}}e^{\frac{iE_0}{\hbar c}ct}\frac{1}{\sqrt{c\Delta t_s}}e^{\frac{iE_s}{\hbar c}ct} = \frac{1}{\sqrt{b}}e^{\frac{iE_0}{\hbar c}ct}\psi_s(t)$$

And, generally, $\psi(x) = \psi_s(x)$ because E_0 (rest energy) can be taken as the reference energy for the whole space (x) region of interest. In other words, only Δt_s is increased to $\Delta t = b\Delta t_s$ but Δx is the same as Δx_s on the flat space approximation by adding the constant energy of E_0 in Figs. 54 and 62. $E = c\Delta t\Delta x = cb\Delta t_s\Delta x$ and $E_s = c\Delta t_s\Delta x$. And $b = E/E_s = E/(E-E_0)$. Then, $ct(x) = E|\psi(x|^2$ and

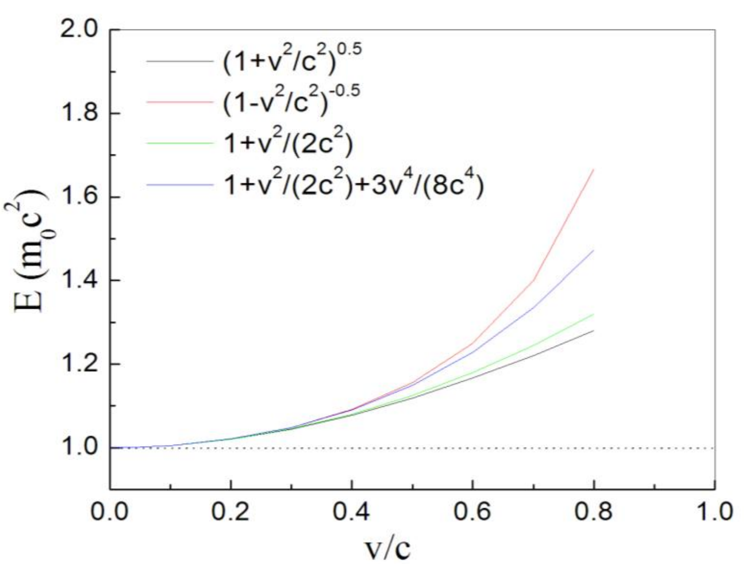


Fig. 53. Comparison of the total energies (E) including the kinetic energies (E_k).

$ct_s(x) = E_s|\psi_s(x)|^2 = E_s|\psi(x)|^2$. Therefore, the well-known Schrodinger equation of $E_s\psi_s(x) = (E - E_0)\psi_s(x) = H\psi_s(x) = \left(\frac{p_x^2}{2m} + V(x)\right)\psi_s(x)$ has been used instead of the Schrodinger equation of $E\psi(x) = H\psi(x) = \left(E_0 + \frac{p_x^2}{2m} + V(x)\right)\psi(x)$.

In other words, because E_0 is added as the constant energy for the whole space (x) region where the particle with the rest energy E_0 moves, E_0 can be taken as the reference energy in Figs. 54 and 62. It indicates that when it is based on the reference energy of E_0, the well-known Schrodinger equation of

$E_s\psi_s(x) = (E - E_0)\psi_s(x) = H\psi_s(x) = \left(\frac{p_x^2}{2m} + V(x)\right)\psi_s(x)$ can be used instead of the original Schrodinger equation of $E\psi(x) = H\psi(x) = \left(E_0 + \frac{p_x^2}{2m} + V(x)\right)\psi(x)$. And based on the reference energy of E_0, $E_s\psi_s(t) = -i\hbar\frac{d}{dt}\psi_s(t)$ and $\psi_s(t) = \frac{1}{\sqrt{c\Delta t_s}}e^{\frac{iE_s}{\hbar c}ct}$ can be used instead of the original equations of $E\psi(t) = -i\hbar\frac{d}{dt}\psi(t)$ and $\psi(t) = \frac{1}{\sqrt{c\Delta t}}e^{\frac{iE}{\hbar c}ct}$ obtained by the flat space approximation. Then , $\psi(x) = \psi_s(x)$ and

$$\psi(t) = \frac{1}{\sqrt{c\Delta t}}e^{\frac{iE}{\hbar c}ct} = \frac{\sqrt{E-E_0}}{\sqrt{E}}e^{\frac{iE_0}{\hbar c}ct}\psi_s(t).$$

Now, as one example, I am going to discuss the particle like an electron moving to the +x direction on the flat x1x2x3 space free of the potential wall as shown in the region B of Fig. 43. Then the free electron can be described as the wave function with the relations of 2ct(x) = $E|\psi(x,t)|^2$. In the flat space approximation of the red box in Figs. 43 and 52, the plane space and time wave functions of $\psi(x) = \frac{1}{\sqrt{\Delta x_b}}e^{\frac{i}{\hbar}P_x x} = \frac{1}{\sqrt{\Delta x_b}}e^{\frac{i}{\hbar}\sqrt{2m(E-E_0)}x}$ *and* $\psi(t) = \frac{1}{\sqrt{c\Delta t_b}}e^{\frac{iE}{\hbar c}ct}$ can be used for an electron moving to the +x direction toward the potential wall. Here, $E = c\Delta t_b\Delta x_b$. The space wave function of $\psi(x) = \frac{1}{\sqrt{\Delta x_b}}e^{\frac{i}{\hbar}P_x x}$ is the solution of $E\psi(x) = H\psi(x) = \left(E_0 + \frac{p_x^2}{2m}\right)\psi(x)$ and $(E - E_0)\psi(x) = H\psi(x) = \left(\frac{p_x^2}{2m}\right)\psi(x)$. The general solution considering the +x and –x moving directions of the free electron in this region is $\psi(x) = \frac{F}{\sqrt{\Delta x_b}}e^{\frac{i}{\hbar}P_x x} + \frac{G}{\sqrt{\Delta x_{br}}}e^{-\frac{i}{\hbar}P_x x}$ in Fig. 43. F and G are the coupling constants and $E_s = (E - E_0) = \left(\frac{p_x^2}{2m}\right)$.

When an electron meets the potential wall with $E_s < V$ (constant) in the region C of Fig. 43, the space wave function of the electron b-boson has the tail into the potential wall. The space wave function of this tail part can be deduced from the Schrodinger equation of $(E - E_0)\psi(x) = H\psi(x) = \left(\frac{p_x^2}{2m} + V\right)\psi(x)$ by assuming the negative kinetic energy of E_k = – (V - (E-E_0)) < 0 with the imaginary space momentum of $p_x = i\sqrt{2m(V - (E - E_0))}$ under the temporary reference energy condition of V. The positive kinetic energy stands for the free electron with that kinetic energy and the negative kinetic energy indicates the bound electron within the potential wall. The space probability density of the bound electron b-boson deformed to the tail form is shown as 2t(x) in Fig. 43. The space and time space of this electron within the potential wall cannot be approximated by the flat space because those have the decaying wave function of $\psi(x) = Ae^{-\sqrt{\frac{2m(V-(E-E_0))}{\hbar^2}}x}$ and $\psi(t)$. Within the potential wall with the constant potential energy of V > E-E_0, the space wave function of $\psi(x) = Ae^{-\sqrt{\frac{2m(V-(E-E_0))}{\hbar^2}}x}$ is the solution of $(E - E_0)\psi(x) = H\psi(x) = \left(\frac{p_x^2}{2m} + V\right)\psi(x)$. The space wave function of $\psi(x) = Ae^{-\sqrt{\frac{2m((V+E_0)-E)}{\hbar^2}}x}$ is the solution of $E\psi(x) = H\psi(x) = \left(\frac{p_x^2}{2m} + (V + E_0)\right)\psi(x)$, too. The free electron after going through the potential wall has the plane space and time wave functions of $\psi(x) = \frac{1}{\sqrt{\Delta x_d}} e^{\frac{i}{\hbar} P_x x}$ and $\psi(t) = \frac{1}{\sqrt{c\Delta t_d}} e^{\frac{iE}{\hbar c} ct}$ from the flat space approximation of the red box in Figs. 43 and 52. The coupling constant A, F and G can be calculated from the boundary conditions. When an electron moves to the +x direction on the x1x2x3 flat space out of the potential wall in Fig. 43, the time width is decreasing from Δt_b to Δt_d and the space width is increasing from Δx_b to Δx_d. In Fig. 52, $|\psi(x)|^2$, $|\psi(t)|^2$ and $|\psi(x,t)|^2 = |\psi(x)|^2|\psi(x)|^2$ are considered as the probability densities. The total energy is expressed by the relativistic equation of $E = E_0/(1-v^2/c^2)^{0.5}$. The relativistic space momentum can be obtained by the equation of $p_x(\text{relativistic}) = p_x/(1-v^2/c^2)^{0.5} = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}(-i\hbar)\frac{d}{dx}$.

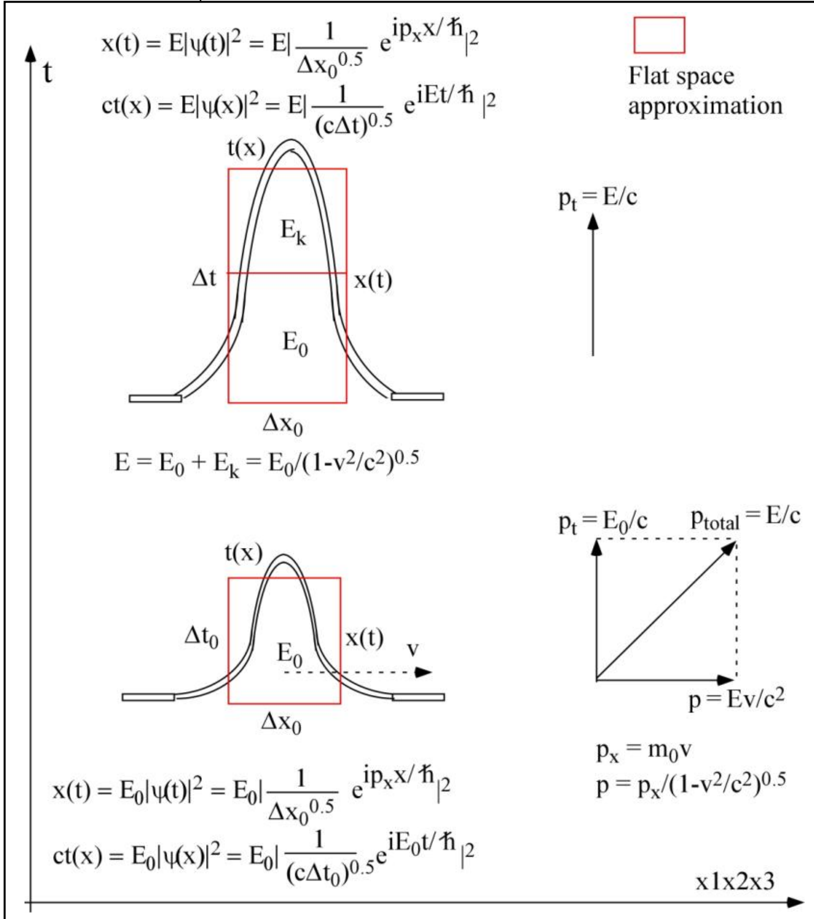


Fig. 54. Relation of relativistic energy and wave functions in quantum mechanics for the +q>0 warped x1x2x3 space. The same explanation is applied for the –q<0 warped x1x2x3 spaces by just vertically flipping the x1x2x3 spaces.

When an electron meets the potential wall with $E_s > V$ (constant) in the region C of Fig. 43, the space and time space of the electron b-boson can be approximated by the flat space. The space wave function can be deduced from the Schrodinger equation of $(E - E_0)\psi(x) = H\psi(x) = \left(\frac{p_x^2}{2m} + V\right)\psi(x)$. The positive kinetic energy stands for the free electron with the plane space and time wave functions. Along with the constant potential energy of $V < E\text{-}E_0$, the space and time

wave functions of $\psi(x) = \frac{1}{\sqrt{\Delta x_c}} e^{\frac{i}{\hbar}\sqrt{2m((E-E_0-V))}x} = \frac{1}{\sqrt{\Delta x_c}} e^{\frac{i}{\hbar}P_x x} and\ \psi(t) = \frac{1}{\sqrt{c\Delta t_c}} e^{\frac{iE}{\hbar c}ct}$ can be used for an electron moving to the +x direction passing the potential wall. Here, E = $c\Delta t_c \Delta x_c$. The space wave function of $\psi(x) = \frac{1}{\sqrt{\Delta x_c}} e^{\frac{i}{\hbar}P_x x}$ is the solution of $E\psi(x) = H\psi(x) = \left(E_0 + \frac{p_x^2}{2m} + V\right)\psi(x)$ and $(E - E_0)\psi(x) = H\psi(x) = \left(\frac{p_x^2}{2m} + V\right)\psi(x)$. The general solution considering the +x and –x moving directions of the free electron in this region is $\psi(x) = \frac{K}{\sqrt{\Delta x_{bc}}} e^{\frac{i}{\hbar}P_x x} + \frac{L}{\sqrt{\Delta x_{cr}}} e^{-\frac{i}{\hbar}P_x x}$ in Fig. 43. K and L are the coupling constants and $E_s = (E - E_0) = \left(\frac{p_x^2}{2m} + V\right)$.
The free electron after going through the potential wall has the plane space and time wave functions of $\psi(x) = \frac{1}{\sqrt{\Delta x_d}} e^{\frac{i}{\hbar}P_x x} and\ \psi(t) = \frac{1}{\sqrt{c\Delta t_d}} e^{\frac{iE}{\hbar c}ct}$ from the flat space approximation of the red box in the region D of Fig. 43. The coupling constant A, F, G, K and L can be calculated from the boundary conditions. When an electron moves to the +x direction on the x1x2x3 flat space out of the potential wall in the regions B and D of Fig. 43, the time width is decreasing from Δt_b to Δt_d and the space width is increasing from Δx_b to Δx_d. In Fig. 52, P(x) = $|\psi(x)|^2$ is the probability density at x.

The electron tunneling through the potential wall barrier is explained by using the space expansion of the electron b-boson as shown in Figs. 43, 54 and 62. Within the wall the electron cannot exist in the viewpoint of the classical mechanics. But in the viewpoint of the quantum mechanics the electron can exist within the potential wall with the reduced probability density at x obtained from the space expansion of the electron b-boson as shown in Figs. 43, 52, 54 and 62. After tunneling the potential wall, the electron wave function keeps the expanded space width and reduced time width which means the reduced probability density at x in Figs. 43, 52 and 54. Therefore, it should be noted that the b-boson shape is expanded along the space axis because of the energy increase by the relativistic effect when the electron is moving with a non-zero velocity as shown in Fig. 19, 23, 54 and 62.

In Fig. 54, the relation of the relativistic energy and wave functions in quantum mechanics for the +q>0 warped x1x2x3 space is shown for the purpose of the simple summary of the quantum mechanics. The same explanation is applied for the –q<0 warped x1x2x3 spaces by just vertically flipping the x1x2x3 spaces. The present procedure can be easily applied to the different potential walls with the different potential energies. Note that in Fig. 54 the Δx_0 value is increased and Δt_0 is decreased with the increasing of the velocity because E_0 is conserved. I solved the Schrodinger equations on the x1x2x3 space. The same procedure can be applied for the x4x5x6 and x7x8x9 spaces and this explanation can be extended easily to the x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 spaces. In the present work, I added the physical meaning of the space and time wave functions. Then, the space and time wave functions can be obtained by solving the Schrodinger equations. Also, it is shown in Fig. 52 that $|\psi(x)|^2$, $|\psi(t)|^2$ and $|\psi(x,t)|^2 = |\psi(x)|^2|\psi(t)|^2$, can be considered as the probability densities. It can be extended easily to the three-dimensional Schrodinger equation with $\Delta E = ct(x1,x2,x3)\Delta V_3(x1x2x3) = E|\psi(x1,x2,x3)|^2\Delta V_3(x1x2x3)$ in Fig. 52. V_3(x1x2x3) is the three-dimensional space volume. Schrodinger equation has been derived for the matter with the positive energies of $E_0 > 0$ and E >

0 in the present work. In other words, it has been used for the positive space momenta and positive time momentum in the present work. Because the wave function comes from the description of the space-time shapes, the same Schrodinger equations and the derived wave functions can be generally used in order to describe all of flat and warped spaces including the flat spaces, matters (particles) and antimatters (antiparticles) with the positive energy or negative energy. For the spaces with the negative energy, the negative energies of $E_0 < 0$ and $E < 0$ need to be used in the Schrodinger equations and the derived wave functions. Space momenta (p_x) can have the positive and negative value as shown in Figs. 48-51. Note that the negative energy corresponds to the negative mass. For the high velocity case, the revised Schrodinger equation of $E\psi(x) = H\psi(x) = \left(E_0 + \frac{p_x^2}{2m} + \frac{3p_x^4}{8m_0^3c^2} + V(x)\right)\psi(x)$ needs to be used because it gives the better results than the Schrodinger equation of $E\psi(x) = H\psi(x) = \left(E_0 + \frac{p_x^2}{2m} + V(x)\right)\psi(x)$ as shown in Fig. 53. It is shown in the present work that the Schrodinger equation can be obtained from the relativistic energy equation of $E = E_0/(1-v^2/c^2)^{0.5}$.

20.2. Classical mechanics, relativity theory and quantum mechanics

As shown in Fig. 55, the space and time locations of a particle can be described as (x,t) in terms of the classical mechanics which the elementary particle is treated as the point particle. In Fig. 55,

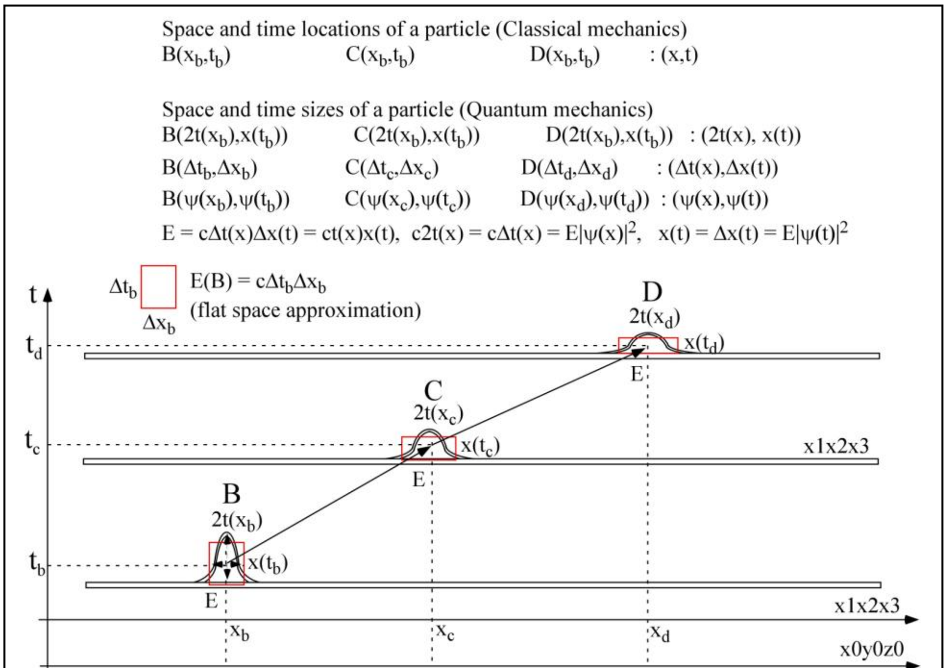


Fig. 55. Comparison of classical mechanics and quantum mechanics.

the space and time locations of a particle are described on the x coordinates of (x1, x2, x3) for the simplicity in the present explanation. Generally, the coordinates of x can stand for the ((x0, y0, z0), (x1, x2, x3), (x4, x5, x6), (x7, x8, x9)) in our three-dimensional quantized spaces. And as shown in Figs. 43, 54 and 62, it has been discussed in the present work that the particle really has the space and time sizes. Therefore, we need to know the particle sizes and locations in the space and time geometry. The space and time sizes of the particle are closely connected to the space and time wave functions in quantum mechanics as discussed in the present work. Therefore, the particle space and time sizes can be described as (ψ(x),ψ(x)), (Δt(x),Δx(t)) or (2t(x),x(t)). Therefore, the classical mechanics is about the change of the space and time locations of the particles and the quantum mechanics is about the change of the space and time sizes of the particles. The particle size is, really, the size of the particle b-boson as shown in Figs. 43, 54 and 62. The particle matter with the Planck size is moving within the particle b-boson as shown in Fig. 43.

Generally, the particle b-bosons belong to the warped spaces. The warped spaces have the space-time coordinates expressed as (x,t) and space-time sizes expressed as ((ψ(x),ψ(x)), (Δt(x),Δx(t)) or (t(x),x(t)). Generally, the coordinates of x stand for the ((x0, y0, z0), (x1, x2, x3), (x4, x5, x6), (x7, x8, x9)) in our three-dimensional quantized spaces. These space-time coordinates are defined as the center space and time locations of the particles in Fig. 55. Some examples of these space time coordinates are shown in Figs 48-51 and 54. Therefore, there are two kinds of

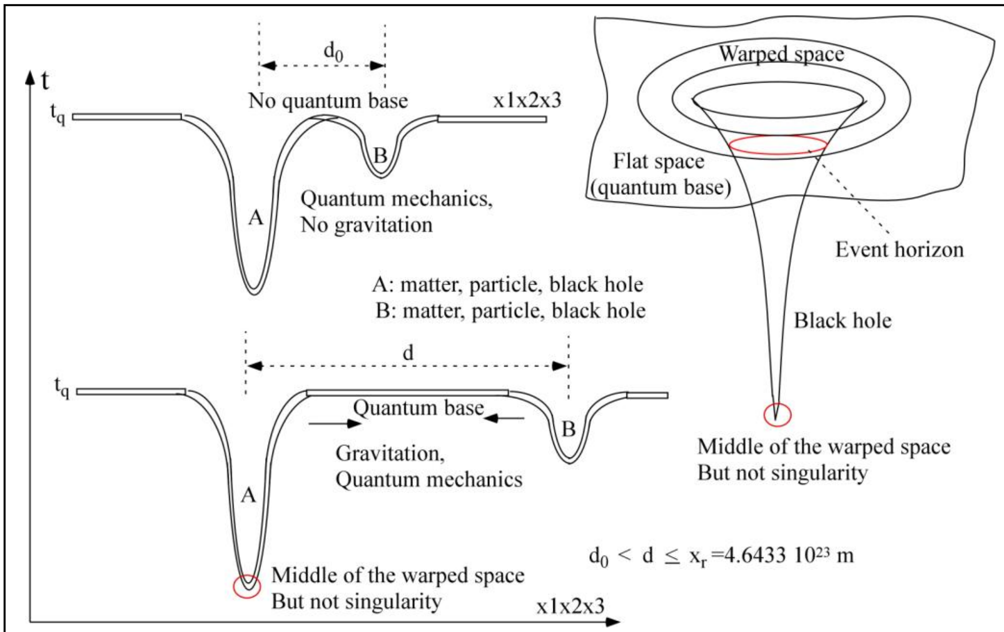


Fig. 56. Comparison of the gravitation and quantum mechanics.

changes for the warped matters. One is the change of the space-time coordinates (momentum transition in Fig. 63) and another one is the change of the space-time sizes (energy transition in Fig. 63). The study on the change of the space-time coordinates of the warped spaces can be called as the classical mechanics. The study on the change of the space-time sizes of the warped spaces can be called as the quantum mechanics. Because we have applied the quantum mechanics only to the elementary particles with the diameter sizes less than $\sim 10^{-15}$ m, it has been misunderstood that the quantum mechanics works only for the small scales. However, generally the quantum mechanics should work for all sizes of the warped spaces including all the matters and particles. Also, the space-time sizes of the flat spaces have been described by the plane waves which are closely connected to the quantum mechanics in the present work. The space-time coordinates of (x,t) which are closely connected to the classical mechanics can be properly assigned to these flat spaces, too. Then, the quantum mechanics and classical mechanics can be applied to the flat spaces, too. It means that our whole universes should be described by both of the quantum mechanics and the classical mechanics.

The b-boson and the internal matter of a particle in Fig. 12 and 43 can be separated near the black hole. If the b-boson and internal matter of a particle is separated, the b-boson and the internal matter are changed to the flat space or absorbed (merged) into the warped space of the black hole. Then the quantum mechanics and classical mechanics cannot be applied to the particle because the space-time location of (x,t) and the space-time size of ((ψ(x),ψ(x)), (Δt(x),Δx(t)) or (t(x),x(t)) cannot be defined any more to the collapsed particle which loses its identity. The boundary outline of the black hole is newly defined in Fig. 56 as the event horizon of the present work as explained at the next two paragraphs of this section. The quantum mechanics and classical mechanics should be applied to the new merged state of the black hole. Therefore, the gravitational formula can be applied only to the space length larger than the space size of the particle as shown in Fig. 56. It will remove the singularity in the gravitational interaction of the black hole. Because the quantum mechanics is based on the space-time sizes of the particle in Fig. 55, the space and time locations of the particle guessed in terms of the quantum mechanics have always the uncertainties of Δx and Δt, respectively. But the space and

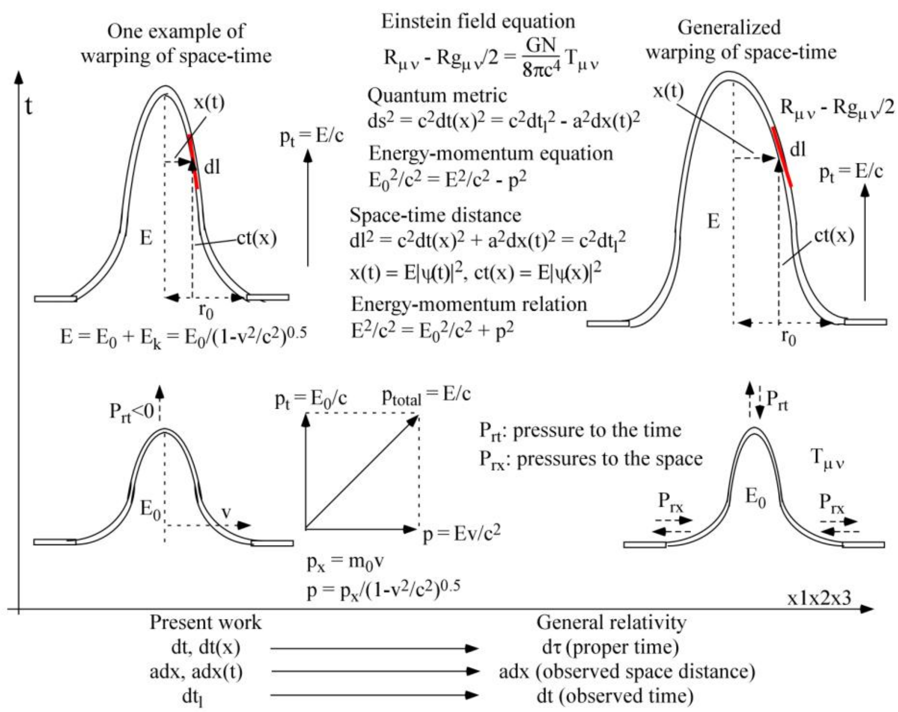


Fig. 57. General relativity for the matter with the +q>0 warped space combined with the quantum mechanics. The same discussion can be applied for the matter with the –q<0 warped space.

time locations of the particle in the classical mechanics are expressed as the average center values of x and t, respectively, in Fig. 55 because the classical mechanics is based on the space and time locations of the point-like particle. It implies that the classical mechanics is based on the concept of the point particle and the quantum mechanics is based on the non-zero size concept (non-zero space and time sizes) of the particle.

In Fig. 56, two matters of A and B with the distance of d are approaching to each other by the gravitational force. These two matters including particles, black holes have the warped x1x2x3 spaces. These two matters can be the x1x2x3, x1x2x3-x4x5x6 or x1x2x3-x4x5x6-x7x8x9 matters including particles, black holes which have the warped x1x2x3 spaces. The matters are moving on the quantum bases which means the x1x2x3 flat space and the gravitons are moving on the quantum bases, called as the graviton bases, between these two matters of A and B. In this case, the quantum mechanics and gravitation can be used to describe the dynamics of two matters. But when the warped spaces of two mattes are touching at the distance d_0, the space between two matters is not the flat space but the warped space. Then the gravitation cannot be applied at the distance less than d_0 because there is no graviton base. It blocks the gravitational collapse which leads to the gravitational singularity at $d = 0$. The combined (merged) warped space shape of two matters with the distance of $d < d_0$ can be described by the quantum mechanics but not by the gravitation. Two matters lose their independent identities by changing to the combined (merged) warped space shape of two matters. The combined (merged) warped space shape of two matters can be described by combining two wave functions of two matters by using the quantum mechanics. This indicates that the gravitation can be applied to the dynamics

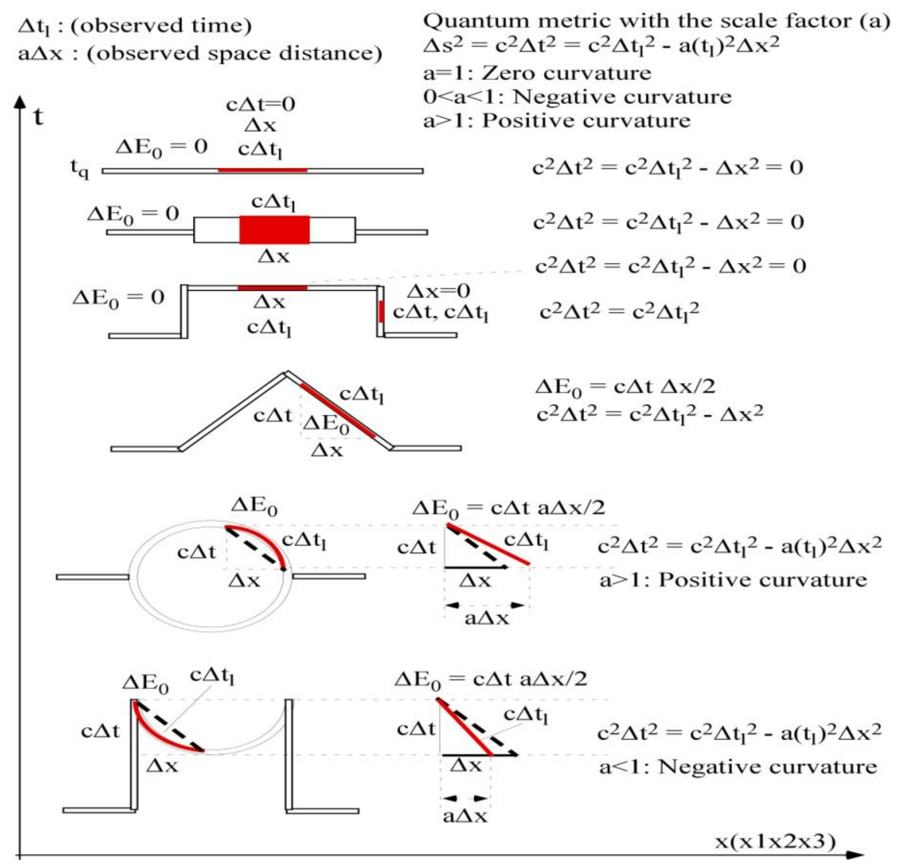


Fig. 58. Space-time curvatures and quantum metrics. The warping energy is $\Delta E_0 > 0$. See Fig. 26.

of two matters with the distance of $d > d_0$ in Fig. 56. Therefore, it is shown in the present work that the gravitational singularity cannot exist as shown in Fig. 56. The massive graviton discussed in section 8 gives the gravitational force range of $d_0 < d \leq x_r = 4.6433\ 10^{23}$ m.

In the present work, the event horizon of the black hole is redefined as the space boundary within which the warped space of the incoming matter to the black hole loses its identity completely by being absorbed into the warped space of the black hole. In the warped region out of the event horizon of the black hole, the warped space of the incoming matter to the black hole loses its identity partly by being absorbed into the warped space of the black hole. Many kinds of particles and antiparticles are created by the quantum warped space fluctuations around the outside of the event horizon of the black hole. When the warped space part of the incoming matter stays in the warped region out of the event horizon, other matters including the information of the incoming matter can be created and emitted. The x1x2x3, x1x2x3-x4x5x6 or x1x2x3-x4x5x6-x7x8x9 matters (particles, black holes) have the warped x1x2x3 spaces. In other words, the x1x2x3 spaces associated with the x1x2x3, x1x2x3-x4x5x6 or x1x2x3-x4x5x6-x7x8x9 matters (particles, black holes) are warped. Then other x4x5x6 and x7x8x9 spaces associated with the x1x2x3 space are warped at the same way as the x1x2x3 space. Because the photons are moving on the quantum bases (called as the photon bases) with the flat space in Fig. 14, the paths of the photons are curved on the space by going around the matters in order to follow the quantum bases but not the warped spaces (see Fig. 89). This is called the lensing effect of the matters on the photons. Photons cannot exist within the event horizon of the black hole because there is no quantum base with the flat space within the black hole. Also, because the gravitation does not exist within the black hole, there is no gravitational singularity in terms of the present three-dimensional quantized space model. The black hole is just the hugely warped space with the event horizon defined in the present work. The x1x2x3 matter can be described by the warped x1x2x3 space. The more energy the x1x2x3 matter has, the more warped the x1x2x3 space associated with the x1x2x3 matter is. The more energy the x1x2x3 matter has, the more gravitational effect the x1x2x3 matter associated with the warped x1x2x3 space has. The particle or the matter moves on the flat x1x2x3 space but not within the warped x1x2x3 space. Because the particle or the matter is the warped x1x2x3 space, the particle or the matter cannot move on the warped x1x2x3 space by keeping its identity. The gravitation makes sense only when the particle or the matter moves on the flat x1x2x3 space.

First, note that the time definition in the present work is different from the time definition of the special and general relativity theories as shown in Fig. 57. The proper time (τ) and observed time (t) in the special and general relativity theories correspond to the proper time (t) and observable time (t_l), respectively, in the present work. In the general relativity, the curvature of the matter is related to the energy, space momenta and possible other stresses by using the following Einstein field equation. $R_{\mu\nu}$-$Rg_{\mu\nu}/2$ = $GNT_{\mu\nu}/(8pc^4)$. The left terms of this equation expresses the curvature of the space-time shape of the matter and the right term has the energy-momentum tensor (energy-mementum-stress tensor) of $T_{\mu\nu}$. The Schwarzschard solution (metric) considering the gravitation effect on the curvature of the space cannot be used for the region with $r < d_0$ in Figs. 55, 57 and 58. This condition removes the possibility of the black hole with the singularity. The space-time curvature of the matter can be described by using the quantum metric given in the present work because the space-time shape or curvature of the matter should be described by using the Schrodinger equation of quantum mechanics which gives the quantum metric of $ds^2 = c^2dt(x)^2 = c^2dt_l(x)^2 - dx(t)^2$ in Figs 57 and 58. In quantum mechanics, $ct(x)= E|\psi(x)|^2$ and $x(t) = E|\psi(t)|^2$ are the space energy density (ρ_x) and time energy density (ρ_t), respectively as shown in Fig. 52. Three examples of possible shapes of the x1x2x3 matter having the zero curvature, positive curvature and negative curvature are shown in Fig. 26. For example, the b-boson has the spherical shape with the positive curvature. The flat space has the zero curvature. Several examples of the spaces with the zero, positive and negative curvatures are shown in Fig. 58. The quantum metric with the curvature scale factor ($a(t_l)$) is $\Delta s^2 = c^2\Delta t^2 = c^2\Delta t_l^2 - a(t_l)^2\Delta x^2$. The values of a=1, 0<a<1 and a>1 correspond to the zero, negative and positive curvatures, respectively.

For the x1x2x3 universe shape, the Einstein field equation and quantum mechanics can be used together as shown in Fig. 59. In order to describe the space-time shape of the universe, the contributions from the x4x5x6 and x7x8x9 matters are disregarded for the simplicity because the x1x2x3 matters associated to the x4x5x6 and x7x8x9 matters are relatively small compared to

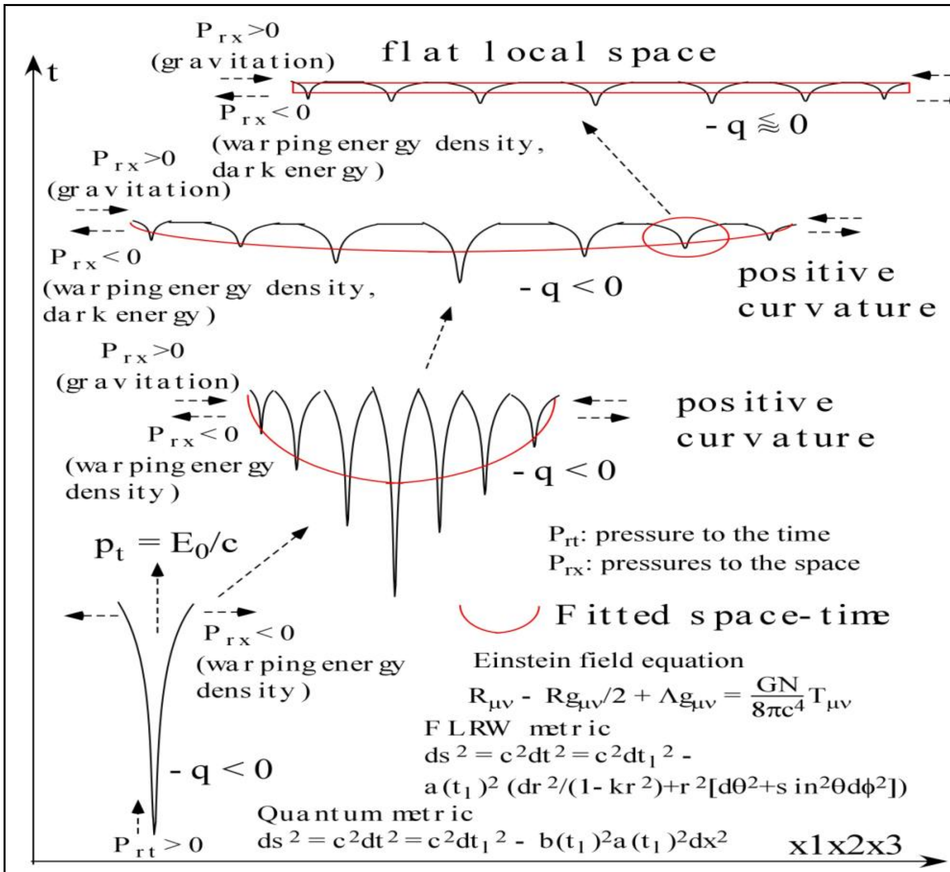


Fig. 59. General relativity applied for our x1x2x3 universe with the –q<0 warped space. The warping energy density effect is defined as the H energy in Fig.6 and section 24. See Figs. 60 and 83.

the x1x2x3 matters. The matters with the negative electric charge of –q < 0 are dominating in our x1x2x3 matter universe. The x1x2x3 matter universe with the positive energy was created as the x1x2x3 matter of the huge black hole as shown in Figs. 2 and 59. It is called as the big bang. This black hole has been rapidly expanded to the space direction and rapidly contracted to the time direction toward to the flat space because the flat space is the most stable shape of the space-time with the minimum energy density. In other words, the warping energy density of $\rho(x) = E|\psi(x)|^2 = ct(x)$ (~ Δt) is rapidly decreased in a very short time and the space width (~Δx) is rapidly increased in a very short time because $E=c\Delta t\Delta x$ in the flat space approximation is conserved. It is thought that this warping energy effect called as the H energy in Fig. 6 causes the inflation of the universe. It has created many small x1x2x3 matters since it was born in Figs. 2 and 6. Currently, the universe is made of x1x2x3 matters, x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 matters. The x1x2x3 matters are dominating in the universe scale. Even in the local scale of the galaxy cluster, it is proposed in the present work that the x1x2x3 matters like the B1 dark

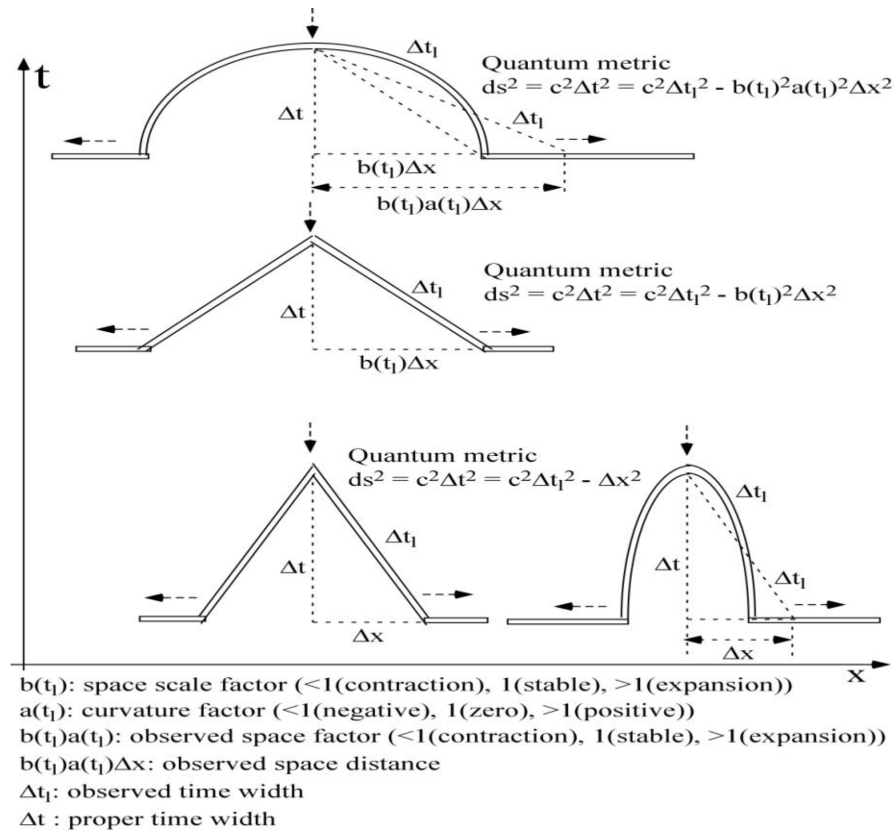


Fig. 60. Quantum metric with the space scale and curvature factors for the +q > 0 spaces. The same discussion can be applied for the –q < 0 spaces, too. See Figs. 56-59 and 61.

matters and x1x2x3 black holes are dominating over the x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 matters like the leptons, hadrons. All matters are moving in the flat x1x2x3 space. But the fitted space-time has the curvature as shown in Fig. 59. This fitted warped space of the whole x1x2x3 universe has the negative electric charge warping. However the present local space can have the nearly flat fitted space. The curvature of this fitted space depends on the gravitations of the matters including the dark matters and normal matters to give the positive space pressure and the space expansion caused by the newly added x1x2x3 spaces called as the dark energy and H energy to give the negative space pressure. Therefore, the additional dark energy (+ H energy) term of $\Lambda g_{\mu\nu}$ can be included into the Einstein field equation in Fig. 59 (see Figs. 85 and 6 for more details).

Also, it needs to be noted that the warping energy density (H energy) which plays a major role during the inflation time of the universe gives the negative space pressure. Because the present local space is believed to be nearly flat, it is concluded that the dark energy on the accelerated space expansion of the present local universe is increasing more and more (see Fig. 85). Those effects can be separated into the space factor of b(t) due to the dark energy and curvature factor of a(t) due to H energy in the quantum metrics in Figs. 59 and 60. The general solution of the Einstein field equation with the dark energy (+ H energy) term of $\Lambda g_{\mu\nu}$ is the FLRW metric (Friedmann-Lemaitre-Robertson-Walker metric) as shown in Fig. 59. This FLRW metric corresponds to the quantum metric of $ds^2 = c^2dt^2 = c^2dt_l^2 - b(t_l)^2a(t_l)^2dx^2$. The space scale factor ($b(t_l)$) responsible for the space expansion and curvature scale factor ($a(t_l)$) responsible for the additional curvature are included in the quantum metric as shown in Fig. 59. Here the total energy (E_0) of the whole universe is conserved through the evolution of the whole universe. Our universe has the positive curvature as shown in Fig. 59 and the negative charge. The FLRW metric can be used in order to describe the local fitted universe. The factor of $a(t_l)$ is called as the (space) scale factor and the curvature of the local fitted universe can be related to the k value within the FLRW metric. Generally the given values of k = -1, 0 and 1 represent the local fitted universe which have the negative, zero and positive curvatures, respectively. Our local fitted universe has the k=1 value because it has the positive curvature and -q < 0 warping as shown in Fig. 60.

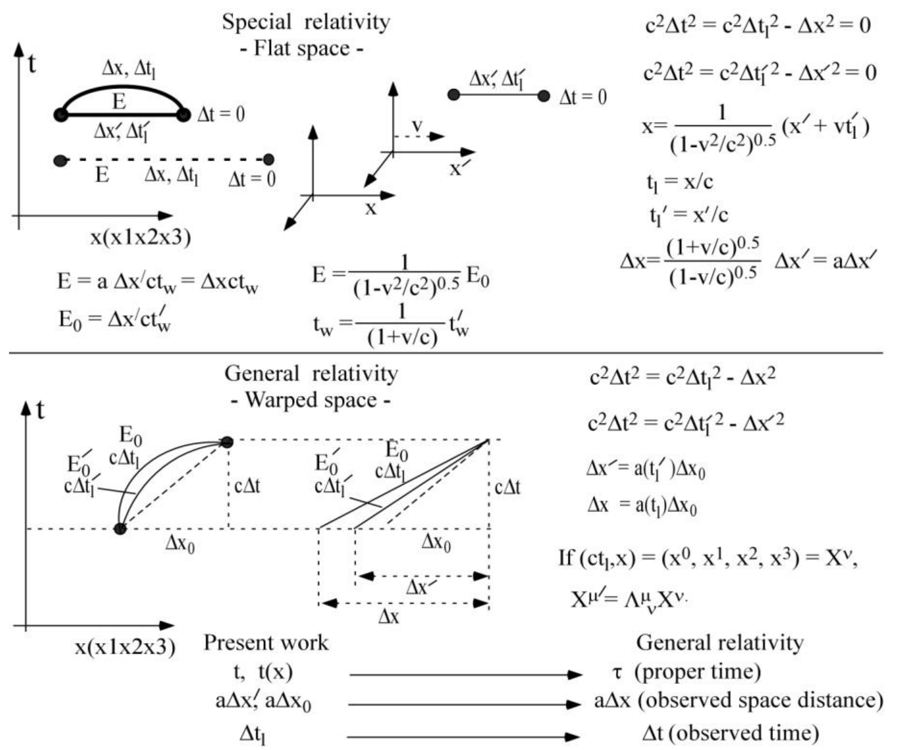


Fig. 61. Comparison of general relativity and special relativity for the energy transition. See Figs. 62 and 63.

In Fig. 60, the quantum metric is related with the space expansion and space curvature. Our universe has the space expansion. And it has the positive curvature with the negative charge. In order to describe the geometry of our universe in Fig. 59, the quantum metric with the space scale factor ($b(t_l)$) and curvature factor ($a(t_l)$) is needed as shown in Fig. 60. The space with the positive curvature and the +q>0 warping are shown in Fig. 60 for the explanation. The same discussion can be applied to the space with the positive curvature and the –q < 0 warping in Fig. 59. The quantum metric can be compared with the FLRW metric (Friedmann-Lemaitre-Robertson-Walker metric) as shown in Fig. 59. The space scale factor ($b(t_l)$) in Fig. 60 is expressed as $a(t_l)$ in FLRW metric. And the curvature factor ($a(t_l)$) in Figs. 60 and 58 is expressed as the terms including the factor of $1/(1-kr^2)$ in FLRW metric. In FLRW metric, the spaces with the negative, zero and positive curvatures are defined as the space with the k=-1, 0

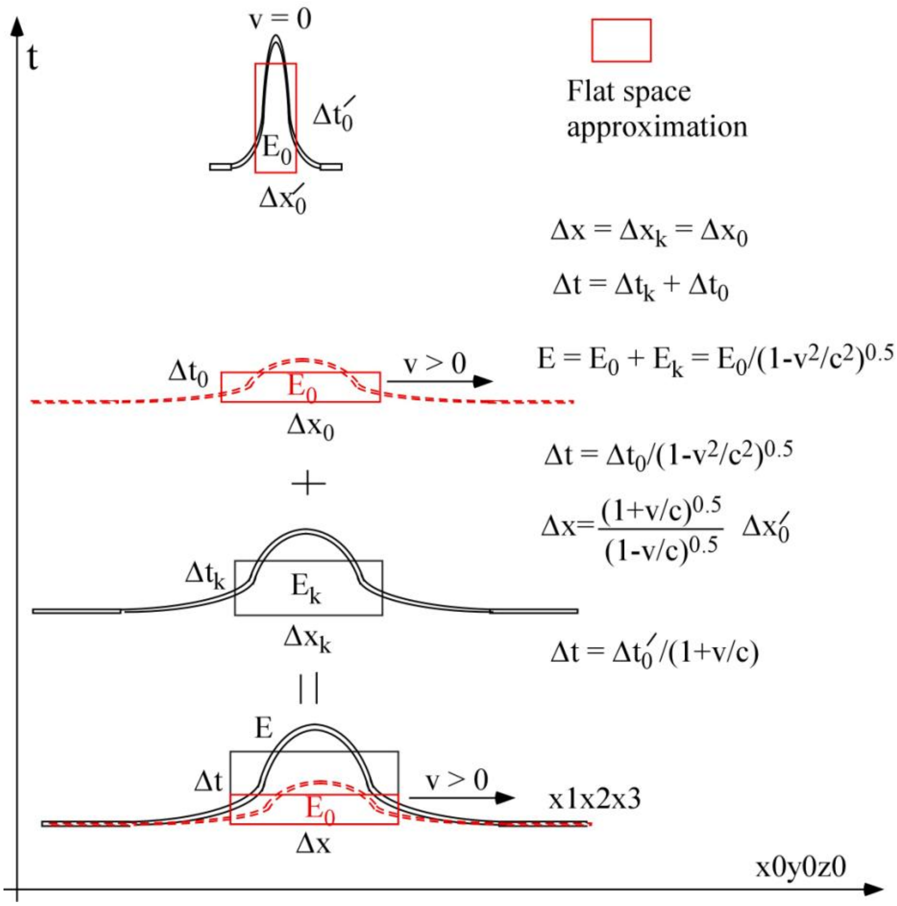


Fig. 62. Relativistic effect on the size of the particle with the non-zero rest mass. See Figs. 19, 23 and 43. Also, see Figs. 61 and 63.

and +1 values, respectively. Note that the local space in our universe is flat as shown in Fig. 58. Therefore, a(tl) = 1 in the quantum metric of Fig. 60 and k=0 in FLRW metric can be roughly used for the local flat space.

The comparison of the special and general relativities are compared in Fig. 61. The special relativity is explained in terms of the wave functions of the particle in Figs. 19 and 23, too. First the special relativity is applied to the flat space. The x' space is moving with the velocity of v relative to the x space. Then, the flat space with the space distance of $\Delta x'$ has the observed time of $\Delta t_l' = \Delta x'/c$ in Fig. 61. Note that the proper time (τ) and observed time (t) in the special and general relativity theories correspond to the proper time (t) and observable time (t_l) in the present work. In the flat space, $\Delta t = 0$. The space seen from the x space is warped because of the velocity effect of v as shown in Fig. 61. Then, the space distance (Δx) and time (Δt_l) observed from the x space by following the warped space-time path are changed from the space distance ($\Delta x^{/}$) and time ($\Delta t_l^{/}$) observed from the $x^{/}$ space by following the flat space-time. Then, the warped space with the space distance of Δx has the observed time of $\Delta t_l = \Delta x/c$ in Fig. 61. Therefore, the quantum metrics of $\Delta s^2 = c^2\Delta t^2 = c^2\Delta t_l^2 - \Delta x^2 = 0$ and $\Delta s^2 = c^2\Delta t^2 = c^2\Delta t_l^{/2} - \Delta x^{/2}$ can be used. The Lorentz transformation between the x and $x^{/}$ space can be derived as follows. In special relativity, $x = \gamma x^{/} + bt_l^{/}$ and $\gamma > 0$. When $x = 0$, $x^{/} = -vt_l^{/}$. Then, $-\gamma vt_l^{/} + bt_l^{/} = 0$ and $b=\gamma v$. And $x = \gamma (x^{/} + vt_l^{/})$. By the same way, $x^{/} = \gamma (x - vt_l)$. As shown in the quantum metrics of Fig. 59, $x = ct_l$ and $x^{/} = ct_l^{/}$. And $ct_l = c\gamma (1+v/c)t_l^{/}$ and $ct_l^{/}= c\gamma (1-v/c)t_l$. From these two equations, $\gamma = 1/(1-v^2/c^2)^{0.5} > 0$ and $b=\gamma v$. Therefore, $x = (x^{/} + vt_l^{/})/(1-v^2/c^2)^{0.5}$ and $t_l = x/c$ which are the exact Lorentz transformation of the special relativity for the flat space. Then, $\Delta x = \sqrt{\frac{1-\frac{v}{c}}{1+\frac{v}{c}}}\Delta x'$ (see Figs. 61-63) which is called as the energy transition in Figs. 62 and 63. If $v < 0$, then $c < 0$. Always $v/c > 0$. Note that it is different from the solution of $\Delta x = \Delta x'/\sqrt{1 - \frac{v^2}{c^2}}$ which is called as the momentum transition in Fig. 63. The special and general relativity theories proposed by Einstein should be separated into the energy transition associated with the space-time shape transition of the matter and the momentum transition associated with the space-time location transition as shown in Figs. 62 and 63.

For the warped space, the general FLRW and quantum metrics and general space transformation of $X^{\mu/} = \Lambda^{\mu}{}_{\nu}X^{\nu}$ need to be used with the Einstein field equation as shown in Figs. 59 and 58. Now the time (t) is generally defined as the proper time in the present work. Then, the proper time width in the energy transition of the special relativity in Figs. 61-63 is $\Delta t = 0$ because it applied on the flat space as shown in Fig. 63. And the proper time width in the general relativity of Fig. 61 is the non-zero Δt when it is applied on the warped space in Figs. 58-61. When the energy is added to the zero curvature time-space, the zero curvature time-space is warped. Then the observed time width and observed space length between two fixed points are different from the proper time width and space length in the zero curvature time-space, respectively, because the path between two fixed points is on the curved space-time. Therefore, the special and general relativity theories for the energy transition are discussing about the relation between the energy and changes of the curvature and time-space distance. Basically, the quantum mechanics based on the shape (energy) change of the time-space is discussing about the relation between the energy and size changes of the space and time in terms of the present three-dimensional quantized space model. In other words, for the same warped space and time, the general relativity is about the curvature changes of the space and time and the quantum mechanics is about the size changes of the space and time. Relativistic effect on the size of the particle with the non-zero rest mass is shown in Fig. 62. When the particle is moving with the velocity of v, the space size of the particle is increasing from $\Delta x_0^{/}$ to $\Delta x = \sqrt{\frac{1+\frac{v}{c}}{1-\frac{v}{c}}}\Delta x^{/}$ (see Figs. 61-63) which is called as the energy transition in Figs. 62 and 63. Note that it is different from the solution of

$\Delta x = \Delta x' / \sqrt{1 - \frac{v^2}{c^2}}$ which is called as the momentum transition in Fig. 63The time width of the particle is decreasing from $\Delta t_0'$ to $\Delta t = \Delta t_0' / (1+v/c)$ in Fig. 62. In Fig. 63, the energy and

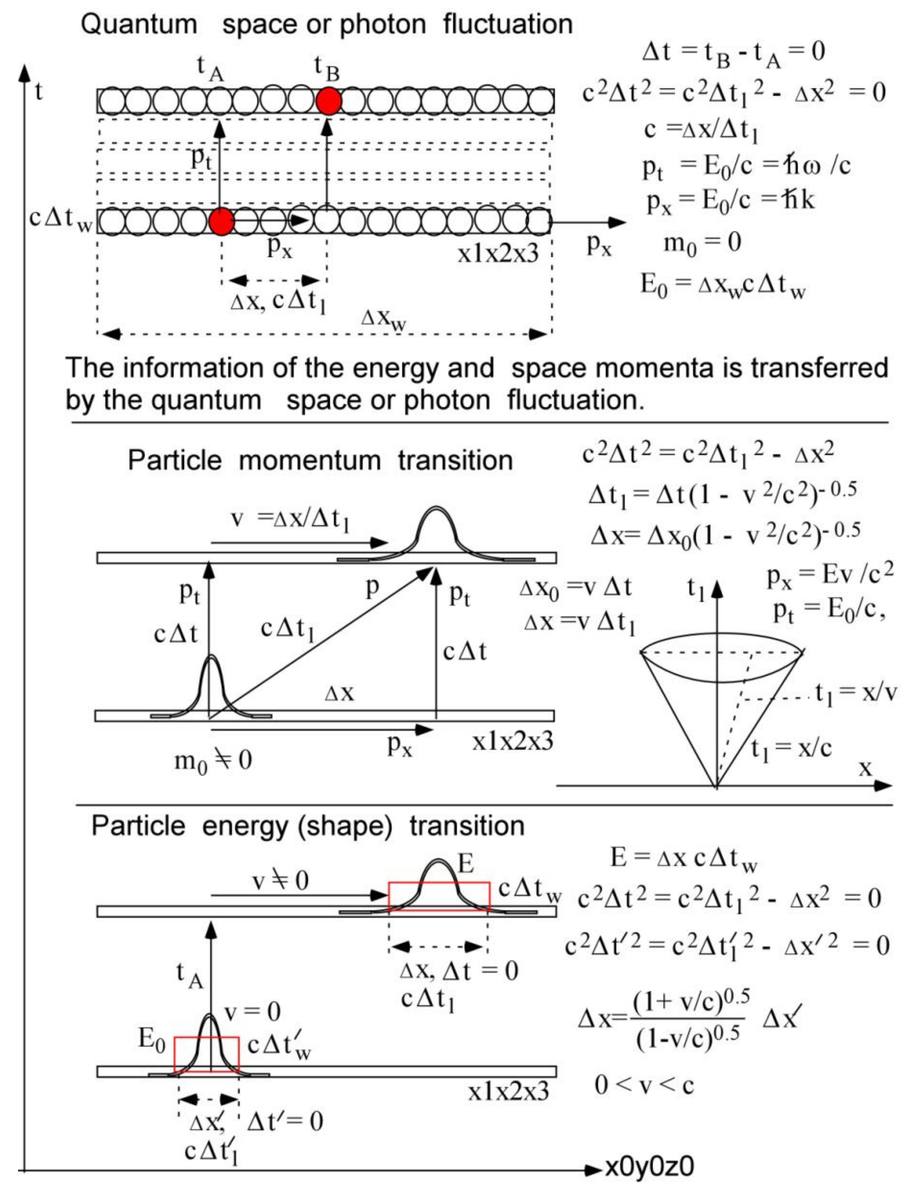


Fig. 63. The energy and space-time momentum transitions of the photon, quantum space and particle are compared.

space-time momentum transitions of the photon, quantum space and particle are compared. The quantum space fluctuation and the photon fluctuation are the background flat space fluctuation. Because it has the zero rest mass, it does not have the time-space warped shape. Therefore, the information of the energy and space momenta is transferred to the next quantum space or photon by the background flat space fluctuation. All of the quantum spaces on the flat space have the same proper time. Therefore, the proper time difference (Δt) of two quantum spaces is zero as shown in Fig. 63. Then, the quantum space fluctuation has the constant speed of $c = \Delta x/\Delta t_l$. And the time and space momentum of the quantum fluctuation is $p_t = E_0/c = \hbar\omega/c$ and $p_x = E_0/c = \hbar k$, respectively. The energy and momenta are transferred like the wave. Therefore, the status this energy and momentum transitions are expressed as the wave function. If this wave-like motion is toward the +x and +t direction, the proper wave function is $\psi(x,t) = \frac{1}{\sqrt{\Delta x_w c\Delta t_w}} e^{\frac{i}{\hbar}P_x x} e^{\frac{iE_0}{\hbar c}ct}$ as

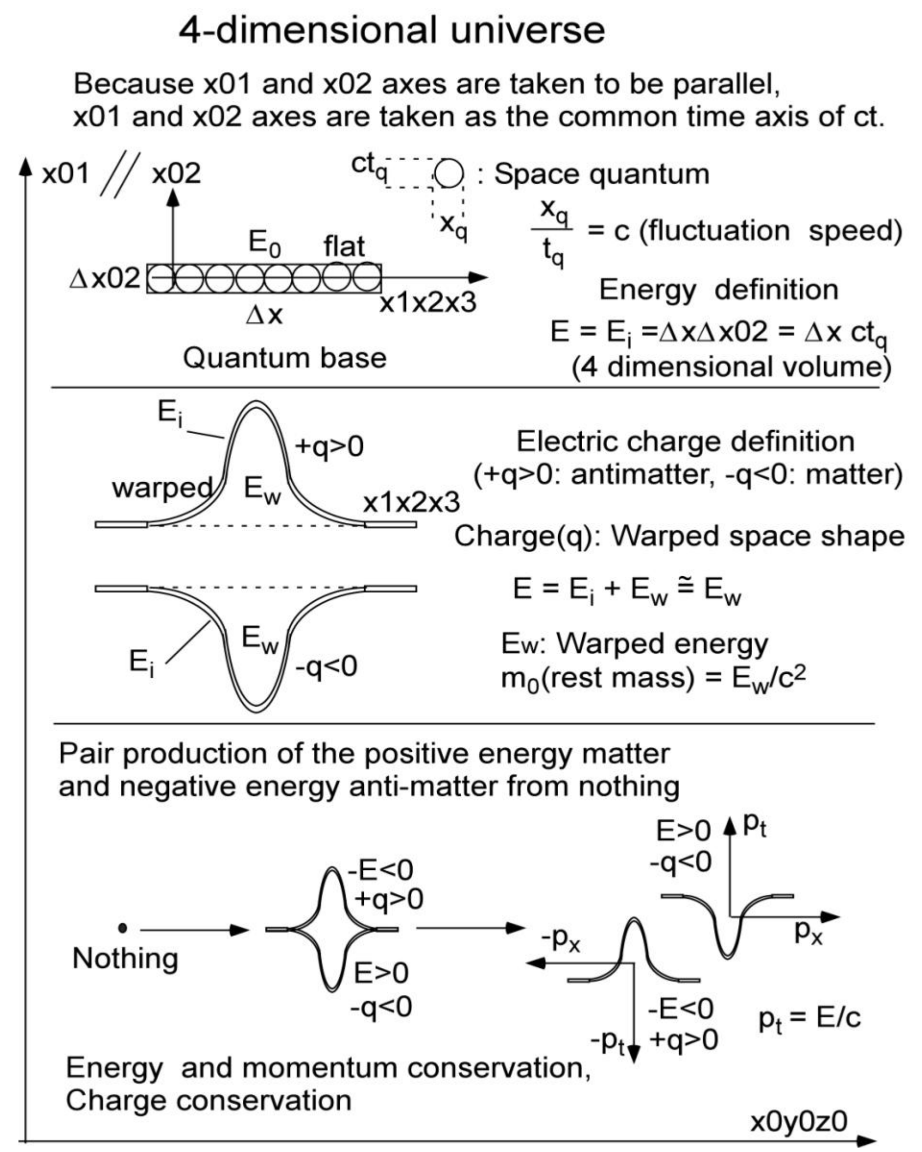


Fig. 64. The 3-dimensional quantized space can be called as the 4-dimensional universe. The energy and charge definitions, energy and momentum conservation and charge conservation are shown.

explained in section 20.1. Here, E_0 is $\Delta x_w c\Delta t_w$ in Fig. 63. The quantum space fluctuation has the quantum time scale of t_q and the photon fluctuation has roughly the Planck time scale of t_p. It indicates that the increasing (flowing) of the proper time (t) and observed time (t_l) is originated from the quantum space fluctuation. The particle has the non-zero rest mass which means the warped space-time shape. This warped space-time shape is moving with the energy and space momenta when the particle is moving by changing the space location as shown in Fig. 63. The momentum transition can be solved by the point particle approximation. This particle is moving from one position to another position with the speed of v = $\Delta x/\Delta t_l$. While it is moving, the proper time (t) of the particle location is increasing along with the increasing of the observed time (t_l) of the particle location as shown in Fig. 63. This gives the quantum matrix of $c^2\Delta t^2 = c^2\Delta t_l^2 - \Delta x^2$. Therefore, $\Delta t_l = \frac{\Delta t}{\sqrt{1-\frac{v^2}{c^2}}}$. This can explain the observed half-life of the moving particle longer than the half-life of the rest particle. In other words, if the half-life ($t_{1/2}$) of the rest particle is $t_{1/2}$, the observed half-life (t_l) of the particle moving with the speed of v is $t_l = \frac{t_{1/2}}{\sqrt{1-\frac{v^2}{c^2}}}$. The space and time momenta are defined, in the present work, as $p_x = \frac{E_0}{c}\frac{\Delta x}{c\Delta t} = \frac{E_0}{c}\frac{\Delta x}{c\Delta t_l\sqrt{1-\frac{v^2}{c^2}}} = \frac{E}{c}\frac{\Delta x}{c\Delta t_l} = \frac{E}{c^2}v$ and $p_t = \frac{E_0}{c}\frac{c\Delta t}{c\Delta t} = \frac{E_0}{c}$, respectively. When $\Delta x_0 = v\Delta t$, in Fig. 63, $\Delta x = \frac{\Delta x_0}{\sqrt{1-\frac{v^2}{c^2}}}$ for the momentum transition. This is explained in Fig. 49. The energy transition of the moving particle is solved by giving the space-time space size to the particle as shown in Fig. 63. The x-size of the particle is $\Delta x^/$ when the v value is zero and Δx when it is moving with the non-zero v value. The relation between $\Delta x^/$ and Δx can be obtained by using the special relativity for the energy transition in Fig. 61. In other words, when the particle is moving with the velocity of v, the space size of the particle is increasing from $\Delta x_0^/$ to $\Delta x = \sqrt{\frac{1+\frac{v}{c}}{1-\frac{v}{c}}}\Delta x^/$ for the energy transition as shown in Figs. 61-63. If v < 0, then c < 0. Then, always v/c is positive. Note that it is different from the solution of $\Delta x = \frac{\Delta x_0}{\sqrt{1-\frac{v^2}{c^2}}}$ for the momentum transition in Fig. 63. The energy (E) of the moving particle is E= $\Delta x c \Delta t_w$ under the flat space approximation as shown as the red square in Fig. 63. It is explained in Fig. 62, too. The particle wave function can be obtained as explained in the section 20.1. It indicates that the particle motion needs to be treated separately in terms of the momentum transition and the shape (energy) transition of the particle.

The 3-dimensional quantized space can be, also, called as the 4-dimensional universe as shown in Fig. 64. Then, the time axis can be treated as the normal space axis in the 4-dimensional universe. Because the x01 and x02 axes are parallel to each other, the x01 and x02 axes in the 4-dimensional universe model can be considered as the common time axis of ct in the 3-dimensional quantized space model. The energy and charge definitions, energy and momentum conservation and charge conservation are shown for the summarization. Also, the pair production of the positive energy matter and negative energy anti-matter from nothing is shown in Fig. 64. More details can be found in the present work.

21. Virtual particles, real particles, black holes and universes

21.1 Virtual particles and real particles

The particle size prediction in Table 2 is within the reasonable range for the known particles. The energy of the Planck size particle (xi-xj-xk b-boson) is 3.1872 10^{-31} eV in Table 2. Planck size particle (b-boson) is the minimum size of the observable particle. The virtual bosons in Fig. 16 are predicted only by the uncertainty principle of $\Delta E \Delta t = \hbar/2$. The Planck range of the virtual force carrying boson is x_r = $2x_p$ = 2*1.616 10^{-35} m = 3.232 10^{-35} m. From the equation of E=9.866 10^{-8} / x_r (eV) obtained from the uncertainty principle of $\Delta E \Delta t = \hbar/2$, the Planck range boson has the energy of 3.0526 10^{27} eV. The Planck energy (1.2209 10^{28} eV) of the Planck range boson has been calculated from $E = c^2\sqrt{\frac{\hbar c}{G}}$. Another reduced Planck energy (2.435 10^{27} eV) of the Planck range boson has been calculated from $E = c^2\sqrt{\frac{\hbar c}{8\pi G}}$. The energy (E = 3.0526 10^{27} eV) of the present Planck range boson obtained from the uncertainty principle is consistent with the reduced Planck energy (2.435 10^{27} eV) and the Planck energy (1.2209 10^{28} eV). In Fig. 16, the virtual particles are divided as the bosons and black holes, and the real particles are divided into the particles and universes in the present work. Here, universes mean the real particles which have the internal structure. The energy and space area of the universe are increased by adding the quantum spaces which causes the background fluctuations as shown in section 15. The minimum observable sizes of the real particles (or b-bosons) are the Planck size of x_p = 1.616 10^{-35} m. Then the energy of this Planck size real particle (xi-xj-xk b-boson) is 3.1872 10^{-31}eV from the equation of E = 12.2047 10^{38} x^2 in Table 2 and Fig. 16. The energy of the force carrying boson is decreased with the increasing of the force range (x_r). The gravitational force between two matters is explained by the force carrying xi-xj graviton. In the present work, the gravitational force range is 4.6433 10^{23} m. This graviton has the zero charge and the rest mass of 2.1248 10^{-31} eV/c2. See section 8 for more details for the graviton. The xi-xj graviton has the spin of 2 and the other b-bosons have the spin of 0 or 1.

21.2. Black holes and universes

Generally, the virtual particle is decaying to the real particles by expanding from the small space size to the large space size. The virtual particles are originated from and correspond to the positive energy matters created by the pair production of the positive and negative quantum spaces as shown in Figs. 3 and 5. This space transition is a kind of the small space inflation compared with the largest space inflation and bigbang of our universe in Fig. 16. It is called, alternatively, as the particle transition of the virtual boson in the present work. The virtual particles with the energy larger than the Planck range virtual boson are defined as the black holes as shown in Fig. 16, in the present work. Also, some of them can be transformed to the real particle by the space inflation which is defined as the huge space expansion in a short time. Our universe is originated from the inflation of one black hole with the huge energy in Figs. 2 and 16. This black hole is the matter black hole with the positive energy and negative charge (EC) as shown in Fig. 2. This positive energy matter black hole can be called as the positive energy matter x1x2x3 universe. The positive energy matter x1x2x3 universe (black hole) and the partner negative energy anti-matter x1x2x3 universe (black hole) are created by the pair production on the x0y0z0 mother universe as shown in Fig. 2.

After one black hole is changed to the real particle which is our universe, many virtual particles of the bosons and black holes with the energy smaller than the original universe are created inside our universe as shown in Fig. 2. Those virtual particles are matters because the original universe is the matter. These virtual particles include the virtual bosons shown in Fig. 16 and the virtual bastons, leptons, quarks and hadrons not shown in Fig. 16, which are created from the background fluctuations of the matter universe under the uncertainty principle. The real particles of the bastons, leptons, quarks and hadrons with the large size of $x >> x_p$ shown in Fig. 16 are created from the particle transition of the corresponding virtual particles. These particles are the matters in our universe. Of course, the matters and antimatters produced by the pair production of the particle and antiparticle from the photons could be annihilated completely. Only the matters originated from the virtual particles have survived so far inside the present universe. This can explain why the matters are dominated over the antimatters inside our present universe. Conceptually, many black holes were made inside our universe and some of these black holes become many smaller universes inside the main universe. The new real particles are made by the transition and decay from some of the new virtual particles to the real particles.

And the black hole created inside the main universe could decay to several smaller black holes with the angular momenta. In case, smaller black holes could rotate around the biggest black hole of them. The biggest black hole becomes stable at the gravitational center of the system by the gravitational interactions. Then, smaller black holes could decay to the smaller force carrying virtual particles and smaller real particles decaying to the bastons, leptons and hadrons. Then the bastons are produced much more than the leptons and hadrons as shown in Fig. 25. Therefore, the bastons became the dark matters and the leptons and hadrons are the normal matters in the rotating arms of the galaxy as shown in Fig. 25. This is the origin of the spiral galaxy formation like our milky-way galaxy as shown in section 13. Other shaped galaxies could be explained in terms of the similar black hole decay. It needs the further researches.

Table 10. Relations between $\bar{W}(1,LC), \bar{Z}(0,LC>0)\ or\ Z(0,LC<0)$ bosons and quarks and leptons. V_{ab} is the matrix element with the conditions of $V_{ab} = V_{ba}$ and Vab = VaxVxb. The color charge effects on the matrix elements of the quarks are disregarded for simplicity. W(EC,LC,0) → W(EC,LC) and W(1,-1) → $\bar{W}(1,0) + Z(0,-1)$. It is assumed that all bosons are emitted in this table for simplicity.

V_{ab} for quarks			V_{ab} for leptons			$\bar{W}(1,LC), \bar{Z}(0,LC>0)$ $or\ Z(0,LC<0)$
ab			ab			LC
ud	uu	dd	$\nu_e e$	$\nu_e\nu_e$	ee	0
us	uc	ds	$\nu_e\mu$	$\nu_e\nu_\mu$	eμ	1
ub	ut	db	$\nu_e\tau$	$\nu_e\nu_\tau$	eτ	2
cd	cu	sd	$\nu_\mu e$	$\nu_\mu\nu_e$	μe	-1
cs	cc	ss	$\nu_\mu\mu$	$\nu_\mu\nu_\mu$	μμ	0
cb	ct	sb	$\nu_\mu\tau$	$\nu_\mu\nu_\tau$	μτ	1
td	tu	bd	$\nu_\tau e$	$\nu_\tau\nu_e$	τe	-2
ts	tc	bs	$\nu_\tau\mu$	$\nu_\tau\nu_\mu$	τμ	-1
tb	tt	bb	$\nu_\tau\tau$	$\nu_\tau\nu_\tau$	ττ	0

22. CKM matrix, neutrino oscillations and CP violations

The quarks and leptons can change the electric, lepton and color flavors through the absorption or emission of the W, Z and Y bosons as shown in Figs. 30, 47, 65, 66, 67, 68 and Tables 9 and 10. The V_{ij} element in the CKM matrix is connected to the partial decay width of

$\Gamma(W^+ \to u_i \overline{d_j}) = \frac{CG_F M_W^3}{6\sqrt{2}\pi} |V_{ij}|^2$. The relative probabilities of these interaction processes associated with the quarks and their proper W bosons can be obtained from the measurements of the decay width for each interaction process. Here, u_1, u_2, u_3, d_1, d_2 and d_3 are u, c, t, d, s and b quarks, respectively. The partial decay widths have been expressed as V_{ij} which makes the CKM matrix. The decays between two different lepton flavors of two quarks are allowed through the flavor changing Z (or anti-Z) or W(or anti W) bosons as shown in Figs. 65 and 68 and Tables 9 and 10. This means that the CKM matrix elements of V_{ij} indicate the partial decay width of the interactions associated with the Z (or anti-Z) or W(or anti W) bosons. Therefore, the CKM matrix has the importance in comparing the strengths of several interaction modes of the quarks.

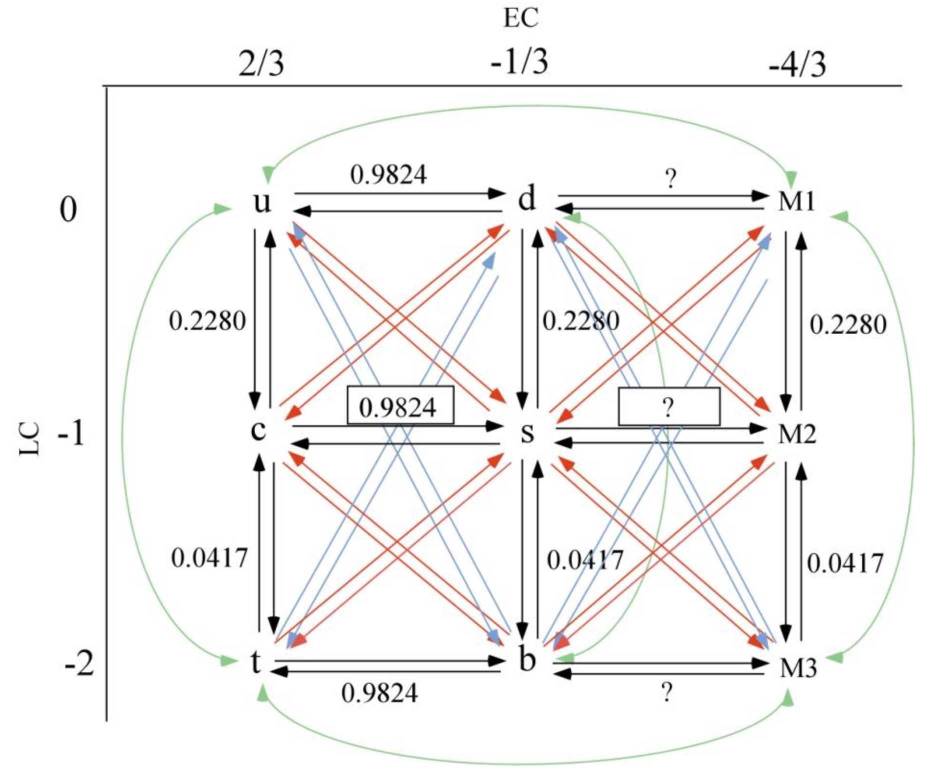


Fig. 65. Relative values of interaction matrix elements (V_{ab}) between $W, \bar{W}, Z$ and $\bar{Z}$ bosons with CC=0 and quarks based on the CKM matrix element values. V_{ab} is the matrix element with the conditions of $V_{ab} = V_{ba}$ and $V_{ab} = V_{ax}V_{xb}$. The matrixes for the $W, \bar{W}, Z$ and $\bar{Z}$ bosons with none-zero CC are not considered, for simplicity. See Fig. 67 for the lepton matrix.

Matrix elements are shown in Figs. 65 and 68.

$$\begin{pmatrix} V_{ud} & V_{us} & V_{ub} \\ V_{cd} & V_{cs} & V_{cb} \\ V_{td} & V_{ts} & V_{tb} \end{pmatrix} = \begin{pmatrix} 0.9742-0.9757 & 0.219-0.226 & 0.002-0.005 \\ 0.219-0.225 & 0.9734-0.9749 & 0.037-0.043 \\ 0.004-0.014 & 0.035-0.043 & 0.9990-0.9993 \end{pmatrix}$$

(J. Alvarez-Gaume et al., Phys. Lett. **B592**, 1 (2004)) is previously known as the CKM matrix. It can be replaced with

$$\begin{pmatrix} V_{ud} & V_{us} & V_{ub} \\ V_{cd} & V_{cs} & V_{cb} \\ V_{td} & V_{ts} & V_{tb} \end{pmatrix} = \begin{pmatrix} 0.9824 & 0.224 & 0.0093 \\ 0.224 & 0.9824 & 0.0410 \\ 0.0093 & 0.0410 & 0.9824 \end{pmatrix}$$ which can be obtained from Fig. 65 and V_{bd} = V_{tu} = 0.0417x0.2280 = 0.0095 in Fig. 65. V_{ab} is the matrix element with the conditions of V_{ab} =

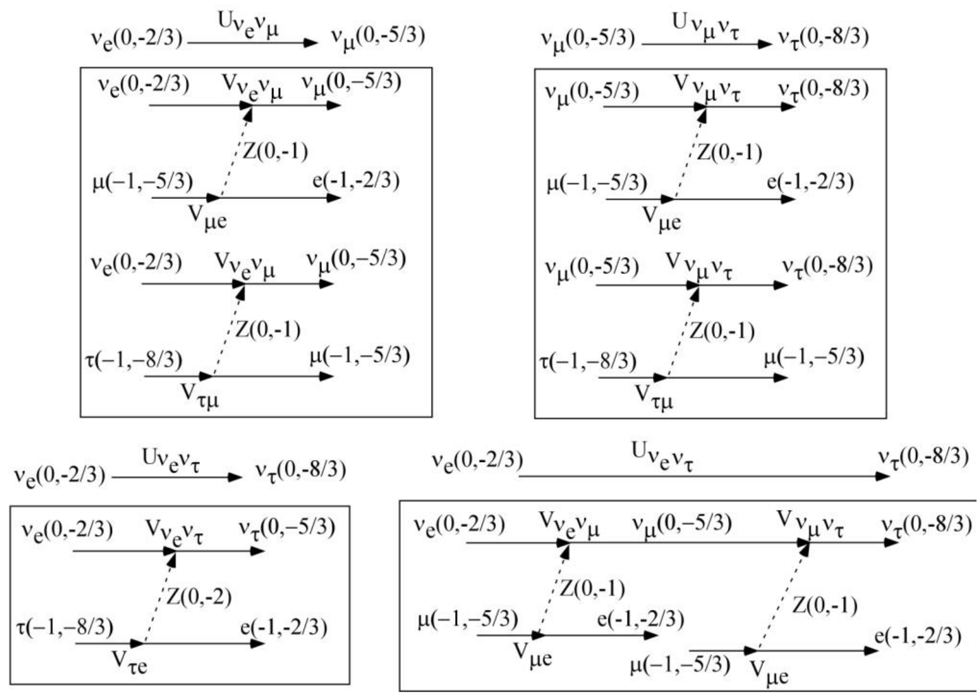


Fig. 66. The changes of the neutrino flavors are explained by the neutrino-lepton interaction but not by the neutrino mixing. The experimentally observed PMNS matrix elements (U_{ab}) between the neutrons are closely related to the interaction matrix elements (V_{ab}) which need to be determined experimentally. The neutrino interaction with the hadrons such as the proton and pion is possible, too.

V_{ba} and $V_{ab} = V_{ax}V_{xb}$. The color charge effects on the matrix elements of the quarks are disregarded for simplicity. In Table 10, W(EC,LC,0) → W(EC,LC) and $\overline{W}(1,-1)$→ $\overline{W}(1,0) + Z(0,-1)$. I assume that the matrix elements in Fig. 65 and the CKM matrix elements are good for the $W, \overline{W}, Z\ and\ \bar{Z}$ boson with CC=0. In other words, it is assumed that W(anti-W)/Z(anti-Z) bosons associated with the CKM matrix elements have the charges of (EC,LC,0). Other matrix elements of the quarks for the W (anti-W) or Z (anti-Z) boson interactions with the non-zero CC values should be decided experimentally. Also, the matrix elements of the leptons for the W (anti-W) or Z (anti-Z) boson interactions in Figs. 47, 66 and 67 need to be decided experimentally.

Several experiments have measured the fluxes of the ν_e neutrinos coming from the sun. These neutrinos are thought to be produced from the pp chain and CNO cycle which takes place within the sun as expected from the solar standard model (SSM). Those data show the deficit of the electron neutrinos when compared with what SSM gives. This is called the solar neutrino puzzle (Y. Fukuda et al., Phys. Rev. Lett. **81**, 1158 (1998).). Asymmetry of the upward-going and downward-going neutrino fluxes has been measured for the ν_μ neutrinos which are produced from the π^+, π^-, μ^+ and μ decays (Y. Fukuda et al., Phys. Rev. Lett. **81**, 1562 (1998).). Those neutrino puzzles need the explanation which can change the lepton flavors (or lepton charges in the present work). These neutrino flux deficits have been explained by using the neutrino oscillations which presupposed the mixing of three neutrinos. The neutrino mixing is not allowed in terms of the present model because the neutrinos have the non-zero lepton charges. In other words, the neutrino mixing is not allowed because of the conservation of the lepton charges (LC). In the present work, these neutrino puzzles are explained by the changes of lepton charges which are caused by the interactions through the Z bosons as shown in Fig. 66. As shown in Figs. 66 and 67, it is thought that the experimentally observed neutrino oscillations and the PMNS matrix elements (U_{ab}) (C. Giunti and M. Tanimoto, Phys. Rev. **D66**, 113006 (2002), Z. Maki, M. Nakawa, S. Sakata, Prog. of Theor. Phys. **28**, 870 (1962)) between the neutrinos are originated from the interaction matrix elements (V_{ab}) of the leptons which need to be determined

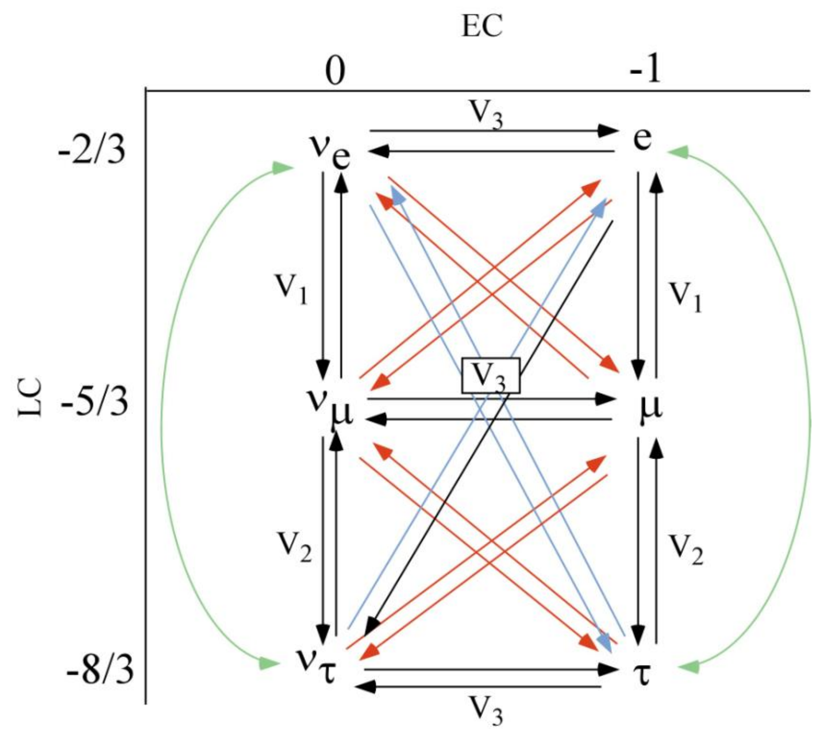


Fig. 67. Interaction matrix elements (V_{ab}) between $W, \bar{W}, Z\ and\ \bar{Z}$ bosons and leptons which need to be decided. V_{ab}, which is expressed as the arrows, is the matrix element with the conditions of $V_{ab} = V_{ba}$ and $V_{ab} = V_{ax}V_{xb}$. This lepton matrix can be compared with the quark matrix in Fig. 65.

experimentally. The lepton matrix corresponding to the quark CKM matrix is $\begin{bmatrix} V_{\nu_e e} & V_{\nu_e \mu} & V_{\nu_e t} \\ V_{\nu_\mu e} & V_{\nu_\mu \mu} & V_{\nu_\mu t} \\ V_{\nu_\tau e} & V_{\nu_\tau \mu} & V_{\nu_\tau t} \end{bmatrix}$ but not the known PMNS matrix (U_{ab}). In other words, the lepton matrix element of $V_{\nu_e \mu}$ corresponds to the quark matrix element of V_{us}. Therefore, all of the lepton matrix elements (V_{ab}) in Fig. 67 need to be decided like the quark matrix elements (V_{ab}) which are presented in Fig. 65. The reversed processes of the examples of Fig. 66 can be easily understood, too. In Fig. 68, the lepton matrix element ($V_{\nu_e\mu}$) is compared with the quark matrix element (V_{us}).

The CP violations have been proposed for the K^0 - anti-K^0, B^0 - anti-B^0 and D^0 - anti-D^0 meson systems with the zero electric charges (J.H. Christen et al., Phys. Rev. Lett. **13**, 138 (1964); A. Alavi-Harati et al. (KTeV collaboration), Phys. Rev. Lett. **83**, 22 (1999); V. Fanti et al., Phys. Lett. **B465**, 335 (1999); B. Auber et al. (BABAR collaboration), Phys. Rev. Lett. **86,** 2515 (2001); K. Abe et al. (Belle collaboration), Phys. Rev. Lett. **87**, 091802 (2001); A. Carbone et al. (LHC_B collaboration), arXiv: 1210.8257 (2012)). These CP violations are caused by the mixing of meson and anti-meson with the zero-electric charges. The mixing of the meson and anti-

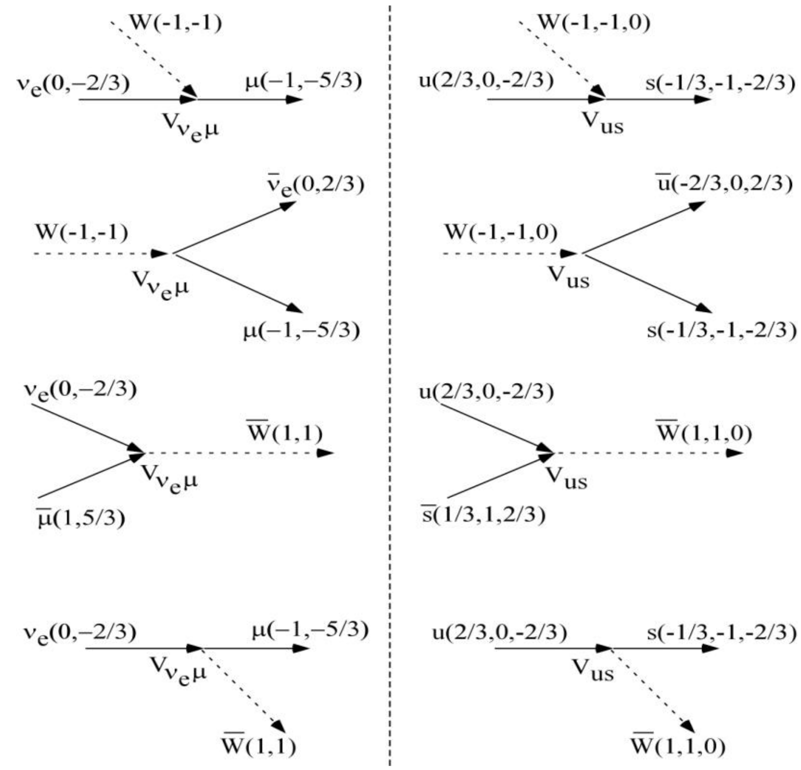


Fig. 68. Lepton matrix element ($V_{\nu_e\mu}$) is compared with the quark matrix element (V_{us}).

meson has been previously described by the box diagram through the exchanges of the W(-1,LC,0) bosons as shown in Fig. 69. If only the electric charges are considered in the box diagram, it works fine. But if the non-zero lepton charges are considered along with the electric charges, the box diagram through the exchanges of the W(-1,LC,0) bosons does not work because of the conservation of the electric (EC) and lepton (LC) charges. In other words, the mixing of the K^0 and anti-K^0 mesons through the exchanges of the W(-1,LC,0) bosons is not allowed because the lepton charges (LC) should be conserved as shown in Fig. 69. In the present

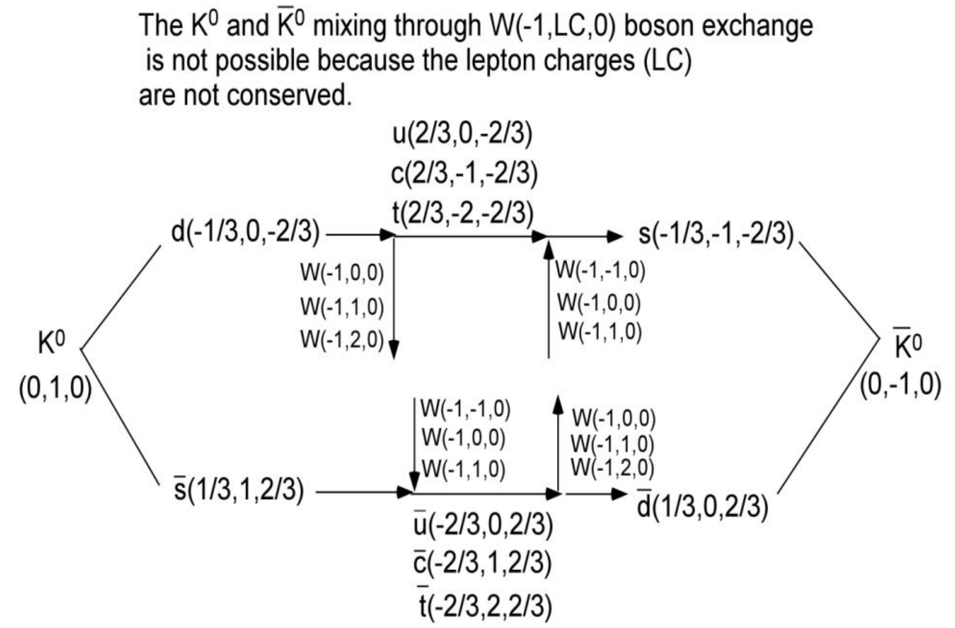


Fig. 69. The box diagram of the K^0 and anti-K^0 mesons through the exchanges of the W(-1,LC,0) bosons is not possible.

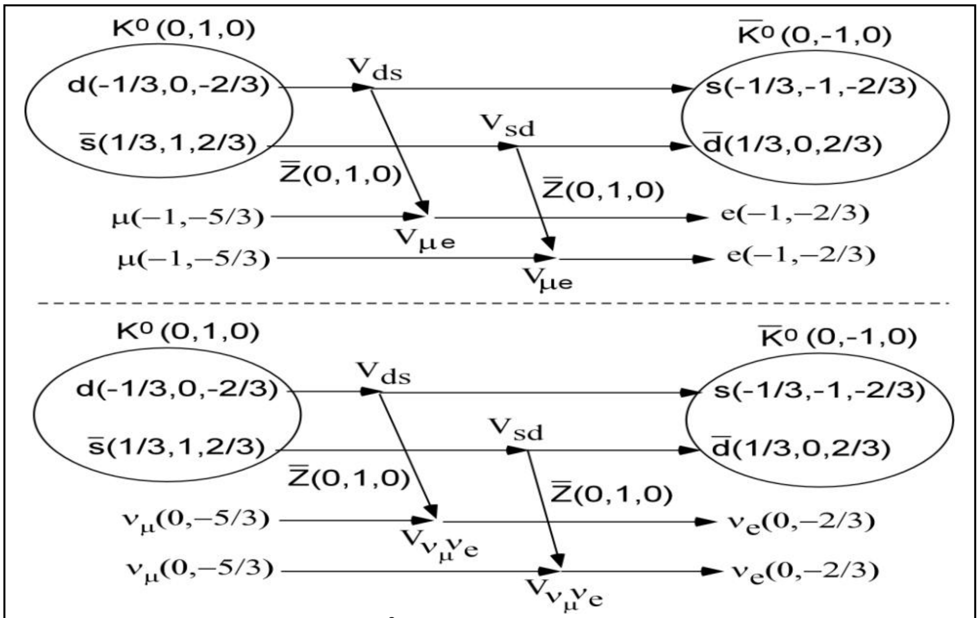


Fig. 70. Interaction of the K^0 meson with the leptons of μ or ν_μ through the exchanges of the Z(0,1,0) bosons. The K^0 meson interaction with the hadrons such as the proton and pion is possible, too.

work, the previously known CP violations of the K^0 - anti-K^0, B^0 - anti-B^0 and D^0 - anti-D^0 meson systems with the zero electric charges are explained by the changes of lepton charges which are caused by the interactions with the leptons through the Z bosons as shown in the K^0 - anti-K^0 examples of Fig. 70.

Therefore, the mixing of the leptons and mixing of the quarks are not allowed because of the charge conservation of EC, LC and CC. The CKM and PMNS matrix elements represent the interaction strength of the quarks and leptons with the Z/W bosons. The CKM and PMNS matrix elements do not mean the previously known mixing of the leptons and mixing of the quarks. In summary, for the K^0 - anti-K^0, B^0 - anti-B^0 and D^0 - anti-D^0 meson systems with the zero electric charges and non-zero lepton charges the CP symmetry is not broken. And the flavor or lepton charge changes of the neutrinos are caused only by the neutrino interaction with other particles but not by the neutrino oscillation due to the neutrino mixing. Because the neutrinos with the zero electric charges have the non-zero lepton charges, the neutrino mixing is not possible. Because the K^0, B^0 and D^0 mesons with the zero electric charges have the non-zero lepton charges, the K^0 - anti-K^0, B^0 - anti-B^0 or D^0 - anti-D^0 meson mixing is not possible, too.

23. The g factor, fine structure constant and electric permittivity

If the observed g factor difference of e and μ is caused mainly by the mass difference effect of e and μ but not the LC charge difference effect of e and μ, the following explanation is possible for the observed g-factors of e and μ.

The QED calculation including the mass effect of each lepton reproduces the observed g-factors of e and μ exactly down to 10^{-11} for the electron and 10^{-6} for the muon (T. Kinoshita, Nucl. Phys. **B(Proc. Suppl.) 157**, 101 (2006)). Therefore, the LC contribution to the g-factor should be smaller than 10^{-11}. If the g-factor comes from both of EC and LC,
for e(-1,-2/3), $\vec{\mu} = g_s \frac{q}{2m}\vec{s} = g_s \frac{-e}{2m}\vec{s} = -\frac{e}{2m}\left(g_s(EC) + g_s(LC)\frac{2}{3}\right)\vec{s}$.
In general, for a particle with (EC,LC), $g_S = |g_S(EC)EC + g_S(LC)LC|$. Therefore, for e(-1,-2/3), $g_S(e) = g_S(EC) + g_S(LC)\frac{2}{3}$ and for μ(-1,-5/3), $g_S(\mu) = g_S(EC) + g_S(LC)\frac{5}{3}$. For ν_e (0,-2/3), $g_S(\nu_e) = g_S(LC)\frac{2}{3}$.

For the electron with (EC,LC) = (-1,-2/3)

$$\alpha = \frac{1}{4\pi\hbar c}\frac{e^2}{\varepsilon_0} = \frac{1}{137.036003} = \frac{e^2}{4\pi\hbar c}\left(\frac{1}{\varepsilon_0(EC)} + \frac{1}{\varepsilon_0(LC)}\frac{4}{9}\right).$$

The ε_0 value is almost equal to the $\varepsilon_0(EC)$ value in the QED calculation in this case. This means that $\varepsilon_0(LC)$ is huge and $\mu_0(LC)$ is negligibly small from the equation of $c = \frac{1}{\sqrt{\varepsilon_0\mu_0}}$. This is a good and reasonable explanation. The measured ν_e magnetic dipole moment (< 10^{-10} μ_B) (A. Cho, Science **137**, 1850 (2007)) of the electron neutrino can be well explained because $\mu_0(LC)$ is negligibly small.

However, alternative explanation for the observed g-factor difference of e and μ is tried, also, as follows. If the observed g-factor difference of e and μ is caused mainly by the LC difference effect of e and μ but not the mass difference effect of e and μ, the following explanation is possible for the observed g-factors of e and μ.

Charged fermions have the magnetic dipole moment of $\vec{\mu} = g_s \frac{q}{2m}\vec{s}$ where g_s is the spin g factor. For the electric charged leptons of e and μ, the spin g factor has been observed. Also, the QED calculations including the mass depending terms have explained the difference between experimental g factor values of e and μ very well. This is very impressive. The observed g_S(e) value and g_S(μ) value are different. This difference can be, also, caused by the lepton charge (LC) difference of e and μ because the electric charges (EC) are the same for e and μ. All of leptons have the assigned EC (electric charge) and LC (lepton charge) in the present work. Therefore, the lepton magnetic moment should come from both of EC and LC.

From this perspective, for e(-1,-2/3), $\vec{\mu} = g_s \frac{q}{2m}\vec{s} = g_s \frac{-e}{2m}\vec{s} = -\frac{e}{2m}\left(g_s(EC) + g_s(LC)\frac{2}{3}\right)\vec{s}$. In general, for a particle with (EC,LC), g_S = -g_S(EC)EC – g_S(LC)LC for EC<0 or EC=0, and g_S = g_S(EC)EC +g_S(LC)LC for EC>0. Therefore, for e(-1,-2/3), g_S(e) = g_S(EC) + g_S(LC) $\frac{2}{3}$ and for μ(-1,-5/3), g_S(μ) = g_S(EC) + g_S(LC) $\frac{5}{3}$. Experimentally, g_S(e) = 2.0023193043768(86) and g_S(μ) = 2.0023318416(12) (T. Kinoshita, Nucl. Phys. **B(Proc. Suppl.) 157**, 101 (2006)). From these experimental g factor values, g_S(EC) = 2.002310946228 and g_S(LC) = 0.0000125372232. By using these two values, we can calculate all of the spin g factors for the leptons. Because the g_S(LC) value is about 10^5 times smaller than g_S(EC), the g_S(QC) value may be about 10^{10} times smaller than g_S(EC). Those g factor values of the leptons are tabulated in Table. 11. Note that the neutrinos also have the non-zero spin g factor values from the contributions of non-zero LC values.

Table 11. The g factor values of the leptons.

Leptons (QE,QL)	g_S
e(-1,-2/3)	2.0023193043768
μ(-1,-5/3)	2.0023318416
τ(-1,-8/3)	2.0023443788232
ν_e(0,-2/3)	0.0000083581488
ν_μ(0,-5/3)	0.0000208953720
ν_τ(0,-8/3)	0.0000334325952

Now I am going to calculate the electric permittivities (ε_0, ε_0(EC) and ε_0(LC)) of the free space from the fine structure constants (α, α(EC) and α(LC)) and the g_S(EC) = 2.002310946228 and g_S(LC) = 0.0000125372232 values. In the following quantum electrodynamics (QED) equation, A_1 coefficients can be calculated by using the Feynman diagram (T. Kinoshita, Nucl. Phys. **B(Proc. Suppl.) 157**, 101 (2006)). Values of the A_1 coefficients were reported by Kinoshita (T. Kinoshita, Nucl. Phys. **B(Proc. Suppl.) 157**, 101 (2006)).

$a_e(EC) = A_1^2\left(\frac{\alpha(EC)}{\pi}\right) + A_1^4(\frac{\alpha(EC)}{\pi})^2 + A_1^6(\frac{\alpha(EC)}{\pi})^3 + A_1^8(\frac{\alpha(EC)}{\pi})^4$, where $a_e(EC) = \frac{g_s(EC)-2}{2}$.

From the above equation, α(EC) is 1/137.53237 because $a_e(EC) = \frac{g_s(EC)-2}{2}$ is 0.001155473125 and g_s(EC) is 2.002310946228. α is 1/137.0360003 because a_e is 0.00115965217 and g_s(e) is 2.0023193043768(86) (T. Kinoshita, Nucl. Phys. **B(Proc. Suppl.) 157**, 101 (2006)).

Then, for the electron with (-1,-2/3),

$$\alpha = \frac{1}{4\pi\hbar c}\frac{e^2}{\varepsilon_0} = \frac{1}{137.036003} = \frac{e^2}{4\pi\hbar c}\left(\frac{1}{\varepsilon_0(EC)} + \frac{1}{\varepsilon_0(LC)}\frac{4}{9}\right).$$

$\alpha = \alpha(EC) + \alpha(LC) = \frac{1}{137.53237} + \alpha(LC)$.

$\alpha(LC) = \frac{1}{137.036003} - \frac{1}{137.53237} = \frac{1}{37969.4528}$.

Therefore, $\varepsilon_0(LC) = 131.2305201\ \varepsilon_0(EC)$.

For the electron, e(-1,-2/3), $\frac{1}{\varepsilon_0} = \left(\frac{1}{\varepsilon_0(EC)} + \frac{1}{\varepsilon_0(LC)}\frac{4}{9}\right)$.

$\varepsilon_0 = 8.854187817 \times 10^{-12}\ \mathrm{Fm}^{-1}$ (J. Alvarez-Gaume et al., Phys. Lett. **B592**, 1 (2004)).

$\varepsilon_0(EC) = 1.003386746\ \varepsilon_0 = 8.884174702\times10^{-12}\ \mathrm{Fm}^{-1}$.

$\varepsilon_0(LC) = 131.2305201\ \varepsilon_0(EC) = 1.165874867\times10^{-9}\ \mathrm{Fm}^{-1}$.

Then, $\varepsilon_0(EC) \ll \varepsilon_0(LC)$.

In general, for the elementary particle with (EC,LC),

$\frac{1}{\varepsilon_0} = \frac{EC^2}{\varepsilon_0(EC)} + \frac{LC^2}{\varepsilon_0(LC)}$.

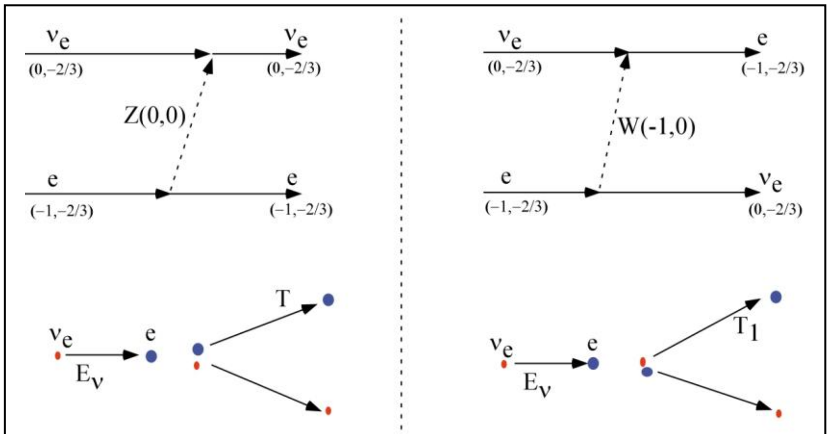


Fig. 71. Three e- ν_e reaction modes of the neutrino magnetic moment measurement. T and T1 are the electron recoil energies.

The Coulomb repulsive force between two electrons (e(-1,-2/3)) is expressed as

$$F = \frac{1}{4\pi r^2}\frac{e^2}{\varepsilon_0} = \frac{e^2}{4\pi r^2}\left(\frac{1}{\varepsilon_0(EC)} + \frac{1}{\varepsilon_0(LC)}\frac{4}{9}\right) = \frac{e^2}{4\pi r^2}\frac{1}{\varepsilon_0(EC)} \times 1.003386746.$$

Now from the equation of $c = \frac{1}{\sqrt{\varepsilon_0\mu_0}}$, the magnetic permeabilities (μ_0(EC) and μ_0(LC)) are obtained as follows.

$\mu_0 = 4\pi\ 10^{-7}\ NA^{-2}$, $\mu_0(EC) = \frac{\mu_0}{1.003386746}$ and $\mu_0(LC) = \frac{\mu_0}{131.6749645}$.

One question needs to be solved in this explanation. The measured ν_e magnetic dipole moment is $< 10^{-10}\ \mu_B$ (A. Cho, Science **137**, 1850 (2007)) and the calculated ν_e magnetic dipole moment is -0.7118 μ_B. This disagreement may be explained as shown in Fig. 71. The g_S value was obtained by fitting the observed electron number (as a function of electron recoil energy) by the theoretical formula (A. Cho, Science **137**, 1850 (2007)). This was done through the electron - ν_e reaction. In the e- ν_e reaction, I am considering three cases in Fig. 47. The leptonic EM interaction through γ or weak interaction through the Z(0,0) boson does not change the lepton flavor. However the weak interaction through the W(-1,0) boson changes the lepton flavor from e to ν_e and ν_e to e in the right reaction mode in Figs. 47 and 71. The weak interaction through the W(-1,0) boson can decrease the electron recoil energy (T_1) and then electron counts at the higher recoil energy (T) can be significantly reduced. Therefore, the standard model calculation should consider these three reaction modes. Or, if the observed g-factor difference of e and μ is caused by not only the LC difference effect of e and μ but also the mass difference effect of e and μ, the

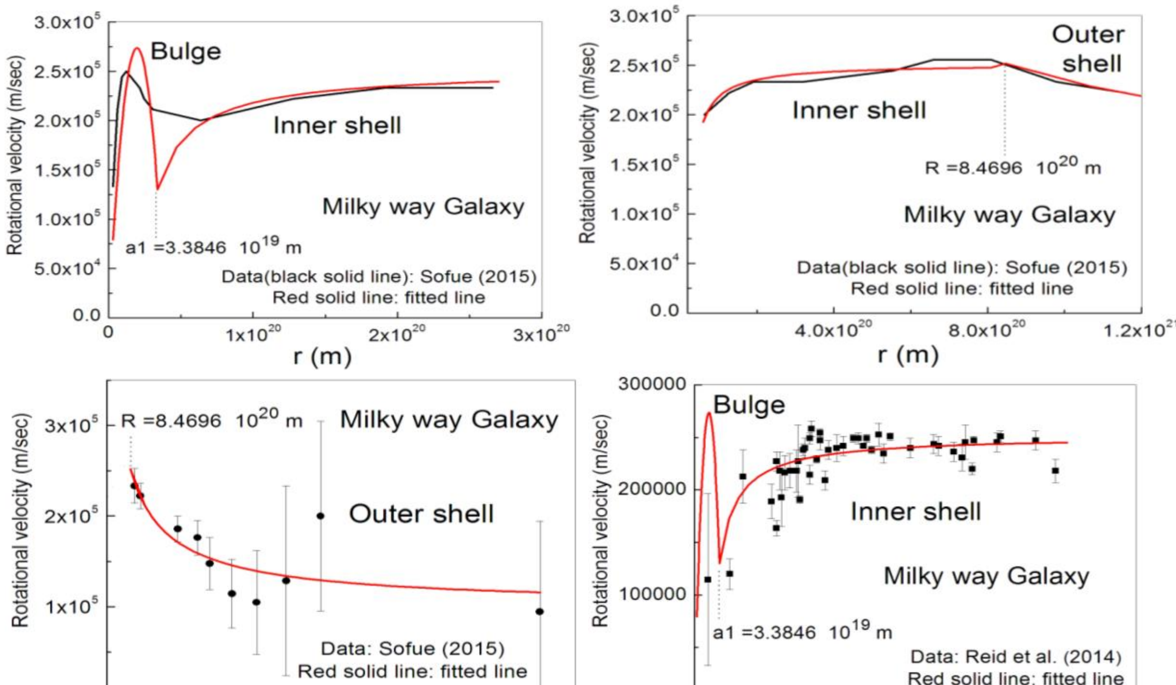


Fig. 72. Orbital rotational velocities in Milky way galaxy (Y. Sofue, Publ. Astron. Soc. Japan **67**, 75 (2015); M.J. Reid et al., Astrophys. J. **783**, 130 (2014)). The bulge radius (a1) is 3.3846 10^{19} m for the Milky way galaxy. See Figs. 73, 74, 79 and 80 for other galaxies.

measured ν_e magnetic dipole moment ($< 10^{-10}\ \mu_B$) (A. Cho, Science **137**, 1850 (2007)) of the electron neutrino can be explained reasonably. This means that the further studies are needed experimentally as well as theoretically to verify whether this alternative explanation is right or not.

24. Dark matters, dark energy and gravitation of the galaxies

Our universe has been treated to be flat in the universe scale. This means that Ω(total matter) is equal to 1. Ω(total matter) = 1 = Ω(matter) + Ω(dark matter) + Ω(dark energy). The dark matters, dark energy and normal matters were observed to be 26.8 %, 68.3 % and 4.9 % of the mass-energy distribution of the universe, respectively, at the present time (N. Jarosik et al.,

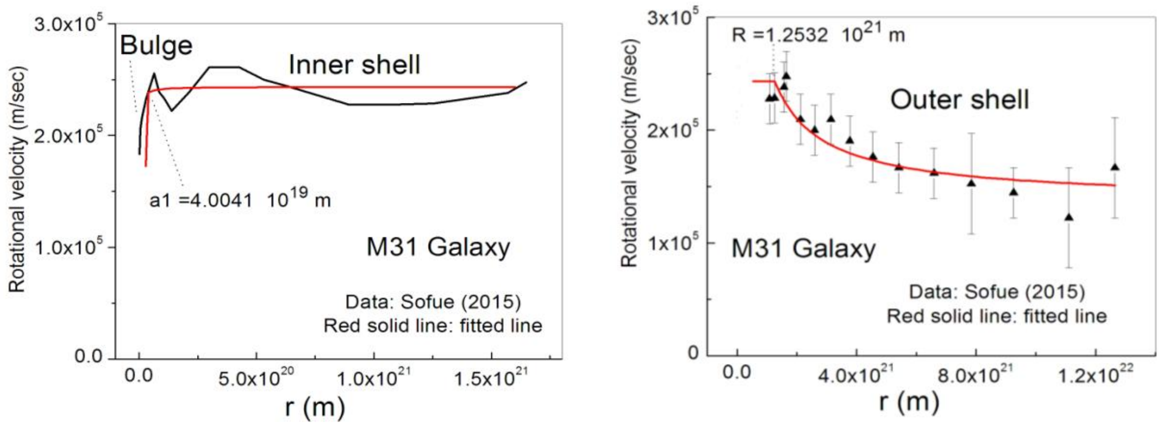


Fig. 73. Orbital rotational velocities in M31 galaxy (Y. Sofue, Publ. Astron. Soc. Japan **67**, 75 (2015). The bulge radius (a1) is 4.0041 10^{19} m. See Figs. 72, 74, 79 and 80 for other galaxies.

Astrophys. J. Suppl. **192**, 14 (2011)). The dark matter has been claimed in order to explain the rather constant rotational velocity of the stars in the Galaxy. The orbital rotational velocity curves have been observed for the NGC3198 spiral galaxy (K.G. Begeman, Astron. Astrophys. **223**, 47 (1989)), M31 galaxy and the Milky way barred spiral galaxy (D. Clements, Ap. J. **295**, 422 (1985); Y. Sofu et al., Publ. Astron. Soc. Japan **61**, 227 (2009); Y. Sofue, Publ. Astron. Soc. Japan; M.J. Reid et al., Astrophys. J. **783**, 130 (2014); M.J. Reid et al., Astrophys. J. **783**, 130 (2014)) as shown in Figs. 72, 73 and 74. The red lines are the fitted lines. When the data observed by Reid et al. are consistent with those reported by Sofue (Y. Sofue, Publ. Astron. Soc. Japan **67**, 75 (2015)) as shown in Fig. 72.

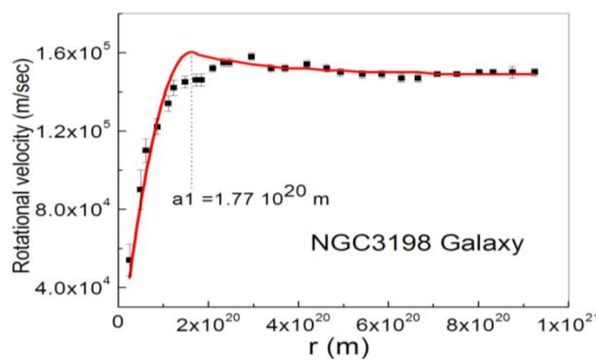


Fig. 74. Orbital rotational velocities in NGC3198 galaxy (K.G. Begeman, Astron. Astrophys. **223**, 47 (1989)). The bulge radius (a1) is 1.77 10^{20} m for the NGC3198 galaxy

In the present work, the data of the NGC3198, M31 and Milky way galaxies as shown in Figs. 72, 73 and 74 are used to fit the observed orbital rotational velocity curves. From the circular motion formula, $v^2/r = GM/r^2$. Here, $v = (GM/r)^{0.5}$. Then M is the summation of all masses within the spherical surface with the radius of r. The mass and radius of the galaxy bulge core including the black hole are m1 and a1, respectively. In order to make the orbital rotational velocity to be nearly constant in the outside of this bulge core, the effective mass density (ρ(dark matter halo)) of the dark matter halo at r > a1 is taken as $b_1 m1/r^2$ (kg/m^3) where b_1 is the constant parameter. Then the effective mass (m(dark matter halo)) of the dark matter halo within the sphere with the radius of r is $4\pi b_1 m1(r\text{-}a1)$ in Fig. 75. In order to make the orbital rotational velocity to be nearly constant in the outside of the bulge core, the summed mass (m(stars+disk)) of the normal matter stars and disk in the outside of the bulge core is assumed to be dm1(r-a1) where d is the constant as shown in Fig. 75. The stars, halo and dusts of the normal matters are included in the mass of m(stars) and m(disk) is the mass of the normal matter disk. If the dark matter disk exists, this dark matter disk mass can be included as m(dark matter) = m(dark matter halo) + m(dark matter disk). Here it is assumed that the dark matter mass and the normal matter mass associated with the bulge are proportional to the mass (m1) of the bulge core. The galaxy bulge consists of the normal matters (baryons and leptons) and the black hole. The inner shell has the normal matters and dark matters and the outer shell has the dark matters (bastons) as shown in Fig. 25. In Fig. 75, the spiral galaxy with the disks of the normal matters and dark matters is shown. In Fig. 76, the elliptical galaxy and the possible dark matter galaxy without the disks of the normal matters and dark matters are compared with the spiral galaxy. Also, the structures of the stars like the sun, planets like the earth, proton and electron are compared in Fig. 76, too. The three components of the bulge, inner and outer shells are defined in the present work.

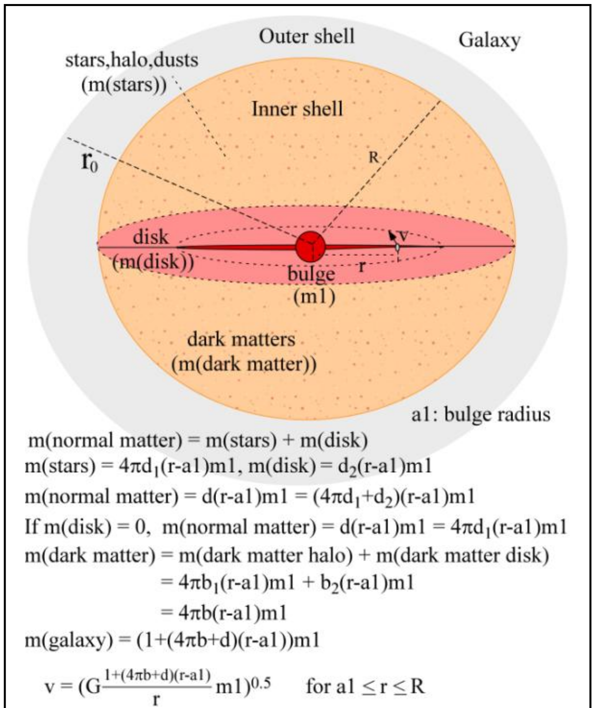


Fig. 75. Galaxy structure with the disk. See the text and Fig. 81 for the more explanation. The dark matters are the bastons (see Fig. 25).

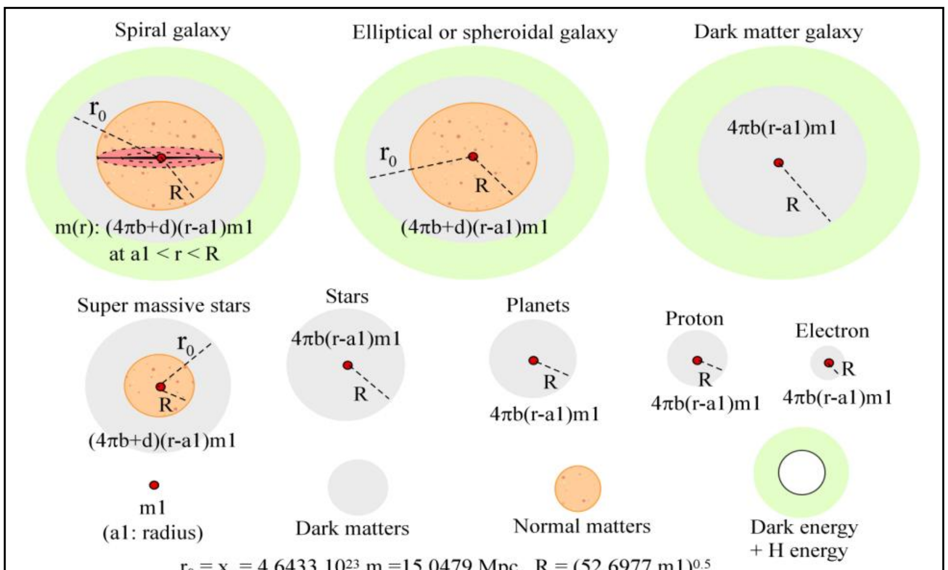


Fig. 76. Dark matters and normal matters associated with the masses (m1).

In the present work, the dark matters and normal matters of the galaxy could have both of the disk and halo in the spiral galaxy. The normal matters were observed to have both of the halo and disk in the spiral galaxy of Fig. 75. Therefore, m(normal matter halo) = $4\pi d_1$(r-a1) = m(stars) and m(normal matter disk) = d_2(r-a1) = m(disk) are defined in Fig. 75. And m(normal matter halo and disk) = ($4\pi d_1$+ d_2)(r-a1) = d(r-a1) = m(stars + disk) = m(normal matter). And, the dark matters can have both of halo and disk in Fig. 75, too. Therefore, m(dark matter halo) = $4\pi b_1$(r-a1) and m(dark matter disk) = b_2(r-a1) are defined in the present work. And m(dark matter halo and disk) = ($4\pi b_1$+ b_2)(r-a1) = 4πb(r-a1) = m(dark matter) is defined in the present work. It is thought that the dark matter disk is overlapped with the normal matter disk in Fig. 75. Then, M = m(r) = $(1+(4\pi b+d)(r-a1))m1$ in the inner shell and m1 is the mass of the bulge. The d_2 and b_2 values are zero for the elliptical galaxy without the disks of the normal and dark matters in the inner shell. In the outer shell, the mass of m(r) is decreased when compared with the mass of m(r) calculated with the formula used in the inner shell as shown in the data of Milky way and M31 galaxies in Figs. 72 and 73. This decreasing effect of the mass m(r) in the outer shell can be explained by introducing the new term of -4πt(r-R)m1 into M = m(r) = $(1+(4\pi b+d)(r-a1)-2\pi t(r-R))m1$. The outer shell should have only the dark matters (bastons) as proposed in Fig. 25. Therefore, d(r-R) is equal to 4πt(r-R). This leads to m(r) = $(1+d(R-a1)+4\pi b(r-a1))m1$ at R ≤ r ≤ r_0. The R values are calculated for the Milky way galaxy and M31 galaxy by fitting the data as shown in Figs. 72 and 73. The dark matters have the enough kinetic energy to reach the distance range of the gravitational force if the galaxy bulge is very active and creates both of the normal matters and dark matters in Figs. 76 and 25. In this case, the radius of r_0 is equal to the range of the gravitational force which is 4.6433 10^{23} m. If the galaxy is not active enough to create the normal matters, only the dark matters are created to form the shell with the radius of R in Fig. 76. The force range of the massive graviton is the radius limit of the galaxy cluster which is the largest gravitational structure in the universe.

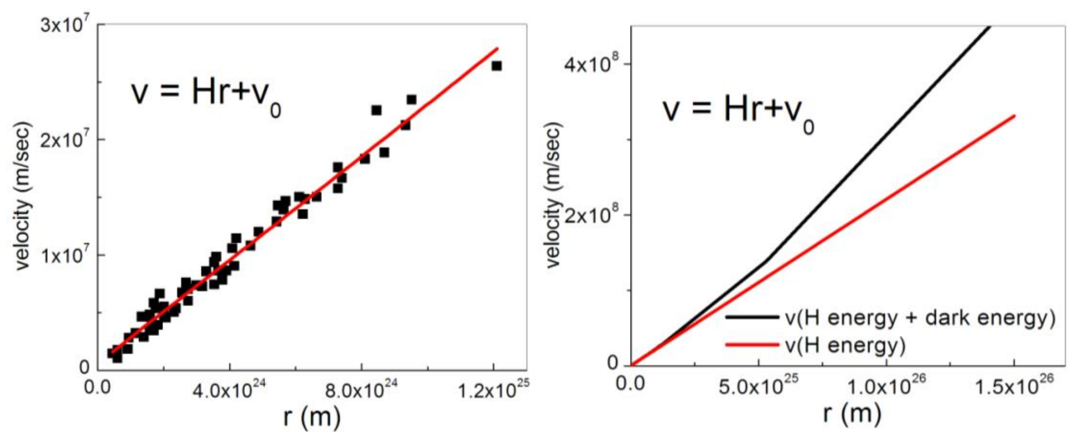


Fig. 77. Hubble diagram (W.L. Freedman et al., Astrophys. J. **553**, 47 (2001).) See Fig. 85.

In the present work, three mass equations of m(r) = $(\beta r-\frac{\beta a1-v_a}{a1^2}r^2)^2$r/G for the bulge region at r ≤ a1, m(r) = $(1+(4\pi b+d)(r-a1))m1$ for the inner shell region at a1 ≤ r ≤ R and m(r) = $(1+(4\pi b+d)(r-a1)-2\pi t(r-R))m1=(1+d(R-a1)+4\pi b(r-a1))m1$ for the outer shell region at R ≤ r ≤ r_0 are used as explained in the text. Also, the mass terms of m(dark energy) caused by the dark energy and m(H energy) caused by the warped space effects on the expansion of the space as shown in Fig. 6 are considered at r_0 ≤ r. At r ≤ r_0, $\rho(dark\ energy)$ = 0 and $\rho(H\ energy)=0$ at the present time. From these conditions, the proposed equations of

$\rho(H\ energy)$ and $\rho(dark\ energy)$ associated with the mass m1 are $\rho(H\ energy) = \frac{\varepsilon(r-r_0)}{r}$ and $\rho(dark\ energy) = \frac{\varepsilon_1(r-r_0)^2}{r}$ at $r_0 \le r$ in Figs. 77 and 78. Therefore, the mass term of m(H energy) is m(H energy) = $2\pi\varepsilon(2r^3-3r_0r^2+r_0^3)/3$. And the mass term of m(dark energy) is the m(dark energy) $= 4\pi\varepsilon_1(\frac{r^4}{4} - \frac{2r_0r^3}{3} + \frac{r_0^2r^2}{2} - \frac{5r_0^4}{12})$ term. Then, m(r) $= -(m(dark\ energy) + m(H\ energy))$ for the region at $r_0 \le r$ in Figs. 77 and 78 is used for the equations of $a = \frac{F}{m} = \frac{Gm(r)}{r^2}, a = -\frac{4\pi G}{3}\rho r, v = Hr\ and\ H^2 = \frac{8\pi G}{3}\rho$ obtained from the Friedmann equations. The H term gives rather steady space expansion and the dark energy term makes the accelerated space expansion as shown in Fig. 77. The m(H energy) = $2\pi\varepsilon(2r^3-3r_0r^2+r_0^3)/3$ term of the H energy shown in Fig. 6 is associated with the warped spaces and big bang and causes the steady space expansion with the Hubble's constant of H_0 for the region at $r_0 \le r$. Therefore, the m(dark energy) $= 4\pi\varepsilon_1(\frac{r^4}{4} - \frac{2r_0r^3}{3} + \frac{r_0^2r^2}{2} - \frac{5r_0^4}{12})$ term of the dark energy shown in Fig. 6 adds up the additional

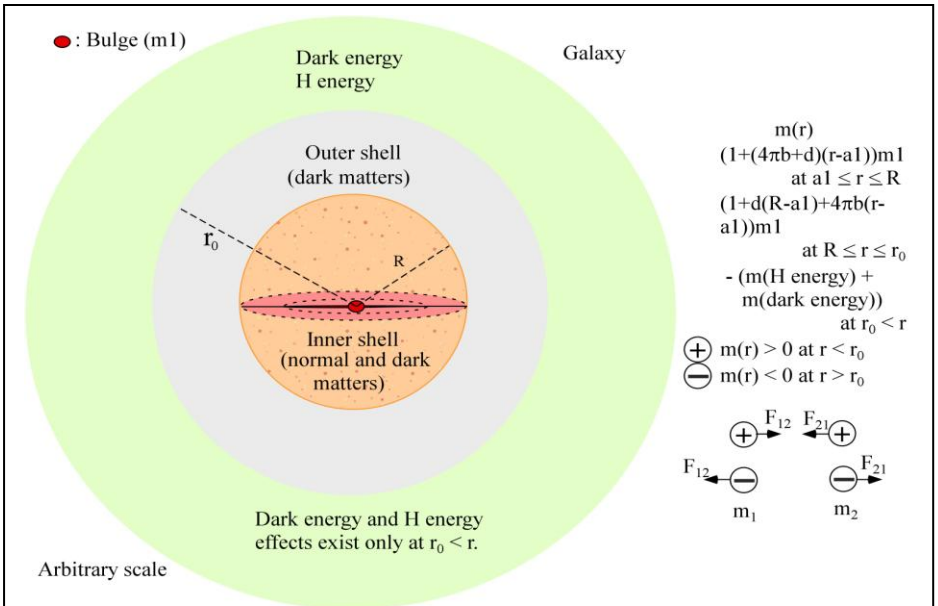


Fig. 78. Dark matters and normal matters associated with the masses (m1). See Figs. 86 and 87 for more details.

acceleration to the steady space expansion with the Hubble's constant of H_0 which is made by the H energy for the region at $r_0 \le r$. Because the Local group including the Milky way galaxy has the normal matter diameter of 2 Mpc = 6.172 10^{22} m (E.K. Grebel, IAU Symposium **192**, 17 (1999)) smaller than r_0 = 4.6433 10^{23} m, it is assumed that the dark energy and H energy effects take place at $r = r_0$. For example, the maximum distance error of 2 Mpc = 6.172 10^{22} m for the 100 Mpc = 3.086 10^{24} m in Fig. 77 does not change the present fitting result (see Fig. 88).

The values of the variables are shown in Tables 12 and 13. The ε and ε_1 fitting parameters are obtained from the Hubble diagram in Fig. 77. The obtained fitting parameters of ε, ε_1 and v_0 are 8.6883(3814) 10^{-27} kg/m^3, 8.8729(41000) 10^{-53} and 1.222926(217700) 10^6 m/sec, respectively. The v_0 value is introduced because the data shown in Fig. 77 are fitted only for $r > r_0$ and the H value has the uncertainty near r = 0. Really, at the viewpoint of the time evolution the H value should be very large near the beginning time ($r < r_0$) of the universe because of the big bang effect. At r > r_0, the ε value depends on the curvature (warping energy) of the whole universe but not on the warping energies (masses) of the individual matters as shown in Fig. 59 (see Fig. 83). When the universe radius reaches the gravitational force range of $r_0 = x_r = 4.6433\ 10^{23}$ m (see Fig. 83), the dark energy starts to appear. So the fitted H value in Fig. 77 works only at r > r_0 (see Fig. 83). The anti-gravitational force of the H energy and dark energy is made by the space quanta as

Table 12. Definitions and obtained values of the parameters used in the present work.

formula		Milky way	M31	Sun
b		$1.3718\ 10^{-21}$	$6.5904\ 10^{-22}$	$4.88(40)\ 10^{-23}$
d	4πt	$9.3132\ 10^{-20}$	$1.7766\ 10^{-20}$	0.0
m(normal matter), a1<r<R	d(r-a1)m1			0.0
m(normal matter), R<r	d(R-a1)m1	$6.4991\ 10^{41}$	$7.3518\ 10^{41}$	
m(dark matter), r=R	4πb(R-a1)m1	$1.2030\ 10^{41}$	$3.4271\ 10^{41}$	$1.2496\ 10^{25}$
m(dark matter), a1<r<r_0	4πb(r-a1)m1			
m(dark matter), r_0 <r	4πb(r_0-a1)m1	$6.8691\ 10^{43}$	$1.3116\ 10^{44}$	
m_{bh}	m_{bh} << m1	$8.59\ 10^{36}$		
m1	m1	$8.5823\ 10^{39}$	$3.4110\ 10^{40}$	$1.9886\ 10^{30}$
m(R)		$7.7879\ 10^{41}$	$1.1120\ 10^{42}$	$1.9886\ 10^{30}$
r_0	$4.6433\ 10^{23}$ m			
m(r_0) = (1+d(R-a1)+4πb(r_0-a1))m1		$6.9349\ 10^{43}$	$1.3193\ 10^{44}$	
m(r) = -(m(dark energy)+m(H energy)) at r > r_0				
m(r) > 0 at r < r_0, m(r) <0 at r > r_0				
ε (kg/m3)	$8.6883(3814)\ 10^{-27}$			
ε_1	$8.8729(41000)\ 10^{-53}$			
v_0 (m/sec)	$1.222926(217700)\ 10^{6}$			

shown in Fig. 6. The gravitational force is made by the massive gravitons. For the independent masses with only one shell of dark matters which are not within the galaxy as shown in Fig. 76, the dark energy and H energy effects exist at R < r. Therefore for these masses in Fig. 76, the r_0 value should be replaced with the R value in order to calculate the m(H energy) and m(dark energy) values. For the masses with only one shell of dark matters which are within the galaxy, the dark energy and dark matter cannot exist around the masses because the galaxy pushes away the dark energy and H energy out of the galaxy. For the independent dark matter galaxy with only one shell of dark matters in Fig. 76, the dark energy and H energy effects exist at R < r. Therefore, for this dark matter galaxy in Fig. 76, the r_0 value should be replaced with the R value in order to calculate the m(H energy) and m(dark energy) values.

And, at a1 ≤ r ≤ R, $v = (G\frac{(1+(4\pi b+d)(r-a1))m1}{r})^{0.5}$. The fitting parameters for nine galaxies in Figs. 72, 73, 74, 78 and 79 are shown in Table 12. The fitted velocity curves for the Milky way galaxy are shown as the solid red lines in Fig. 72. m_{dm} and m_{sd} are m(dark matter) = 4πb(R-a1) and m(normal matter) = d(R-a1) at r = R, respectively. The radius of R is the radius of the inner shell associated with the mass of m1 as shown in Figs. 75, 76 and 78. Therefore, $m_{dm} + m_{sd} = (4\pi b+d)(R-a1)m1$. And the total mass (m(Milky way)) of the Milky way galaxy is m(Milky way) = $m1+m_{dm} + m_{sd}$ = 7.7879 10^{41} kg at r = R = 8.4696 10^{20} m. For the M31 galaxy, R is 1.2532(1245) 10^{21} m. And the total mass (m(M31)) of the M31 galaxy is m(M31) = $m1+m_{dm} + m_{sd}$ = 1.112 10^{42} kg at r = R = 1.2532(1245) 10^{21} m. In general, for the inner shell of the galaxy at a1 ≤ r ≤ R, $v = (G\frac{(1+(4\pi b+d)(r-a1))m1}{r})^{0.5}$.

Table 13. Fitting parameter values of the mass equations for the galaxies.

Galaxies	4πb+d 10^{-20}	a1 (m) 10^{19}	m1 (kg) 10^{39}	β 10^{-14}	t 10^{-21}	R (m) 10^{20}
Milky way	11.037 (348)	3.3846 (3917)	8.5823 (2627)	2.7876 (1960)	7.4112 (5608)	8.4696 (14174)
M31	2.6048 (2191)	4.0041 (2506)	34.11 (238)	0.61226 (121)	1.4138 (891)	12.5321 (1245)
NGC3198	0.47292 (1482)	17.700 (249)	67.36 (129)	0.19751 (1048)		
M33	2.9735 (1211)	7.10 (20)	7.10 (20)	0.27228 (1408)		
NGC4378	0.86132 (1290)	8.1958 (531)	151.66 (150)	1.0289 (48)		
F568-3	2.7101 (10123)	11.20 (45)	8.2443 (18975)	0.072285 (5890)		
NGC1560	2.1027 (1537)	14.10 (10)	7.3525 (2746)	0.098105 (2327)		
NGC1003	0.65777 (645)	33.238 (273)	37.507 (249)	0.084678 (1513)		
NGC6946	8.3249 (6477)	4.7043 (65)	5.7435 (3685)	0.81781 (7985)		

For the outer shell at R ≤ r ≤ r_0,
$v = (G\frac{(1+(4\pi b+d)(r-a1)-4\pi t(r-R))m1}{r})^{0.5} = (G\frac{(1+d(R-a1)+4\pi b(r-a1))m1}{r})^{0.5}$. And a mass of m1 with the radius a1 has to be replaced as $(1 + (4\pi b + d)(r - a1))m1 = \alpha(m1)m1$ or G has to be replaced with $G(1 + (4\pi b + d)(r - a1)) = G\alpha(m1)$ at a1 ≤ r ≤ R. The orbital rotational velocity curves in NGC3198, M31 and Milky way galaxies are well reproduced by using the present fitting processes as shown in Figs. 72, 73, 74, 79 and 80. From the Figs. 72 and 73 for M31 and Milky way galaxies, the d=4πt and (4πb+d) values are obtained. Then the b values for these two galaxies are extracted. The b and d values of the M31 and Milky way galaxies are shown in Table 13. The m(dark matter) and m(normal matter) values are, also, tabulated in Table 13. And the orbital rotational velocity (v) is proportional to $\sqrt{m1}$. At the earth scale of the mass, this modified gravitational formula becomes the usual gravitational force formula of $F_{12} = G\frac{m1m2}{r^2}$ because, for the relatively small masses of m1 and m2 within the inner shell of the galaxy, m(dark matter) associated with these masses of m1 and m2 is negligible and the dark energy and H energy do not exist inside the inner shell and outer shell of the galaxy. Two galaxies at the distance of r < r_0 attract each other because two masses have the positive sign in the mass of m(r). It predicts that the maximum diameter of the possible galaxy cluster in the

normal matter distribution is equal to the order of r_0 = 4.6433 10^{23} m which is consistent with the diameters of the observed galaxy clusters less than 10 Mpc = 3.086 20^{23} m (http://en.wikipedia.org/wiki/Galaxy_cluster (2015)).

Table 14. Comparison between the suggested and present localized dark matter densities. 1 AU = 1.496 10^{11} m. ρ(present) is calculated by using the obtained b value of 4.8848(3970) 10^{-23} for the sun.

Planets	Distance r(AU)	ρ (kg/m³)		ρ(present) (kg/m³)
Mercury	0.387	$\leq 3\ 10^{-14}$	$\leq 4\ 10^{-14}$	2.898 10^{-14}
Venus	0.723	$\leq 7\ 10^{-15}$	$\leq 8\ 10^{-14}$	8.303 10^{-15}
Earth	1.000	$\leq 8\ 10^{-16}$	$\leq 7\ 10^{-16}$	4.340 10^{-15}
Icarus	1.076	$\leq 1.8\ 10^{-13}$		3.749 10^{-15}
Mars	1.524	$\leq 7\ 10^{-16}$	$\leq 3\ 10^{-16}$	1.869 10^{-15}
Jupiter	5.203	$\leq 5\ 10^{-15}$		1.603 10^{-16}
Saturn	9.537	$\leq 3\ 10^{-15}$		4.772 10^{-17}
Uranus	19.191	$\leq 2\ 10^{-15}$		1.178 10^{-17}
Neptune	30.069	$\leq 3\ 10^{-15}$		4.800 10^{-18}
Pluto	35.529	$\leq 8\ 10^{-15}$		3.438 10^{-18}

The mass density (ρ(dark matter) = bm1(sun)/r^2 (kg/m^3)) of the localized dark matter is associated with the mass of the sun in Fig. 76. In this case, m1 is the mass (m1(sun)) of the sun

Table 15. The R values obtained by using the equation of $R = \sqrt{52.6977\ m1}$. The 4πb+d values of the proton and earth are speculated.

	m1 (kg)	R (m)	a1 (m)	4πb+d
electron	9.10938 10^{-31}	6.92852 10^{-15}		
proton	1.67262 10^{-27}	2.96889 10^{-13}	8.7680 10^{-16}	(~10^{-37})
person	100	72.5931815		
earth	5.972 10^{24}	1.77401 10^{13}	6.3710 10^{6}	(~10^{-24})
sun	1.98855 10^{30}	1.02368 10^{16}	6.9600 10^{8}	6.1384 10^{-22}
Milky way	8.5823 10^{39}	6.72508 10^{20}	3.3846 10^{19}	1.1037 10^{-19}
M31	3.411 10^{40}	1.34072 10^{21}	4.0041 10^{19}	2.6048 10^{-20}
NGC3198	6.736 10^{40}	1.88407 10^{21}	1.7700 10^{20}	4.7292 10^{-21}
M33	7.10 10^{39}	6.11681 10^{20}	7.1000 10^{19}	2.9735 10^{-20}
NGC4378	1.5166 10^{41}	2.82704 10^{21}	8.1958 10^{19}	8.6132 10^{-21}
F568-3	8.2443 10^{39}	6.59132 10^{20}	1.1200 10^{20}	2.7101 10^{-20}
NGC1560	7.3525 10^{39}	6.22463 10^{20}	1.4100 10^{20}	2.1027 10^{-20}
NGC1003	3.7507 10^{40}	1.40589 10^{21}	3.3238 10^{20}	6.5777 10^{-21}
NGC6946	5.7435 10^{39}	5.50154 10^{20}	4.7043 10^{19}	8.3249 10^{-20}

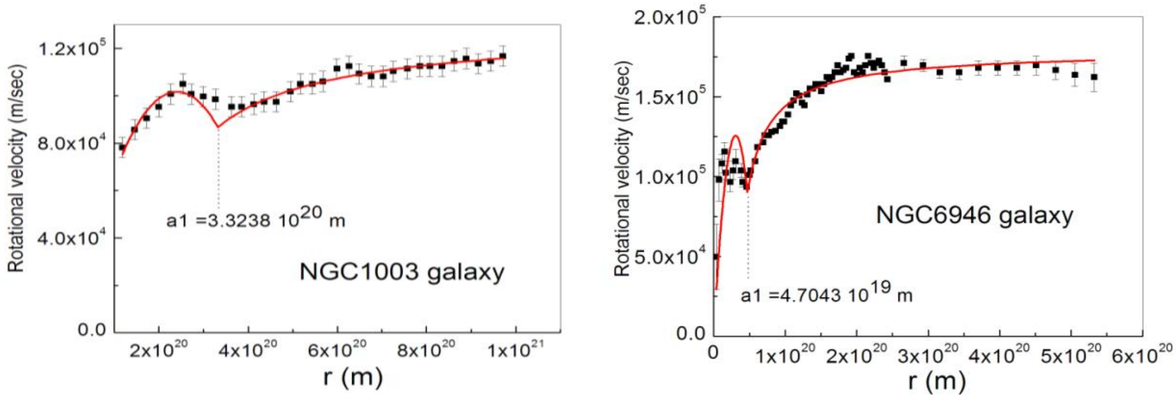


Fig. 79. Orbital rotational velocities in NGC1003 galaxy (V.H. Robles et al., Astrophys. J. **763**, 19 (2013)) and NGC6946 galaxy (A. Diaferio et al., arXiv: 1206.6231 (2012)). The bulge radius (a1) is 3.3238 10^{20} m for the NGC1003 galaxy and 4.7043 10^{19} m for the NGC6946 galaxy. See Figs. 72, 73, 74 and 79 for other galaxies.

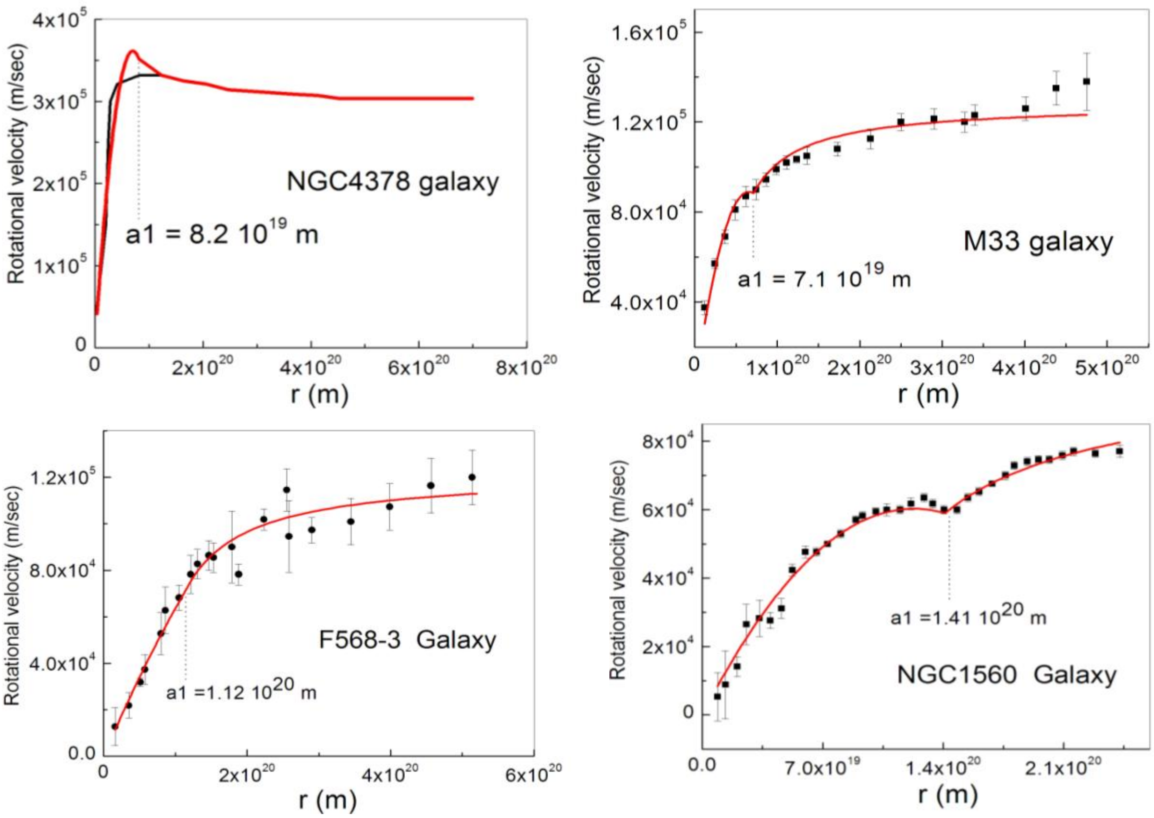


Fig. 80. Orbital rotational velocities in M33 galaxy (E. Corbelli and P. Salucci, arXiv: astro-ph/9909252 (1999)), NGC4378 galaxy (V.C. Rubin, Comments on Astrophys. **8**, 79 (1979)), NGC1560 galaxy (V.H. Robles and T. Mators, Astrophys. J. **763**, 19 (2013)) and F568-3 galaxy (D.H. Weinberg et al., PANS **112**, 12249 (2015)). The bulge radius (a1) is 7.1 10^{19} m for the M33 galaxy, 8.2 10^{19} m for the NGC4378 galaxy, 1.41 10^{20} m for the NGC1560 galaxy and 1.12 10^{20} m for the F568-3 galaxy. See Figs. 72, 73, 74 and 79 for other galaxies.

and r is the distance from the sun. Since the year of 1995, the upper limits of dark matter densities causing the perihelion precession of the solar planets, Pluto and Asteroid Icarus have been reported (O. Gron and H.H. Soleng, Astrophys. J. **456**, 445(1996); M. Sereno and Ph. Jetzer, Mon. Not. Roy. Astron. Soc., **371**, 626 (2006) ; I.B. Khriplovich, arXiv :astro-ph/0702260.) as shown in Table 14. In the present work, the upper limit values of the ρ(dark matter) values are fitted by the equation of ρ(dark matter) = $bm1(sun)/r^2$ (kg/m^3) to obtain the b value as shown in Table 14. The obtained b value of the sun is $4.8848(3970)\ 10^{-23}$. The present calculations are in a good agreement with those upper limits of the dark matter as shown in Table 14. The dark matter density at the sun's location associated with the bulge mass (m1(Milky way)) of the Milky way galaxy is estimated as ρ(dark matter) = $bm1(milky\ way)/r^2$ (kg/m^3) = $1.93093\ 10^{-22}$

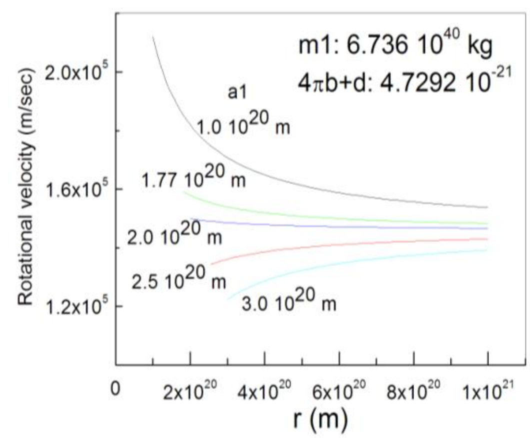


Fig. 81. Rotational velocity curves are compared by changing only the a1 values.

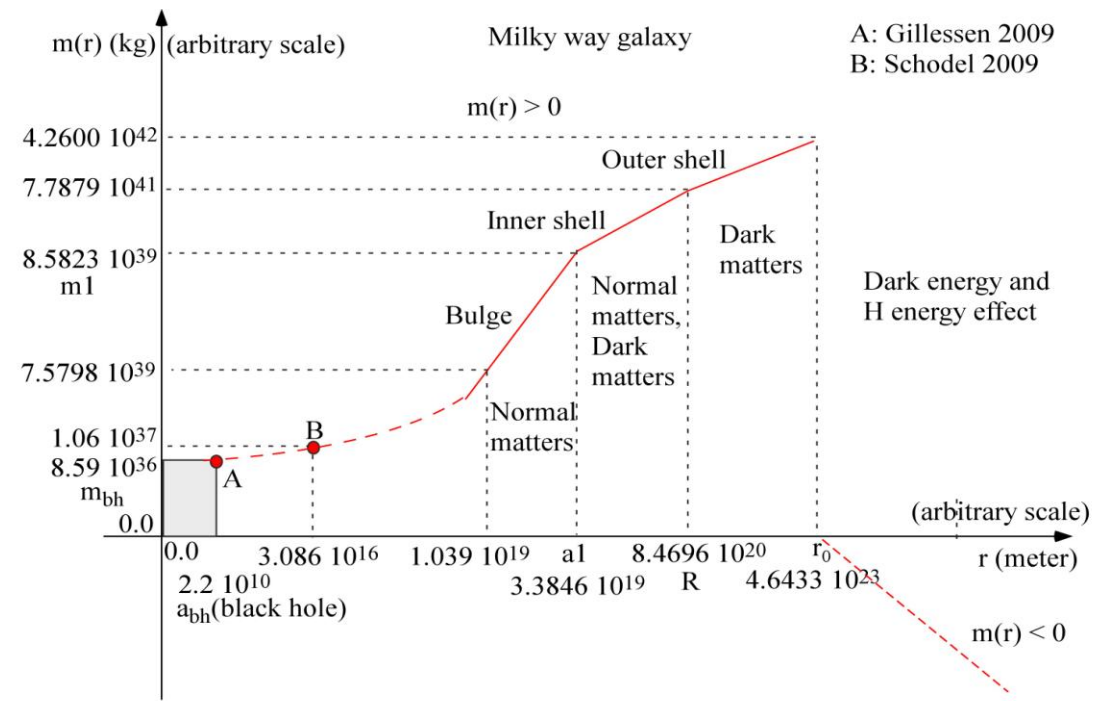


Fig. 82. Structure of the Milky way galaxy based on the present work. The dark energy and H energy effects are assumed to take place at r_0 because the Local group normal matter size is smaller than r_0. See Figs. 87 and 88.

kg/m^3 which is much smaller than the dark matter densities associated with the sun shown in Table 14. Here r is the distance from the bulge mass of the Milky way galaxy to the sun's location. Therefore, it indicates that the sun has the dominating effect on the dark matter distribution within the solar system.

The dark matter effects can be disregarded for the planets like the earth because the dark matters have the small effects on the stars like the sun in the modified gravitational force (F_{12}). However,

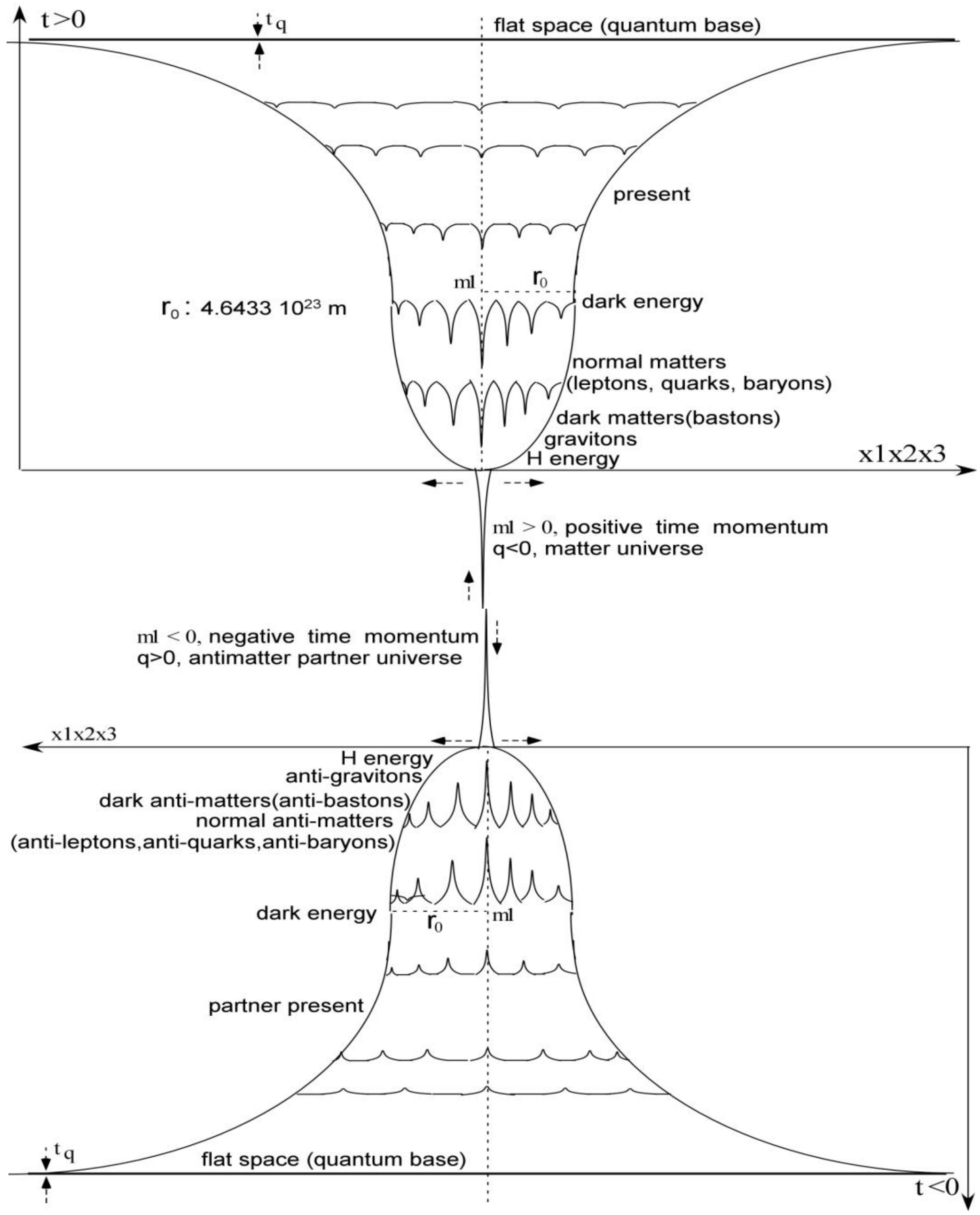


Fig. 83. Evolution of our matter universe and its antimatter partner universe. Note that the pair of the universe and its partner universe makes a birth from the nothing and become the flat space of the quantum base. See Figs. 6 and 78.

the dark matters have the large effects on the galaxies. Therefore, the dark matter effects on the small matters on the earth can be disregarded. For the galaxy at $a1 \leq r \leq R$, the equation of $v = (G\frac{(1+(4\pi b+d)(r-a1))m1}{r})^{0.5}$ can reproduce the various rotational velocity curves of the galaxies by changing the fitting parameter values of m1, 4πb+d and a1 as shown in Fig. 81. In

Fig. 81, the m1 and 4πb+d values are fixed and only the a1 values are changed. If all three parameters of m1, 4πb+d and a1 are changed, it can reproduce successfully the observed rotational curves for the galaxies like M33, M31, NGC4984, NGC4378, NGC3145, NGC1620, NGC7664, NGC1560, F568-3, NGC1003 and NGC6946. Therefore, the bulge masses (m1) and bulge radii of other galaxies can be estimated by following the same calculation processes of the present work. In Fig. 79, the orbital rotational velocities in NGC1003 galaxy (V.H. Robles et al., Astrophys. J. 763, 19 (2013)) and NGC6946 galaxy (A. Diaferio et al., arXiv: 1206.6231 (2012)) are fitted by using the equation of $v = (G\frac{(1+(4\pi b+d)(r-a1))m1}{r})^{0.5}$ at a1 ≤ r ≤ R. In Fig. 80, the orbital rotational velocities in M33 galaxy (E. Corbelli and P. Salucci, arXiv: astro-ph/9909252 (1999)), NGC4378 galaxy (V.C. Rubin, Comments on Astrophys. **8**, 79 (1979)), NGC1560 galaxy (V.H. Robles and T. Mators, Astrophys. J. **763**, 19 (2013)) and F568-3 galaxy (D.H. Weinberg et al., PANS **112**, 12249 (2015)) are fitted by using the equation of $v = (G\frac{(1+(4\pi b+d)(r-a1))m1}{r})^{0.5}$ at a1 ≤ r ≤ R.

The fitted curves are shown as the solid red lines in Fig. 80. The fitted curves are shown as the solid red lines in Figs. 79 and 80. And the obtained fitting parameters are shown in Table 13. The R values are obtained by fitting the orbital rotational velocities of the Milky way galaxy and M31 galaxy. But the R values for other galaxies are unknown. Then, the general equation of $R = \sqrt{52.6977\,m1}$ is obtained from the R values of the Milky way galaxy and M31 galaxy in Table 12. The possible R values calculated by using the equation of $R = \sqrt{52.6977\,m1}$ are tabulated for electron, proton, person, sun and nine galaxies in Table 15. Therefore, the R value for any known mass of m1 can be easily calculated.

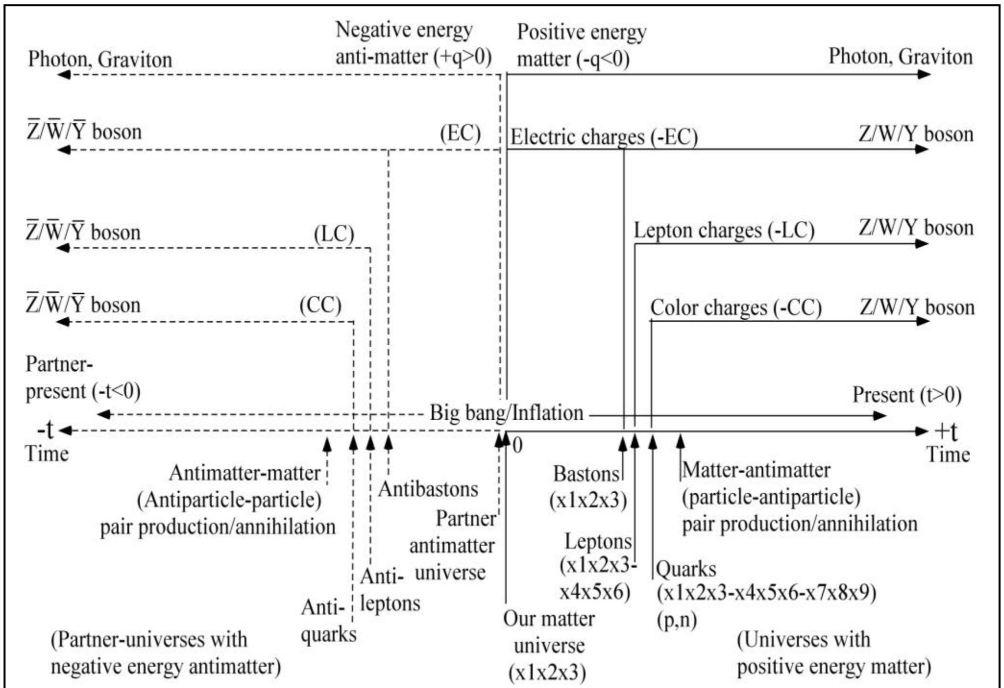


Fig. 84. Simple evolution scheme of our universes.

Now the rotational curves in the bulges of the galaxies are discussed. The bulge shows the orbital rotational curve shape similar to the rigid body rotational curve shape following the equation of v

= 2πr/T (T: constant time period). In the present work, the deviation of the real rotational curve in the bulge of the galaxy from the rigid body rotation is explained by the equation of $v = \beta r - \alpha r^2$ for $r \leq a1$. This means that the time period is not a constant and is increasing with the increasing of the distance (r) from the center when compared with the pure rigid body rotation approximation. Then at r = a1, the value of $v_a = (G\frac{(1+(4\pi b+d)(a1-a1))m1}{r})^{0.5} = (\frac{Gm1}{r})^{0.5}$ should be the same to the value of $v_a = \beta a1 - \alpha a1^2$. From this condition, $v = \beta r - \frac{\beta a1 - v_a}{a1^2} r^2$ for $r \leq a1$ in Fig. 79. The obtained β values are shown in Table 13. The fitted lines are shown as the red lines in Figs. 72, 73, 74, 79 and 80.

Therefore, the galaxy has the bulge (bulge shell) region, inner shell and outer shell as shown in Figs. 75, 76, 78 and 82. In Fig. 82, the bulge of the galaxy includes the super-massive black hole. The super-massive black hole (SBH) is in the center of the galaxy which is called as the black hole core. The Milky way galaxy is taken as one example in order to explain the bulge region of the galaxy. In the present work, the velocities of the stars in the bulge are described by the

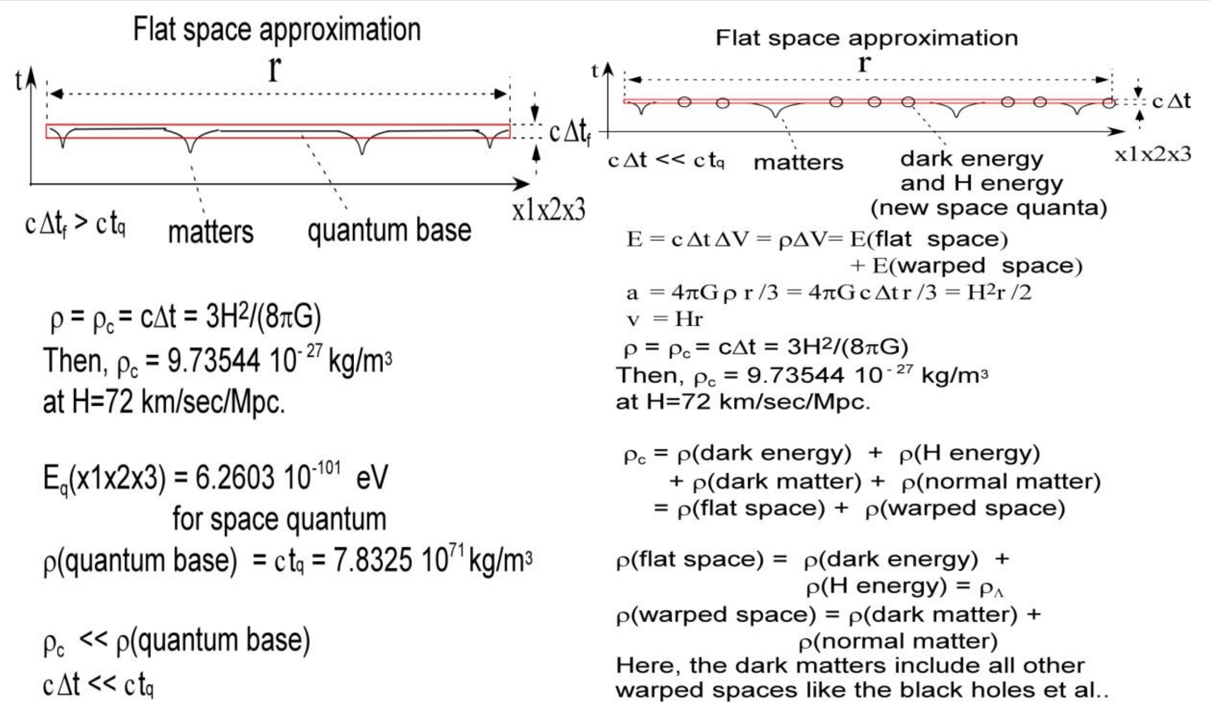


Fig. 85. Flat space approximation of the universe. See Figs. 59 and 6 for more details. See Fig. 77 for the case without the flat space approximation. See section 15, too.

equation of $v = \beta r - \frac{\beta a1 - v_a}{a1^2} r^2$. Also, from the circular motion formula, $v^2/r = G(m(r))/r^2$. Here, $v = (G(m(r))/r)^{0.5}$. Therefore, $m(r) = (\beta r - \frac{\beta a1 - v_a}{a1^2} r^2)^2 r/G$. The mass ($m_{bh}$) of the super-massive black hole in the Milky way galaxy was observed as 8.59 10^{36} kg by Gillessen et al. (S. Gillessen et al., Astrophys. J. **692**, 1075 (2009)) and 8.15 10^{36} kg by Ghez et al. (A.M. Ghez et al., Astrophys. J. **689**, 1044 (2008)) in the radius (a_{bh}) of 2.2 10^{10} m. The mass of 1.06 10^{37} kg in the radius of 3.086 10^{16} m was observed by Schodel et al. (R. Schodel et al., Astro. and Astrophys. **502**, 91 (2009)), too. The solid red line in Fig. 82 represents the mass values corresponding to the fitted line shown in Fig. 72.

The structure of the Milky way galaxy is shown in Figs. 75 and 82. Therefore, the Milky way galaxy consists of three parts of the bulge, inner shell and outer shell as proposed in Fig. 25. In the present work, it is assumed that the dark matter mass and the normal matter mass associated with the bulge are proportional to the mass (m1) of the bulge core. The inner shell is formed with

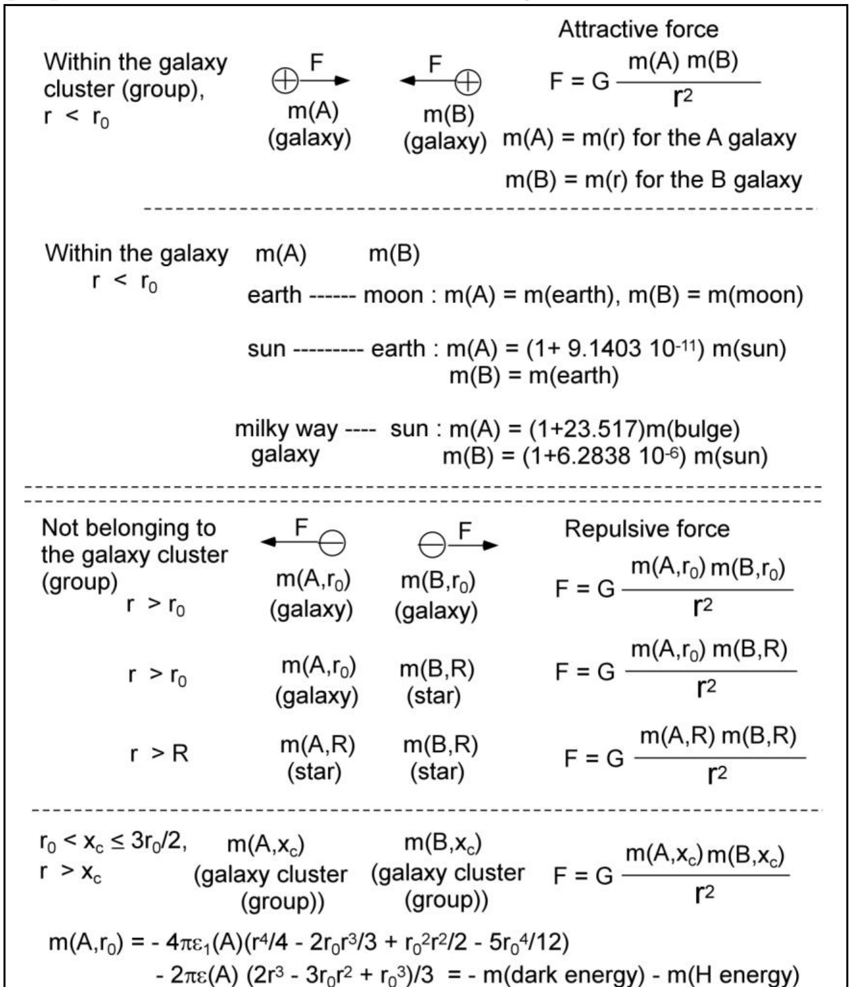


Fig. 86. Gravitational force within the galaxy and repulsive force out of the galaxy are compared. See Figs. 76, 78 and 87.

the normal matters of baryons and leptons ans the dak matters of the bastons as shown in Fig. 25. And, the outer shell consists mainly of the dark matters which are the bastons as proposed in Fig. 25. In the present work, the dark matters of the bastons associated with the mass (m1) of the bulge should not exist at the outside of the outer shell with $r > r_0$ as proposed in Fig. 25. The outside boundary (R) of the inner shell and the outside boundary (r_0) of the outer shell are extracted by using the observed rotational velocity data of the M31 and Milky way galaxies in the present work. Therefore, it is important to observe the R values for all other galaxies except the Milky way and M31 galaxies with the observed R values as shown in Table 12. The Milky way galaxy structure shown in Figs. 75 and 82 can be applied to all galaxies including the spheroidal and elliptical galaxies and possible dark matter galaxies without the disks, too. Also, the similar analysis can be applied to the evolution of the whole universe as shown in Fig. 83. A pair of the universe and its partner universe makes a birth and experiences the big bang and inflation from the nothing. Then the universe and its partner universe become the flat space of the quantum base with the quantum time of t_q as shown in Fig. 83. Also, see Fig. 6 for the accelerated expansion of the universe. A simple evolution scheme of our universe is shown in Fig. 84 for the summary of the physics explained in the present work. Also, the accelerated space expansion is caused by the added new x1x2x3 spaces which is called as the dark energy effect. The additional dark energy and H energy effects play the role of the negative gravitational effect on the mass of m1as shown in Figs. 6 and 78.

In Fig. 85, the critical energy density defined for the flat space approximation of the universe is shown. In this case, the Hubble's constant of H_0 = 72 km/sec/Mpc is used in the equation of $\rho = H_0 r$. The Hubble's constant of H_0 = 72 km/sec/Mpc gives the critical energy density of 9.73544 10^{-27} kg/m^3 and the estimated universe age of 13.59 10^9 years from t = 1/H_0. The space has two parts of the warped spaces and flat spaces. The dark energy and H energy are made by the creation of the new space quanta on the flat space in Figs. 6 and 85. The warped spaces include all matters and black holes. The dark matters in Fig. 85 include the black holes and all other matters except the normal matters of the leptons and baryons. See Figs. 6, 59 and 77 for the case without the flat space approximation. The flat space approximation has been useful in estimating the possible age of the universe since the big bang of the universe. Our universe has been treated

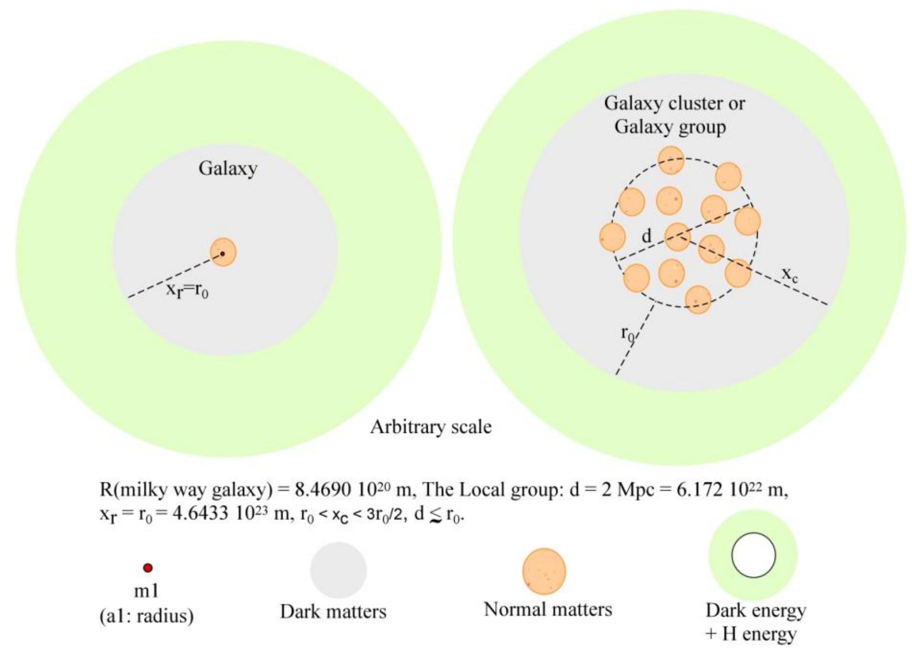
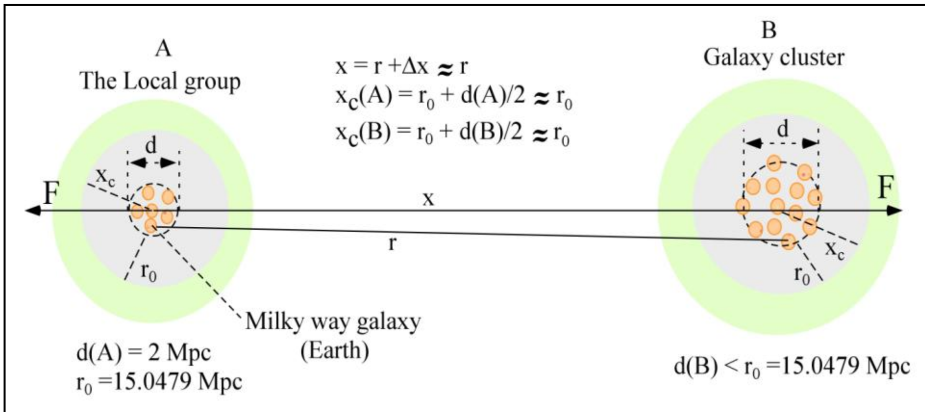


Fig. 87. Structure of the galaxy cluster or galaxy group. See Figs. 76, 78 and 86. The structure of the independent galaxy is compared.

to be flat in the universe scale to obtain the mass-energy distribution of the universe. The observed mass-energy distribution of the universe is originated from the flat space approximation of the universe as shown in Fig. 85, This means that Ω(total matter) is equal to 1. Ω(total matter) = 1 = Ω(matter) + Ω(dark matter) + Ω(dark energy). The dark matters, dark energy and normal matters were observed to be as 26.8 %, 68.3 % and 4.9 % of the mass-energy distribution of the universe, respectively, at the present time (N. Jarosik et al., Astrophys. J. Suppl. **192**, 14 (2011)). The Ω(dark energy) term used by Jarosik (N. Jarosik et al., Astrophys. J. Suppl. **192**, 14 (2011)) corresponds to the Ω(dark energy + H energy) term in Fig. 85 of the present work. The total energy of the quantum base in our universe should be much larger than the total energy of the dark energy and H energy as shown in Fig. 85.

In Fig. 86, the gravitational force within the galaxy and anti-gravitational force out of the galaxy are compared. The gravitational force between two positive masses is made by the exchanging of the gravitons at $r < r_0$ and the repulsive force between two galaxies is made by the creation of the new space quanta of the dark energy and H energy associated with two galaxies as shown in Fig. 86. In Fig. 83, the accelerated expansion of the universe starts when the size (diameter) of the universe is $r_0 = x_r = 4.6433\ 10^{23}$ m. Here x_r is the force range of the massive graviton as shown in section 8. The accelerated expansion of the universe takes place because the new space quanta defined as the dark energy in Fig. 6 are added. Also, in the galaxy scale the accelerated expansion caused by the addition of the new space quanta defined as the H energy and dark energy takes place when the distance between two galaxies is equal to the force range ($x_r = 4.6433\ 10^{23}$ m) of the massive graviton as shown in Fig. 87. Because of the limited gravitational force range, the normal matter size of the galaxy cluster is limited to the force range ($x_r = 4.6433\ 10^{23}$ m) of the massive graviton as shown in Fig. 87 and section 8. The radius of the dark matter size in the galaxy cluster goes up to $3r_0/2$ in Fig. 87. The observed diameter sizes of the galaxy clusters smaller than 15.0479 Mpc = $4.6433\ 10^{23}$ m (http://en.wikipedia.org/wiki/Galaxy_cluster (2015)) are consistent with the force range ($x_r = 4.6433\ 10^{23}$ m) of the massive graviton. The diameter sizes of the galaxy clusters are observed for the normal matter sizes of the galaxy clusters. For example, the Local group has the diameter of about 2 Mpc (E.K. Grebel, IAU Symposium **192**, 17 (1999)) as shown in Figs. 87 and 88. In Fig. 88, the repulsive force between



$$F = G\,\frac{m(A,x_c(A))\,m(B,x_c(B))}{x^2} \approx G\,\frac{m(A,r_0)\,m(B,r_0)}{r^2}$$

Fig. 88. The repulsive force between the Local group and the galaxy cluster. This repulsive force is approximated at the earth location within the Milky way galaxy. See Figs. 86 and 87.

the Local group and the galaxy cluster caused by the dark energy and H energy is shown. Because we measure the distance from the earth of the Milky way galaxy within the Local group to a galaxy within the galaxy cluster, the approximated form of the repulsive force can be used as shown in Fig. 88. The galaxy group and galaxy cluster in Figs. 87 and 88 are described to be spherically symmetric for the simplicity. However, note that the real galaxy group and galaxy clusters are not spherically symmetric because the galaxies are not distributed in the spherically symmetric way at the center. It is one reason why the approximation is made for the simplicity in Fig. 88.

In the present work, the parameters of ε and ε_1 are not dependent on the masses. The ε value is very large and the ε_1 value is zero when the H energy should be much larger around the beginning time ($r < r_0$) of the universe because of the huge big bang effect in Fig. 83. When the big bang effect on the H energy disappears and the warped space effect on the H energy is dominating, the ε value becomes nearly constant. Then, the ε value depends on the curvature (warping energy) of the whole universe but not on the warping energies (masses) of the individual matters as shown in Fig. 59. As shown in Fig. 83, the universe is steadily expanding. When the universe radius reaches the gravitational force range of $r_0 = x_r = 4.6433\ 10^{23}$ m in Fig. 83, the dark energy starts to appear as shown in Fig. 6. So the fitted H value in Fig. 77 works only at $r > r_0$ in Figs. 77 and 83. Because of the big bang effect, the v_0 value is introduced in the fitting process shown in Fig. 77. Therefore, the ε and ε_1 values are taken to be constant around the present time at $r > r_0$ in Figs. 77 and 83. Our warped space in Figs. 59 and 83 has been being expanded toward the flat space of the quantum base. Finally, our universe becomes the flat space of the quantum base at the end of the universe evolution in Fig. 83. In this flat space the space expansion is made only by the dark energy which creates the new space quanta from the pair production of the positive energy and negative energy space quanta as shown in Figs. 3, 6, 59 and 83. Therefore, for the flat space of the quantum base, $\rho(total) = \rho_c = \rho(dark\ energy) = constant,\ \rho(normal\ matters) = 0,\ \rho(dark\ matters) = 0\ and\ \rho(H\ energy) = 0$. For the universe in Fig. 83, the proposed equations of $\rho(H\ energy) = \frac{\varepsilon(r-r_0)}{r}$ and $\rho(dark\ energy) = \frac{\varepsilon_1(r-r_0)^2}{r}$at $r_0 \leq r$ works only around the present time. For the beginning time of the universe near the big bang, the very large value of $\rho(H\ energy)$ and the zero value of $\rho(dark\ energy)$are expected. For the last time of the universe near the flat space of the quantum base, the zero value of $\rho(H\ energy)$ and the constant small value of $\rho(dark\ energy)$ are expected. The voids between the galaxy clusters shown in Fig. 2 are made because the dark energy and H energy effects make the accelerated expansion of the flat spaces between the galaxy clusters. The voids between the super clusters of the galaxies shown in Fig. 2 are made, also, because the dark energy and H energy effects make the accelerated expansion of the flat spaces between the galaxy clusters. The stars like sun, planets like the earth and many small masses like protons have the negligible dark matters associated with those masses as shown for the sun in Tables 12 and 13 and Fig. 76. Those normal matters can exist independently on the flat space at the outside of the galaxies or galaxy clusters.

25. Conclusions

In conclusion, three-dimensional quantized spaces are newly introduced by myself in the present work. Four three-dimensional quantized spaces with total 12 dimensions are used to explain the universes including ours as shown in Fig. 1. The physics and mathematics of the universe based on the standard model, quantum mechanics, general relativity, string theory etc. have been developed based on the unquantized space in Fig. 1. The three-dimensional quantized space model is, for the first time, applied in the present work. Each n-dimensional quantized space has the energy when it has the time width because the energy is defined as $E_n = c\Delta t\Delta V_n$. ΔV_n is the volume of the n-dimensional quantized space. For example, for the 3-dimensional quantized space, E= cΔtΔV where ΔV is the three dimensional space volume. Our universe is formed with the four 3-dimensional quantized spaces as shown in Fig. 1. Four 3-dimensional quantized spaces can be overlapped over the same states as shown in Fig. 1. There is the flat mother quantized space (x0y0z0 space in Fig. 1) with the infinite time width and infinite space width. The mother quantized space cannot be warped because it has the infinite time width and infinite space width. The overlapped quantized spaces are associated with each other. The daughter quantized spaces (x1x2x3, x4x5x6 and x7x8x9 spaces in Fig. 1) with the finite time width and finite space width can be warped on the flat mother quantized space. Therefore, if one daughter quantized space is warped, other daughter quantized spaces are warped, too. The warped space is defined with the charge and rest mass. The negative warping of the quantized space is defined as the negative charge which means the matters.

The warped three-dimensional quantized spaces with the quantum time width ($\Delta t=t_q$) (see Fig. 4B) are applied to explain the origin of the charges and evolution of the universe. Also, the warped quantized time with the quantum space size ($\Delta x=x_q$) of the three-dimensional spaces (see Fig. 4C) is used to explain the magnetic charges. In the present work, the positive energy has the positive time momentum (E/c>0) flowing toward the positive time direction and the negative energy has the negative time momentum (-E/c<0) flowing toward the negative time direction as shown in Figs. 48, 49 and section 18. The birth of our positive energy matter universe is justified from the production of the positive and negative energy warped space pair. This birth is the beginning of the physical universe with the big bang. The warped space is the unstable space with the excited warping energy and the flat space is the stable space with the minimum energy. Therefore, always the warped space has the property to change to the expanded flat space which means the addition of the new space quanta called as H energy (Hanul energy or Hwang energy) and dark energy. It caused the inflation, big bang and expansion of our universes. The quantum space fluctuation has the constant speed of c. The time and space momentum of the quantum fluctuation is $p_t = p_x = E_0/c$. The quantum space fluctuation has the quantum time scale of t_q and the photon fluctuation has roughly the Planck time scale of t_p. The increasing (flowing) of the proper time and observed time of our x1x2x3 flat space universe is originated from the quantum space fluctuation (see Fig. 63).

The energy is newly defined as the space-time volume of E = cΔtΔV in the present work. Here ΔV is the space volume. It is shown that the quantum length (x_q) and time (t_q) of our universes are $2x_p^2$ = 5.223 10^{-70} m and x_q/c = 1.7422 10^{-78} s, respectively, which give the present masses of the elementary particles. Different quantum time will give the different masses of the elementary particles. Then it is proposed that the time is originated from the unobservable quantum space fluctuation. If the x1x2x3 space is the flat space with the time width of t_q (quantum time), this x1x2x3 space cannot be observed by us even though the x1x2x3 space exists. It is because its time width of t_q is un-observable. Therefore, the x1x2x3 space vacuum is defined as the x1x2x3 flat space with the quantum time width of t_q in the present work. Only the localized x1x2x3 spaces with the time width of $\Delta t>2t_p$ (Planck time) and the space length of $\Delta x>2x_p$ (Planck length) can be observed as the (anti)particles ((anti)bosons, (anti)fermions), (anti)matters, photons and b-bosons. The same explanation can be easily applied to the x4x5x6 and x7x8x9 spaces. Also, a proposed xi-xj-xk massive graviton has the mass (m_p=3.1872 10^{-31} eV/c^2) of the xi-xj-xk Planck size boson .

If the x1x2x3 space is warped to the +t direction, it is called as the +q > 0 (positive electric charge) warping which creates the anti-matter universe. If the x1x2x3 space is warped to the -t direction, it is called as the -q <0 (negative electric charge) warping which creates the matter universe. It is the sign definition of the charge corresponding to the space warping used in the present work. However, the different sign definition of the charge can be used if we want. For example, if the x1x2x3 space is warped to the +t direction, it can be defined as the -q < 0 (negative electric charge) warping which creates the matter universe. Then if the x1x2x3 space is warped to the -t direction, it can be defined as the +q > 0 (positive electric charge) warping which creates the antimatter universe. Electric (EC), lepton (LC) and color (CC) charges are defined to be the charges of the x1x2x3, x4x5x6 and x7x8x9 warped spaces, respectively, in the present work. Here i = 1, 2 or 3, j = 4, 5 or 6 and k = 7, 8 or 9. Then, the lepton is the xi (EC) - xj (LC) correlated state which makes 3x3 = 9 leptons and the quark is the xi (EC) – xj (LC) – xk (CC) correlated state which makes 3x3x3 = 27 quarks because the elementary particles of leptons and quarks are one-dimensional warped space quantum states (see Table 3 and Fig. 12). In addition to those, the new particle of a baston is proposed to have the xi (EC) state which gives three bastons which are the one-dimensional warped space quanta. These bastons are proposed as the dark matters seen in x1x2x3 space, too (see Fig. 46). A new b boson (Baedal or Bumo boson) is introduced to make the elementary particles (see Figs. 12-15). The rest masses of the particles come mostly from the masses of their b bosons. The fermions and the graviton have the spherical b bosons and the Z/W/ Y bosons in table 4 have the deformed b-bosons as shown in Fig. 14 and 15. The Higgs bosons of the quantum field theory introduced to give the masses to the particles should be replaced with the b bosons of the present three dimensional quantized model introduced to give the masses to the particles. The charge configuration of each particle can be applied to the particle decays. Many kinds of particles and magnetic particles are defined in terms of the three-dimensional quantized spaces. Also, the magnetic electric charges (MEC), magnetic lepton charges (MLC) and magnetic color charges (MCC) are newly defined. Many particle decay modes published by particle data group need to be modified a little bit from the EC, LC and CC charge conservations, if needed. New compound nuclei of the paryons, korons, josyms and barams are introduced (see Fig. 44). And it is shown that the quantum mechanics and special and general relativity theories are closely connected to each other.

Space, time and charge symmetries are newly defined (see section 17). A particle with a configuration of (E_0/c, P_x, -q) and its antiparticle with a configuration of (-E_0/c, -P_x, q) can be annihilated to nothing of Δt=0 and Δx=0 which means zero energy, zero space momenta and zero charges. Those two particles are defined as partners which can be created from nothing or annihilated to nothing. For example, a particle (or matter) with (E_0/c>0, P_x, -q) can be totally annihilated with a partner antiparticle or (or partner antimatter) with (-E_0/c<0, -P_x, q) to make nothing of Δt=0 and Δx=0 which has zero energy, zero space momenta and zero charges. In other words, this is called as the partner relation by the symmetry operator of $C_J T_J P_J$. Our matter universe can be created from the pair production of the matter and its partner antimatter as shown in Figs. 2, 4 and 5. Therefore, the antimatters missing within our x1x2x3 universe full of the matters exist as the partner antimatters within the partner x1x2x3 universe. This partner x1x2x3 universe with the negative energy is full of the partner antimatters. These partner antimatters within the partner x1x2x3 space are the partner antimatters in the viewpoint of the matters within our x1x2x3 space. Note that the time inversion symmetry operator of T_J cannot be applied within the x1x2x3 or x4x5x6 matter universe which has been always fixed to the positive energy and positive time momentum. The time inversion symmetry operator of T_J can be applied to all matters and particles in the viewpoint of the x0y0z0 space which can have both of positive and negative time momenta. But the P_J, C_J and C_{mJ} symmetry operators can be applied locally within the x1x2x3 and x4x5x6 spaces without changing the sign of the energy.

There are many physical problems which we do not know how to solve. Based on the present model, those problems are discussed in the present work. Those problems are including the matter universe question, three generations of the leptons and quarks, the proton decay, Majorana particle, dark matter, dark energy, dark flow, magnetic monopoles, graviton, hadronization, quark confinement, time before the big bang, a black hole, very high energy cosmic rays, hard x-rays, high temperature superconductor, quantum entanglement, quantum wave function collapse, neutrino oscillations, neutrino oscillations, CP violations and proton spin crisis. Also, it is shown, for the first time, that the wave function in the quantum mechanics is closely connected to the energy of the warped space caused by the moving elementary particles. The fermion charges are explained as the internal harmonic vibration quantum numbers obtained by solving Schrodinger harmonic vibrational equation with the Planck length scale. Then it is shown that the fractional electric charge of a quark comes from the charge unit system based on the electron charge of EC=-1. So, if we use the different charge unit system based on the electron charge of EC=-3, the fractional charges can disappear. The observed vacuum energy is thought to be closely related to the space expansion due to the newly added x1x2x3 space quanta. The observable minimum excitation energy of the x1x2x3 space is caused by the x1x2x3 Planck size b-boson with the energy of $E_p(x1x2x3) = 3E_p(xi) = E_p(x1x2x3\text{-}x4x5x6)/2 = 3.1872\ 10^{-31}$ eV.

And it is concluded that the experimentally observed and neutrino oscillations and the matrix elements (U_{ab}) between the neutrinos are originated from the interaction matrix elements (V_{ab}) of the leptons. Also, the matrix elements of the quarks for the W (anti-W) or Z (anti-Z) boson interactions are shown in Fig. 65. The matrix elements of the leptons for the W (anti-W) or Z (anti-Z) boson interactions need to be decided experimentally. It is thought that the mixing of the leptons and mixing of the quarks are not allowed because of the charge conservation of EC, LC and CC. The CKM and PMNS matrix elements represent the interaction strength of the quarks and leptons with the Z/W bosons. The CKM and PMNS matrix elements do not mean the previously known mixing of the leptons and mixing of the quarks. In summary, for the K^0 - anti-K^0, B^0 - anti-B^0 and D^0 - anti-D^0 meson systems with the zero electric charges and non-zero lepton charges the CP symmetry is not broken. And the flavor or lepton charge changes of the neutrinos are caused only by the neutrino interaction with other particles but not by the neutrino oscillation due to the neutrino mixing. Because the neutrinos with the zero electric charges have the non-zero lepton charges, the neutrino mixing is not possible. Because the K^0, B^0 and D^0 mesons with the zero electric charges have the non-zero lepton charges, the K^0 - anti-K^0, B^0 - anti-B^0 or D^0 - anti-D^0 meson mixing is not possible, too.

The space and time momenta are discussed including the relativistic effects in Figs. 48 – 51. Case (2) in Fig. 49 reproduces the well-known results that have been used for the space and time momenta of the matter with the positive energy. We can use two cases (1) and (2) in Figs. 48 and 49 for both of the antimatter and the matter with the positive energy. The same discussions can be applied for the xi-xj (anti)particles like the (anti)leptons and the xi-xj-xk (anti)particles like the (anti)quarks, (anti)baryons and (anti)mesons with the positive energy moving on the x1x2x3 flat space. See Figs. 19 and 23, too. In the present work, the x2-x4 one-dimensional particle is defined as the particle with the size of $\Delta x2 \geq 2x_p$, $\Delta x4 \geq 2x_p$ and $\Delta x1=\Delta x3=\Delta x5=\Delta x6=x_q$. And the x1x2x3-x4x5x6 three-dimensional particle is defined as the particle with the size of $\Delta x1 \geq 2x_p$, $\Delta x2 \geq 2x_p$, $\Delta x3 \geq 2x_p$, $\Delta x4 \geq 2x_p$, $\Delta x5 \geq 2x_p$ and $\Delta x6 \geq 2x_p$ (see Figs. 10-14 and Table 3). Here x_p and x_q are the Planck length and quantum length, respectively, in Fig. 3. And the x2 one-dimensional particle is defined as the particle with the size of $\Delta x2 \geq 2x_p$ and $\Delta x1=\Delta x3=x_q$. The quantum entanglement between two one-dimensional particles shown in Fig. 42 is explained by using the one-dimensional quantum base, which is the unobservable one-dimensional flat space with the quantum time width of t_q, two-dimensional quantum space widths of x_q and long length of $x \gg x_p$. In other words, two entangled particles are connected with the quantum base. Two fermions are connected to the boson moving on the boson base which is the quantum base between two fermions as shown in Fig. 15. And two particles are connected to the graviton moving on the graviton base which is the quantum base between two particles as shown in Fig. 15. The photons are moving on the flat space of the quantum base called as the photon base, too. The three-dimensional quantum base is the three-dimensional flat space with the quantum time width of t_q. The collapse or creation time of the quantum base is the same to the quantum time of $t_q = 1.7422\ 10^{-78}$ s regardless of the length of the quantum base because the quantum base has the quantum time width of $t_q = 1.7422\ 10^{-78}$ s.

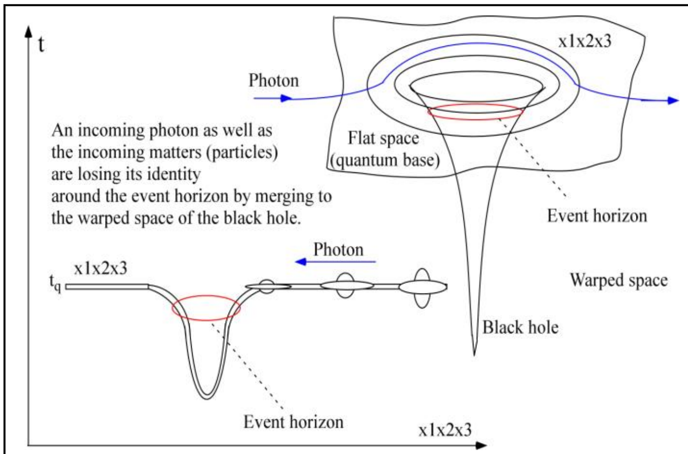


Fig. 89. Lensing effect of the photon.

Also, three kinds of photons are proposed as shown in Fig. 45. The electric and magnetic waves are the background fluctuation parallel to the wave moving direction and electromagnetic wave is the background fluctuation perpendicular to the wave moving direction. The background fluctuation velocity is called as the phase velocity and the wave velocity is called as the group velocity in the vacuum. The phase velocity is the same as the wave velocity which is defined as the light velocity of c. The photon has the zero rest mass and it cannot warp the space when it moves. Photons moves on the flat quantum base with the quantum time width of t_q. If there is the warped space, the photon goes around the warped space because the photons do not have the gravitational force with the warped space. It is called as the lensing effect of the warped space like the black holes, stars and particles. For example, when the $\gamma(0,0)$ photons move on the quantum base of the x1x2x3 space, these photons have the lensing effects around the matters with the warped x1x2x3 space like the x1x2x3 and x1x2x3-x4x5x6 black holes, x1x2x3-x4x5x6 stars and particles as shown in Fig. 89. The general relativity theory is thought to be about the relation of the warped x1x2x3 space and the matters with the warped x1x2x3 space like the x1x2x3 and x1x2x3-x4x5x6 black holes, x1x2x3-x4x5x6 stars and particles. The special relativity is closely related to the space-time warping effect of the moving particle on the flat space as shown in Fig. 23.

The quantum wave function collapse is explained by the space expansion of the b-boson caused by the internal vibration ($v \neq 0$) of the corresponding matter within the b-boson as shown in Fig. 43. The collapse time of the quantum wave function is the same to their time widths. If the b-boson of the particle has the time width less than 10^{-15} m/c, the collapse time of the quantum wave function is less than $t(x) = E|\psi(x)|^2 = 10^{-15}$ m/c (sec) = 3.33 10^{-24} sec in Fig. 43. The space-time shape of this b-boson can be expressed as t(x) and –t(x). Then, 2ct(x)/E corresponds to the quantum wave function, $|\Psi(x)|^2$, in the quantum mechanics of the electron (see Figs. 23 and 43). The Schrodinger equation is revised in order to include the rest mass energy of $E_0=m_0c^2$. The space and time wave functions of $\psi_s(x) and\ \psi_s(t) = \frac{1}{\sqrt{c\Delta t_s}} e^{\frac{iE_s}{\hbar c}ct}$ are the solutions of the well-known Schrodinger equation which does not include the rest mass energy of $E_0=m_0c^2$. $\psi(x) and\ \psi(t)$ are the solutions of the Schrodinger equation which includes the rest mass energy of $E_0=m_0c^2$. Then, $\psi(x) = \psi_s(x)$ and $\psi(t) = \frac{\sqrt{E-E_0}}{\sqrt{E}} e^{\frac{iE_0}{\hbar c}ct}\psi_s(t)$ (see section 20). Also, it is shown in Fig. 52 that $|\psi(x)|^2$, $|\psi(t)|^2$ and $|\psi(x,t)|^2 = |\psi(x)|^2|\psi(x)|^2$ are considered as the probability densities. Because the wave function comes from the description of the space-time shapes, it is concluded that the same Schrodinger equations and the derived wave functions can be generally used in order to describe all of flat and warped spaces including the flat spaces, matters (particles) and antimatters (antiparticles) with the positive energy or negative energy.

As shown in Fig. 54, the space and time locations of a particle can be described as (x,t) in the classical mechanics. It has been presumed in the classical mechanics that the particle is the point particle. And as shown in Figs. 54 and 43, it has been discussed in the present work that the particle really has the space and time sizes. Therefore, we need to know the particle sizes and locations in the space and time geometry. Particle space and time sizes are closely connected to the energy and space and time wave functions in quantum mechanics as discussed in the present work. Therefore, the particle space and time sizes can be described as (ψ(x),ψ(x)), (Δt(x),Δx(t)) or (2t(x),x(t)). So, the classical mechanics is about the change of the space and time locations of the particles and the quantum mechanics is about the change of the space and time sizes of the particles. The particle size is the size of the particle b-boson as shown in Fig. 43. The particle matter with the Planck size is moving within the particle b-boson as shown in Fig. 43.

Generally, the particle b-bosons belong to the warped spaces. The warped spaces have the space-time coordinates expressed as (x,t) and space-time sizes expressed as ((ψ(x),ψ(x)), (Δt(x),Δx(t)) or (t(x),x(t)). Generally, the coordinates of x stand for the ((x0, y0, z0), (x1, x2, x3), (x4, x5, x6), (x7, x8, x9)) in our three-dimensional quantized spaces. These space-time coordinates are defined as the center space and time locations. Some examples of these space-time coordinates are shown in Figs 48-51 and 54. Therefore, there are two kinds of changes for the warped matters. One is the change of the space-time coordinates and another one is the change of the space-time sizes. The study on the change of the space-time coordinates of the warped spaces can be called as the classical mechanics. The study on the change of the space-time sizes of the warped spaces can be called as the quantum mechanics. Because we have applied the quantum mechanics only to the elementary particles with the diameter sizes less than $\sim 10^{-15}$ m, it has been misunderstood that the quantum mechanics works only for the small scales. However, generally the quantum mechanics should work for all sizes of the warped spaces including all the matters and particles. Also, the space-time sizes of the flat spaces have been described by the plane waves which are closely connected to the quantum mechanics in the present work. Also the space-time coordinates of (x,t) which are closely connected to the classical mechanics can be properly assigned to these flat spaces. Then, the quantum mechanics and classical mechanics can be applied to the flat spaces, too. It means that our whole universes should be described by both of the quantum mechanics and the classical mechanics.

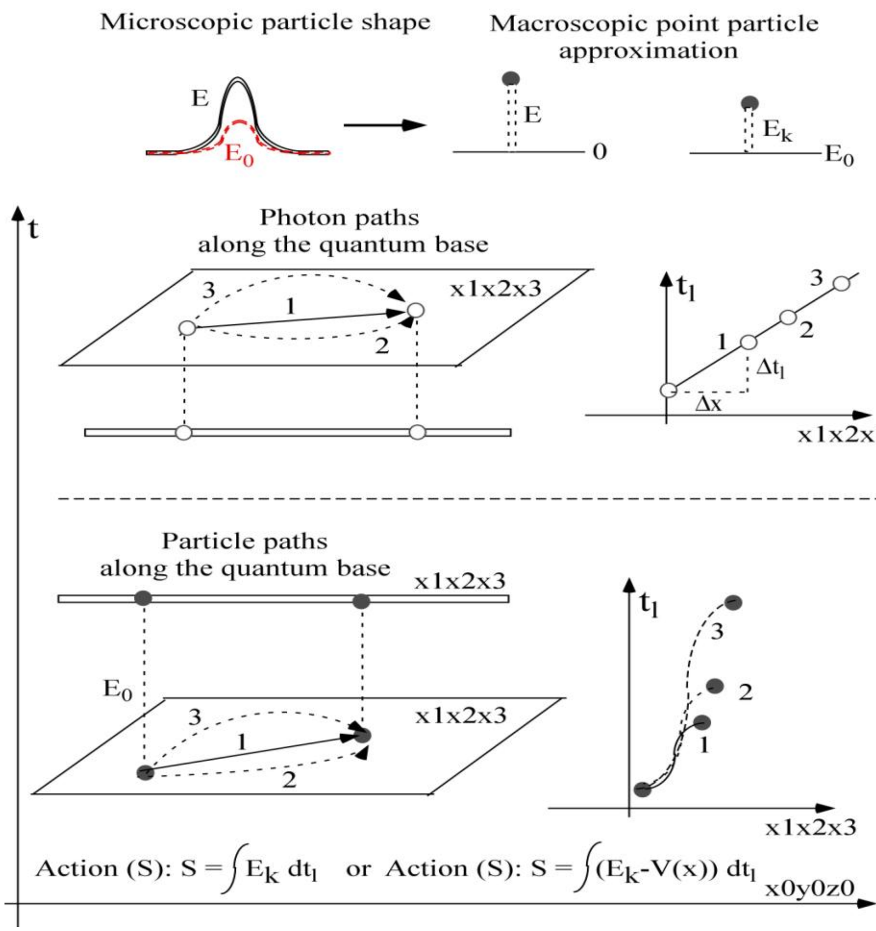


Fig. 90. The action principle can be described in terms of the 3-dimensional quantized space model.

The b-boson and the internal matter of a particle can be separated near the black hole. If the b-boson and internal matter of a particle are separated, the b-boson and the internal matter are changed to the flat space or absorbed into the warped space of the black hole. Then the quantum mechanics and classical mechanics cannot be applied to the particle because the space-time location of (x,t) and the space-time size of ((ψ(x),ψ(x)), (Δt(x),Δx(t)) or (t(x),x(t)) cannot be defined any more to the collapsed particle. The quantum mechanics and classical mechanics should be applied to the new merged state of the black hole. Therefore, the gravitational formula can be applied only to the space length larger than the space size of the particle. It will remove the singularity in the gravitational interaction. Because the quantum mechanics is based on the space-time sizes of the particle in Fig. 54, the space and time locations of the particle in the quantum mechanics have always the uncertainties of Δx and Δt, respectively. But the space and time locations of the particle in the classical mechanics are expressed as x and t, respectively, in

Fig. 54 because the classical mechanics is based on the space and time locations of the particle. It implies that the classical mechanics is based on the concept of the point particle and the quantum mechanics is based on the non-zero size concept (non-zero space and time sizes) of the particle. And the action principle can be described in terms of the 3-dimensional quantized space model as shown in Fig. 90. The particles and photons are moving along the flat quantum base which is unobservable because it has the quantum time width of t_q.

The special and general relativity theories are discussing about the relation between the energy and changes of curvature and time-space distance. Basically, the quantum mechanics based on the shape change of the time-space is discussing about the relation between the energy and size changes of the space and time in terms of the present three-dimensional quantized space model. In other words, for the same warped space and time, the general relativity is about the curvature changes of the space and time and the quantum mechanics is about the size changes of the space and time. The x1x2x3 matter universe with the positive energy was created as the x1x2x3 matter of the huge black hole as shown in Figs. 2 and 59. It is called as the big bang. This black hole has been rapidly expanded to the space direction and rapidly contracted to the time direction toward to the flat space because the flat space is the most stable shape of the space-time with the minimum energy density. In other words, the warping energy density of $\rho(x) = E|\psi(x)|^2 = ct(x)$ ($\sim \Delta t$) is rapidly decreased in a very short time and the space width ($\sim\Delta x$) is rapidly increased in a very short time because $E=c\Delta t\Delta x$ in the flat space approximation is conserved. It is thought that this warping energy effect (H energy) causes the inflation of the universe. When the particle is moving with the velocity of v, the space size of the particle is increasing from $\Delta x^/$ to $\Delta x = \sqrt{\frac{1+\frac{v}{c}}{1-\frac{v}{c}}}\Delta x^/$ for the energy transition (see Figs. 61-63). If v < 0, then c < 0. And always v/c > 0. Note that it is different from the solution of $\Delta x = \frac{\Delta x_0}{\sqrt{1-\frac{v^2}{c^2}}}$ for the momentum transition. This particle is moving from one position to another position with the speed of $v = \Delta x/\Delta t_l$. While it is moving, the proper time (t) of the particle location is increasing along with the increasing of the observed time (t_l) of the particle location as shown in Fig. 63. This gives the quantum matrices of $c^2\Delta t^2 = c^2\Delta t_l^2 - \Delta x^2$. Therefore, $\Delta t_l = \frac{\Delta t}{\sqrt{1-\frac{v^2}{c^2}}}$ for the momentum transition.

A simple evolution scheme of our universe is shown in Fig. 83 for the summary of the physics explained in the present work. Also, the evolution and origin of the black hole and our universe are newly explained. The virtual particle is decaying to the real particles by expanding from the small space size to the large space size. The virtual particles with the energy larger than the Planck range virtual boson are defined as the black holes in Fig. 16. Our universe is originated from one matter black hole with the huge energy and positive energy. Because the present universe is filled with the matters, it is thought that the original black hole which was changed to our universe is the matter. And the dark energy and dark matter are explained in the present work. Also, the g factor, fine structure constant and electric permittivity are discussed in terms of the present model. It is concluded that the ε_0 value is almost equal to the ε_0(EC) value in the QED calculation. This means that ε_0(LC) is huge and μ_0(LC) is negligibly small.

In the present work, three mass equations of m(r) = $(\beta r - \frac{\beta a1 - v_a}{a1^2} r^2)^2 r/G$ for the bulge region at r ≤ a1, m(r) = $(1+(4\pi b+d)(r-a1))m1$ for the inner shell region at a1 ≤ r ≤ R and m(r) = $(1+(4\pi b+d)(r-a1)-2\pi t(r-R))m1 = (1+d(R-a1)+4\pi b(r-a1))m1$ for the outer shell region at R ≤ r ≤ r_0 are used as explained in the text. Also, the mass terms of m(dark energy) caused by the dark energy and m(H energy) caused by the warped space effects on the expansion of the space as shown in Fig. 6 is considered at r_0 ≤ r. At r ≤ r_0, $\rho(dark\ energy) = 0$ and $\rho(H\ energy) = 0$. From these conditions, the proposed equations of $\rho(H\ energy)$ and $\rho(dark\ energy)$ are $\rho(H\ energy) = \frac{\varepsilon(r-r_0)}{r}$ and $\rho(dark\ energy) = \frac{\varepsilon_1(r-r_0)^2}{r}$ at $r_0 \le r$. Therefore, the mass term of m(H energy) is m(H energy) = $24\pi\varepsilon(2r^3-3r_0r^2+r_0^3)$ where ε is the effective H energy mass density at the infinite r limit. The values of the variables are shown in Tables 12 and 13. The ε and ε_1 fitting parameters are obtained from the Hubble diagram in Fig. 77. The obtained fitting parameters of ε, ε_1 and v_0 are 8.6883(3814) 10^{-27} kg/m^3, 8.8729(41000) 10^{-53} and 1.222926(217700) 10^6 m/sec, respectively. The v_0 value is introduced because of the possible starting velocity after the big bang near the beginning time ($r = 0$) of the universe. The anti-gravitational force of the H energy and dark energy is made by the new space quanta as shown in Fig. 6. The gravitational force is made by the massive gravitons with the force range of x_r = 4.6433 10^{23} m. The total energy of the quantum base in our universe should be much larger than the total energy of the dark energy and H energy as shown in Fig. 85.

Then, m(r) = $m(dark\ energy) + m(H\ energy)$ for the region at r_0 ≤ r is used for the equations of $a = \frac{F}{m} = \frac{GM(r)}{r^2}$, $a = -\frac{4\pi G}{3}\rho r, v = Hr\ and\ H^2 = \frac{8\pi G}{3}\rho$ in Fig. 77. The H term gives rather steady space expansion and the dark energy term makes the accelerated space expansion as shown in Fig. 77. The m(H energy) = $2\pi\varepsilon(2r^3-3r_0r^2+r_0^3)/3$ term of the H energy shown in Fig. 6 is associated with the warped spaces and big bang and causes the steady space expansion with the Hubble's constant of H_0 for the region at r_0 ≤ r. Therefore, the m(dark energy) = $4\pi\varepsilon_1(\frac{r^4}{4} - \frac{2r_0r^3}{3} + \frac{r_0^2r^2}{2} - \frac{5r_0^4}{12})$ term of the dark energy shown in Fig. 6 adds up the additional acceleration to the steady space expansion with the Hubble's constant of H_0 which is made by the H energy for the region at r_0 ≤ r. And, at a1 ≤ r ≤ R, $v = (G\frac{(1+(4\pi b+d)(r-a1))m1}{r})^{0.5}$. The fitting parameters for nine galaxies in Figs. 72, 73, 74, 78 and 79 are shown in Table 12. The fitted velocity curves for the Milky way galaxy are shown as the solid red lines in Fig. 72. m_{dm} and m_{sd} are m(dark matter) = 4πb(R-a1) and m(normal matter) = d(R-a1) at r = R, respectively. The radius of R is the radius of the inner shell associated with the mass of m1 as shown in Figs. 75, 76 and 78. Therefore, m_{dm} +m_{sd} = (4πb+d)(R-a1)m1. And the total mass (m(Milky way)) of the Milky way galaxy is m(Milky way) = m1+m_{dm} + m_{sd} = 7.7879 10^{41} kg at r = R = 8.4696 10^{20} m. For the M31 galaxy, R is 1.2532(1245) 10^{21} m. And the total mass (m(M31)) of the M31 galaxy is m(M31) = m1+m_{dm} + m_{sd} = 1.112 10^{42} kg at r = R = 1.2532(1245) 10^{21} m.

In general, for the inner shell of the galaxy at a1 ≤ r ≤ R, $v = (G\frac{(1+(4\pi b+d)(r-a1))m1}{r})^{0.5}$.
For the outer shell at R ≤ r ≤ r_0,

$v = (G\frac{(1+(4\pi b+d)(r-a1\,)-4\pi t(r-R))m1}{r})^{0.5} = (G\frac{(1+d(R-a1)+4\pi b(r-a1\,))m1}{r})^{0.5}$. And a mass of m1 with the radius a1 has to be replaced as $\left(1+(4\pi b+d)(r-a1)\right)m1 = \alpha(m1)m1$ or G has to be replaced with $G\left(1+(4\pi b+d)(r-a1)\right) = G\alpha(m1)$ at $a1 \le r \le R$. The orbital rotational velocity curves in NGC3198, M31 and Milky way galaxies are well reproduced by using the present fitting process as shown in Figs. 72, 73, 74, 79 and 80. From the Figs. 72 and 73 for M31 and Milky way galaxies, the d=4πt and (4πb+d) values are obtained. Then the b values for these two galaxies are extracted. The b and d values of the M31 and Milky way galaxies are shown in Table 13. The m(dark matter) and m(normal matter) values are, also, tabulated in Table 13. And

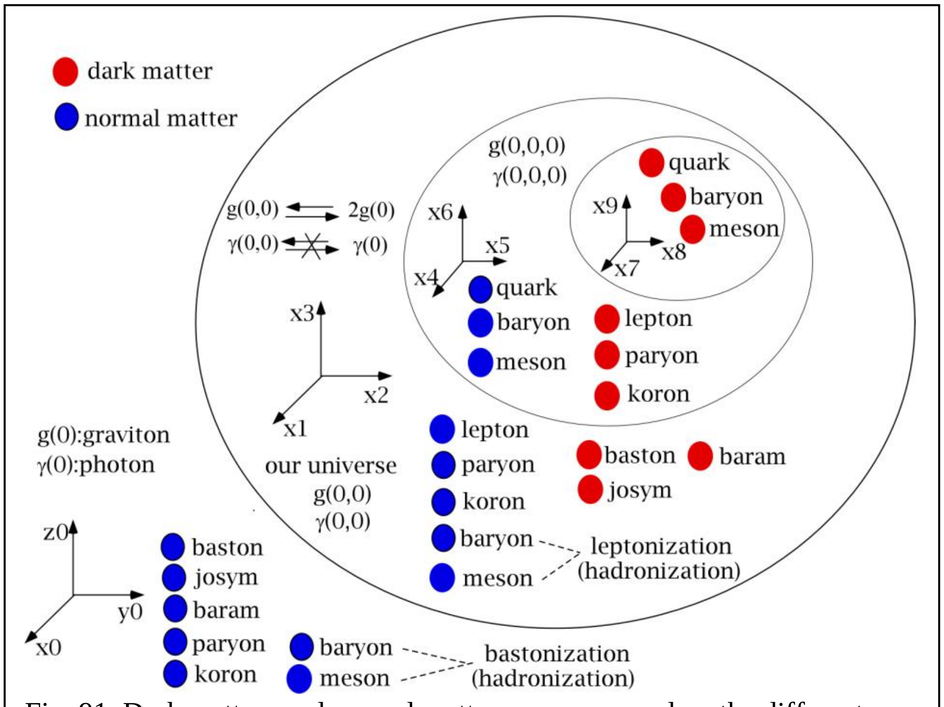


Fig. 91. Dark matters and normal matters are compared on the different three-dimensional spaces. See Figs. 13, 44, 46 and 93.

the orbital rotational velocity (v) is proportional to $\sqrt{m1}$. At the earth scale of the mass, this modified gravitational formula becomes the usual gravitational force formula of $F_{12} = G\frac{m1m2}{r^2}$ because, for the relatively small masses of m1 and m2 within the inner shell of the galaxy, m(dark matter) associated with these masses of m1 and m2 is negligible and the dark energy and H energy do not exist inside the inner shell and outer shell of the galaxy.

The structure of the Milky way galaxy is shown in Figs. 75 and 82. Therefore, the Milky way galaxy consists of three parts of the bulge, inner shell and outer shell as proposed in Fig. 25. In the present work, it is assumed that the dark matter mass and the normal matter mass associated with the bulge are proportional to the mass (m1) of the bulge core. The galaxy bulge is formed with the normal matters of baryons and leptons as shown in Fig. 25. And, the outer shell consists mainly of the dark matters which are the bastons as proposed in Fig. 25. In the present work, the dark matters of the bastons associated with the mass (m1) of the bulge should not exist at the outside of the outer shell with $r > r_0$ as proposed in Fig. 25. The outside boundary (R) of the inner shell and the outside boundary (r_0) of the outer shell are extracted by using the observed rotational velocity data of the M31 and Milky way galaxies in the present work. Therefore, it is important to observe the R values for all other galaxies except the Milky way and M31 galaxies with the observed R values as shown in Table 12. The Milky way galaxy structure shown in Figs. 75 and 82 can be applied to all galaxies including the spheroidal and elliptical galaxies and possible dark matter galaxies without the disks, too. Also, the similar analysis can be applied to the evolution of the whole universe as shown in Fig. 83. A pair of the universe and partner universe makes a birth and experiences the big bang from the nothing. Then the universe and its partner universe become flat space of the quantum base as shown in Fig. 83. Also, see Fig. 6 for the accelerated expansion of the universe. A simple evolution scheme of our universe is shown in Fig. 84 for the summary of the physics explained in the present work. Also, the accelerated space

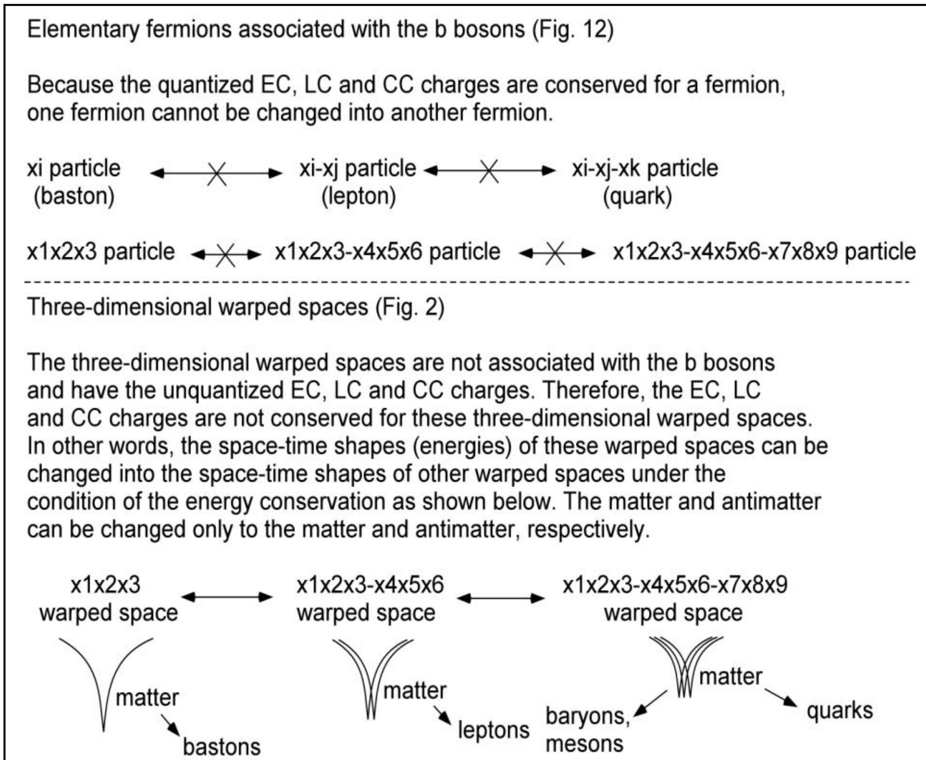


Fig. 92. It is shown that the space-time shape of the three-dimensional warped spaces having the unquantized EC, LC and CC charges can be changed. The three-dimensional warped spaces not associated with the three-dimensional b bosons are shown as the origin of the fermions including the three-dimensional particles (x1x2x3, x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 particles) and one-dimensional particles (bastons, leptons, baryons, mesons, quarks) which have the quantized EC, LC and CC charges .

expansion is caused by the added new x1x2x3 spaces which is called as the dark energy effect. This additional dark energy effect plays the role of the negative gravitational effect on the mass of m1as shown in Figs. 6 and 78. The gravitational force between two positive masses is made by the exchanging of the gravitons at $r < r_0$ and the repulsive force between two galaxies is made by the creation of the new space quanta associated with two galaxies as shown in Fig. 86.

Finally, the dark matters and normal matters are compared on the different three dimensional spaces in Fig. 91. Note that we live on the x1x2x3 universe in Fig. 91. Therefore, the quarks cannot be observed on our x1x2x3 space but the baryons and mesons with the leptonization (hadronization) can exist as the normal matters on our x1x2x3 space as shown in Figs. 13, 46, 91 and 93. The bastons shown on our x1x2x3 space are considered as the dark matters which make the gravitational interactions through the graviton of g(0,0) but does not make the electric interactions through the photon of γ(0,0) with the normal matters. Note that g(0,0) can be transferred to 2g(0) but γ(0,0) cannot be transferred to 2γ(0) because of the charge dependence of the photon along the space axes. Also, in Fig. 92, it is shown that the space-time shape of the three-dimensional warped spaces having the unquantized EC, LC and CC charges can be changed. The three-dimensional warped spaces not associated with the three-dimensional b bosons are shown as the origin of the fermions including the three-dimensional particles (x1x2x3, x1x2x3-x4x5x6 and x1x2x3-x4x5x6-x7x8x9 particles) and one-dimensional particles (bastons, leptons, baryons, mesons, quarks) which have the quantized EC, LC and CC charges . In Fig. 93, the hadronization of the leptonization and bastonization is shown. The 3-dimensional black holes, matters and particles can be considered as the dark matters for all spaces in Fig. 91 because the 3-dimensional black holes, matters and particles have the gravitational interactions but not the electromagnetic interactions with the normal matters in each space in Fig. 91.

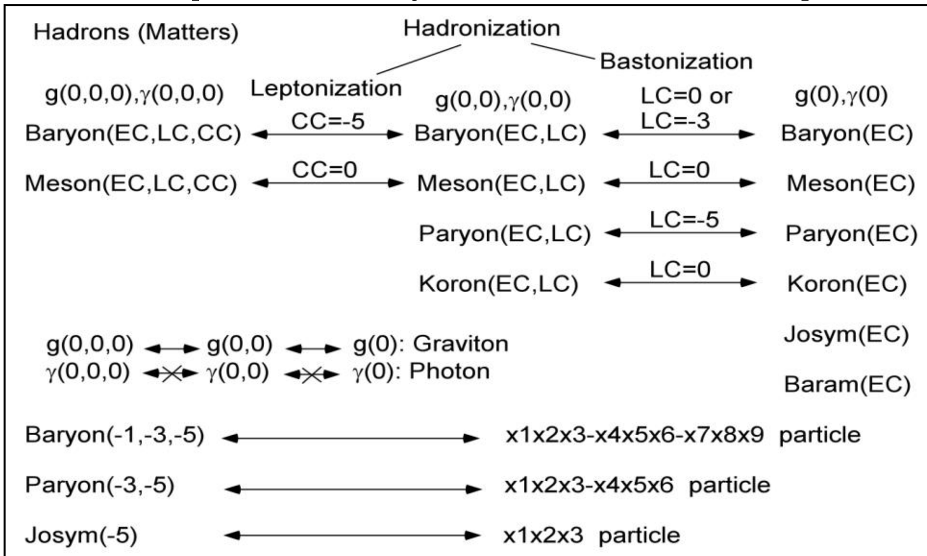
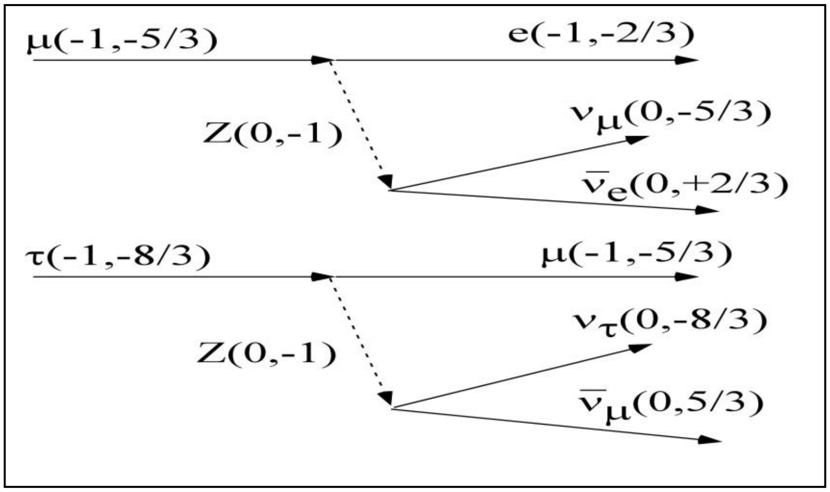
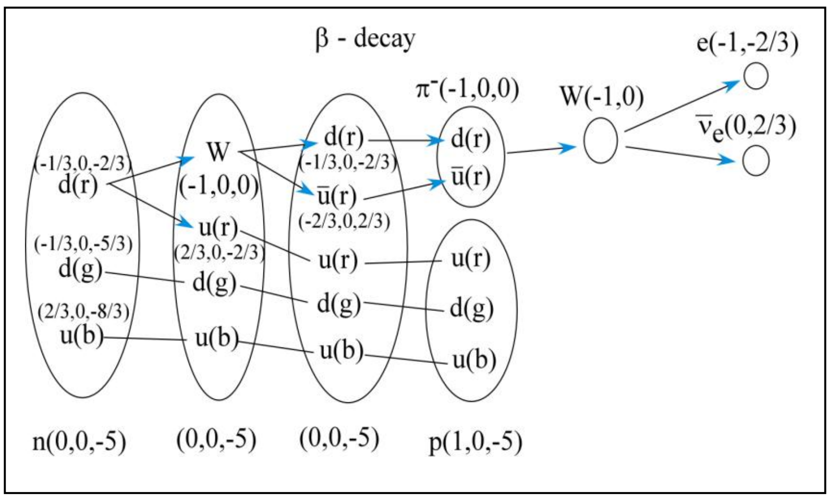


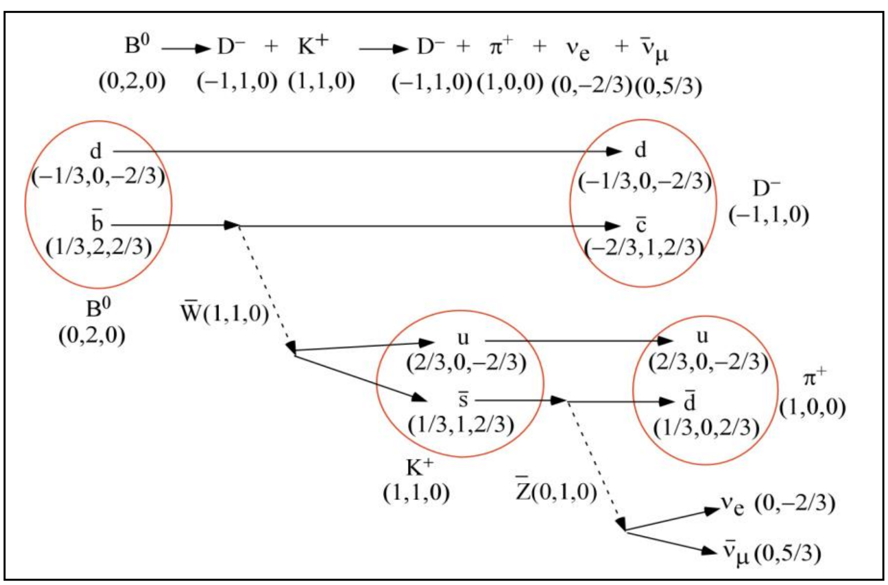
Fig. 93. The hadronization is shown. See Figs. 12, 13, 44, 46 and 91.

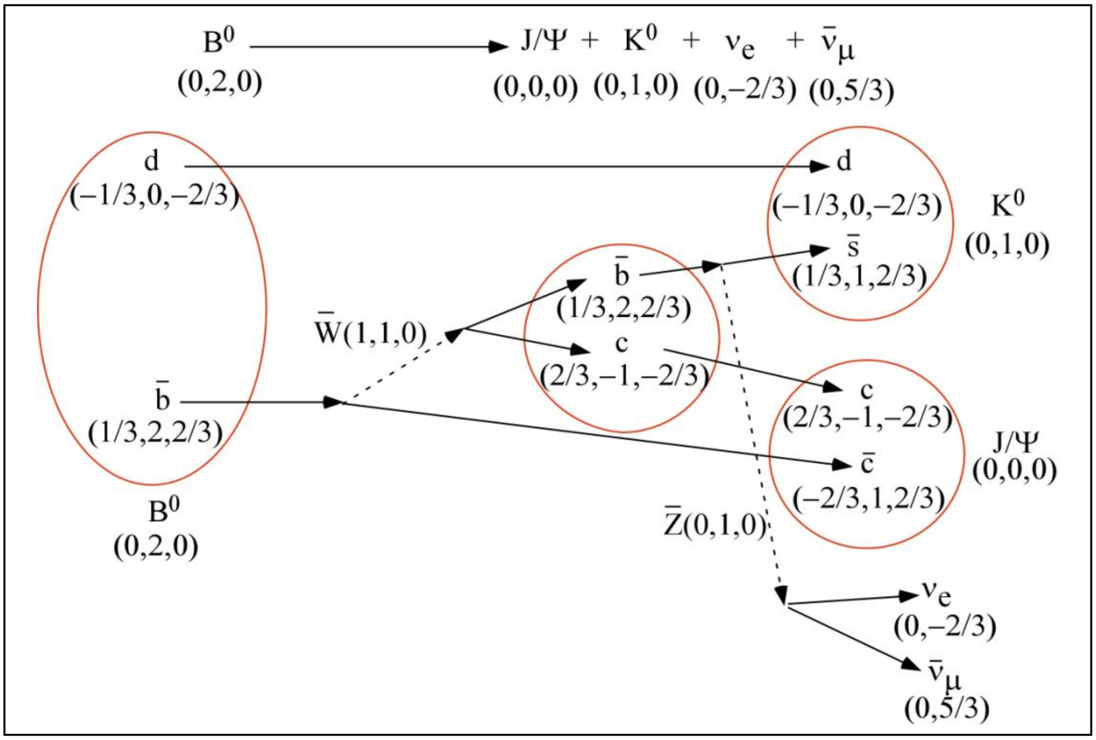
I think that the gravitational force, electromagnetic force, weak and strong forces in the universe are consistently explained and finally unified by using the three-dimensional quantized spaces in the present work. I think that the quantum mechanics, general relativity and classical mechanics in the universe are consistently explained and finally unified by using the three-dimensional quantized spaces in the present work. I wish, in my heart, that this is the real physics story but not the scientific fiction (SF) story. I wish other brilliant researchers including the independent researchers can extend this model. Also, I wish the brilliant mathematicians can develop the general geometrical and manifold descriptions of the n-dimensional quantized spaces. I wish all the independent researchers have the good luck and the courage. I wish, in my heart, that we on the earth live the peaceful and happy lives.

Particle reaction and decay schemes





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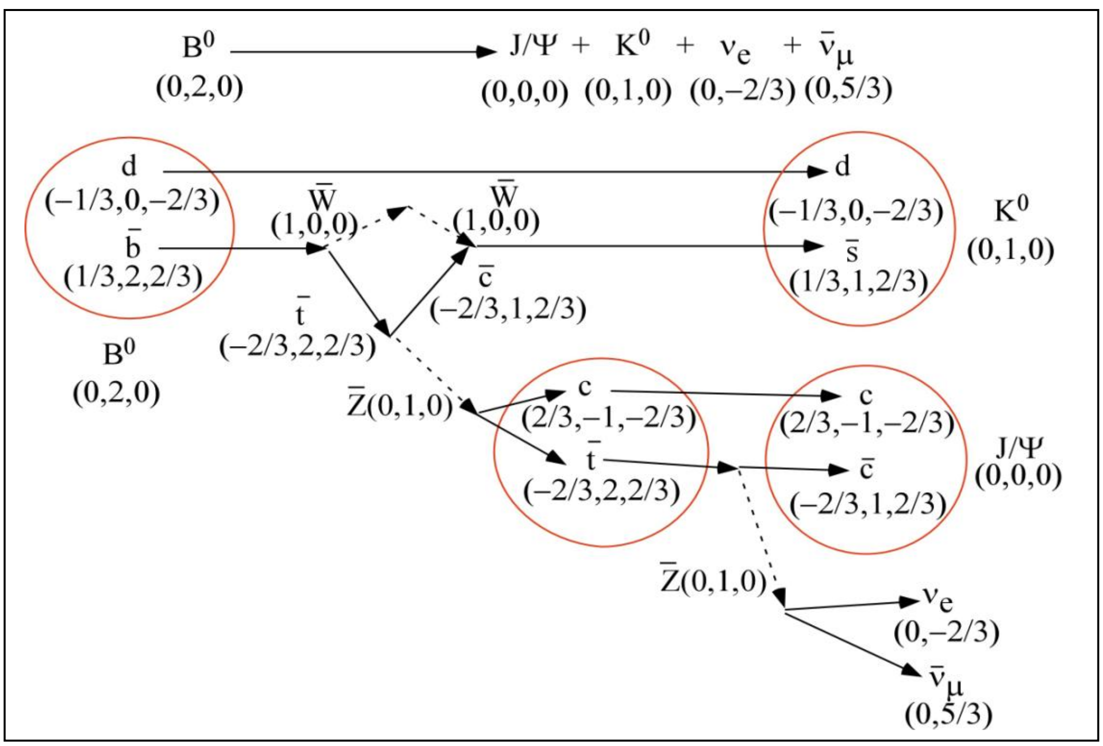
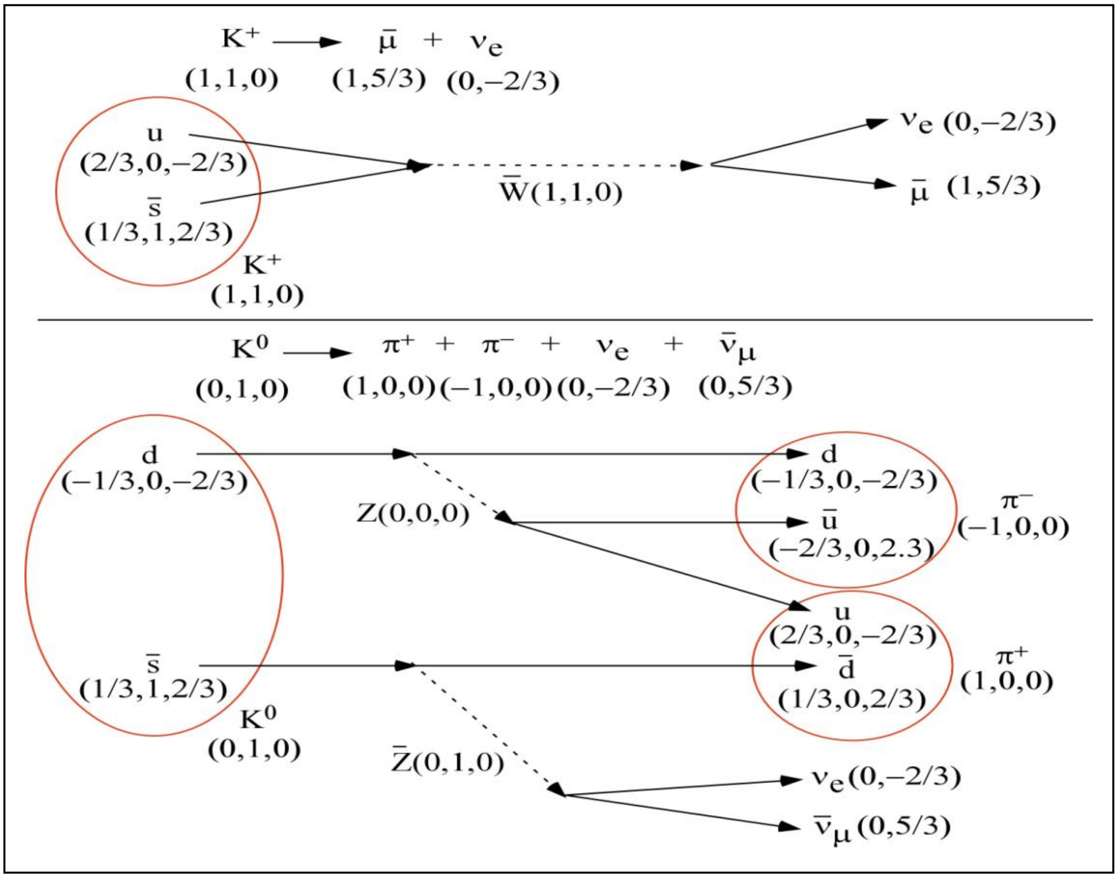
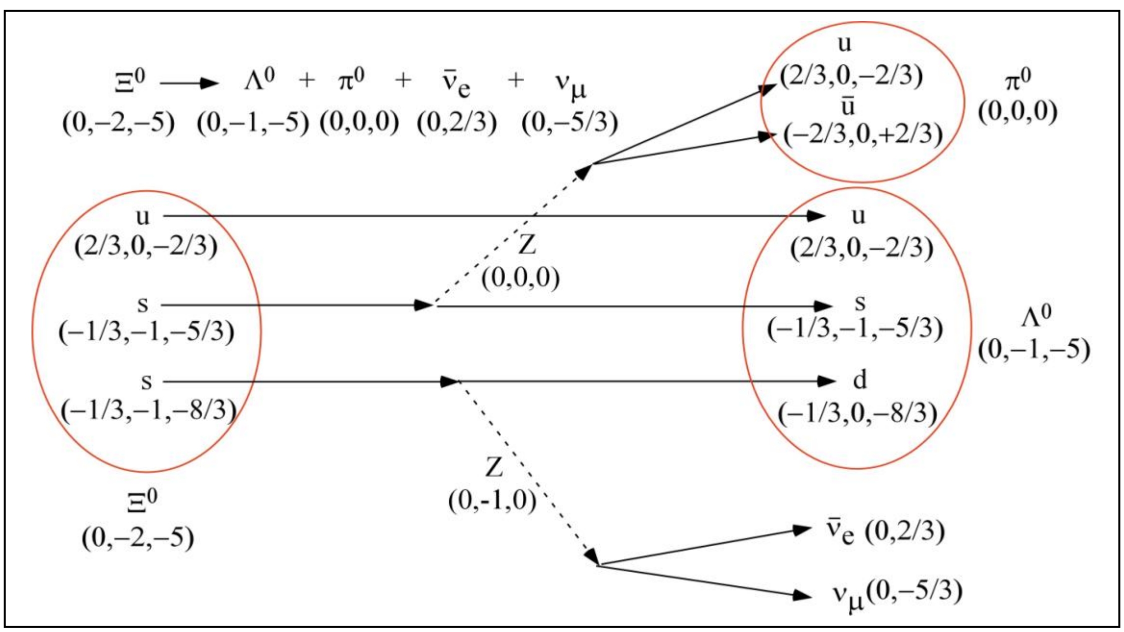
(0,2,0)
(0,0,0) (0,1,0) (0,−2/3) (0,5/3)
d
(−1/3,0,−2/3)
$\bar{b}$
(1/3,2,2/3)
B^0
(0,2,0)
$\bar{W}$(1,1,0)
$\bar{b}$
(1/3,2,2/3)
c
(2/3,−1,−2/3)
d
(−1/3,0,−2/3)
$\bar{s}$
(1/3,1,2/3)
K^0
(0,1,0)
c
(2/3,−1,−2/3)
$\bar{c}$
(−2/3,1,2/3)
J/Ψ
(0,0,0)
$\bar{Z}$(0,1,0)
ν_e
(0,−2/3)
$\bar{\nu}_\mu$
(0,5/3)


$B^0 \rightarrow J/\Psi + K^0 + \nu_e + \bar{\nu}_\mu$
(0,2,0)
(0,0,0) (0,1,0) (0,−2/3) (0,5/3)
d
(−1/3,0,−2/3)
$\bar{b}$
(1/3,2,2/3)
B^0
(0,2,0)
$\bar{W}$
(1,0,0)
$\bar{W}$
(1,0,0)
$\bar{t}$
(−2/3,2,2/3)
$\bar{c}$
(−2/3,1,2/3)
d
(−1/3,0,−2/3)
$\bar{s}$
(1/3,1,2/3)
K^0
(0,1,0)
$\bar{Z}$(0,1,0)
c
(2/3,−1,−2/3)
$\bar{t}$
(−2/3,2,2/3)
c
(2/3,−1,−2/3)
$\bar{c}$
(−2/3,1,2/3)
J/Ψ
(0,0,0)
$\bar{Z}$(0,1,0)
ν_e
(0,−2/3)
$\bar{\nu}_\mu$
(0,5/3)


K+ → μ̄ + νe
(1,1,0) (1,5/3) (0,−2/3)
u
(2/3,0,−2/3)
s̄
(1/3,1,2/3)
K+
(1,1,0)
W̄(1,1,0)
νe (0,−2/3)
μ̄ (1,5/3)
K0 → π+ + π− + νe + ν̄μ
(0,1,0) (1,0,0) (−1,0,0) (0,−2/3) (0,5/3)
d
(−1/3,0,−2/3)
Z(0,0,0)
s̄
(1/3,1,2/3)
K0
(0,1,0)
Z̄(0,1,0)
d
(−1/3,0,−2/3)
ū
(−2/3,0,2.3)
π−
(−1,0,0)
u
(2/3,0,−2/3)
d̄
(1/3,0,2/3)
π+
(1,0,0)
νe(0,−2/3)
ν̄μ(0,5/3)


Ξ0 → Λ0 + π0 + ν̄e + νμ
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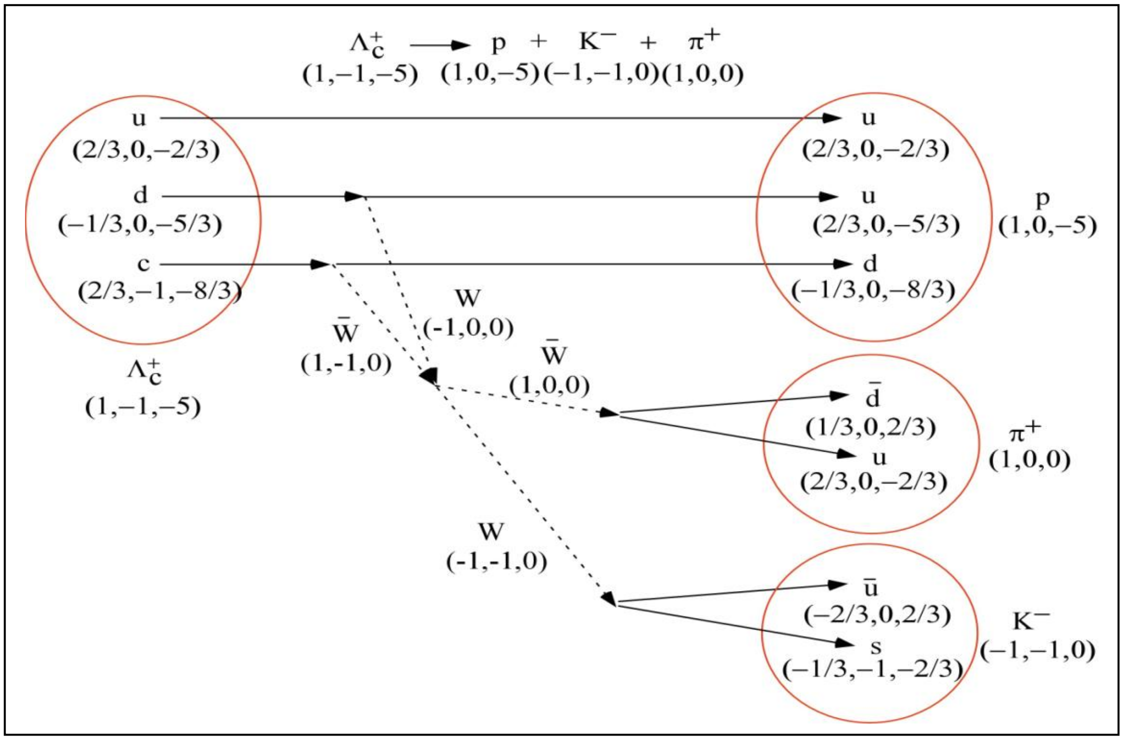
u
(2/3,0,−2/3)
s
(−1/3,−1,−5/3)
s
(−1/3,−1,−8/3)
Ξ0
(0,−2,−5)
Z
(0,0,0)
Z
(0,-1,0)
u
(2/3,0,−2/3)
ū
(−2/3,0,+2/3)
π0
(0,0,0)
u
(2/3,0,−2/3)
s
(−1/3,−1,−5/3)
d
(−1/3,0,−8/3)
Λ0
(0,−1,−5)
ν̄e (0,2/3)
νμ(0,−5/3)


Λc+ → p + K− + π+
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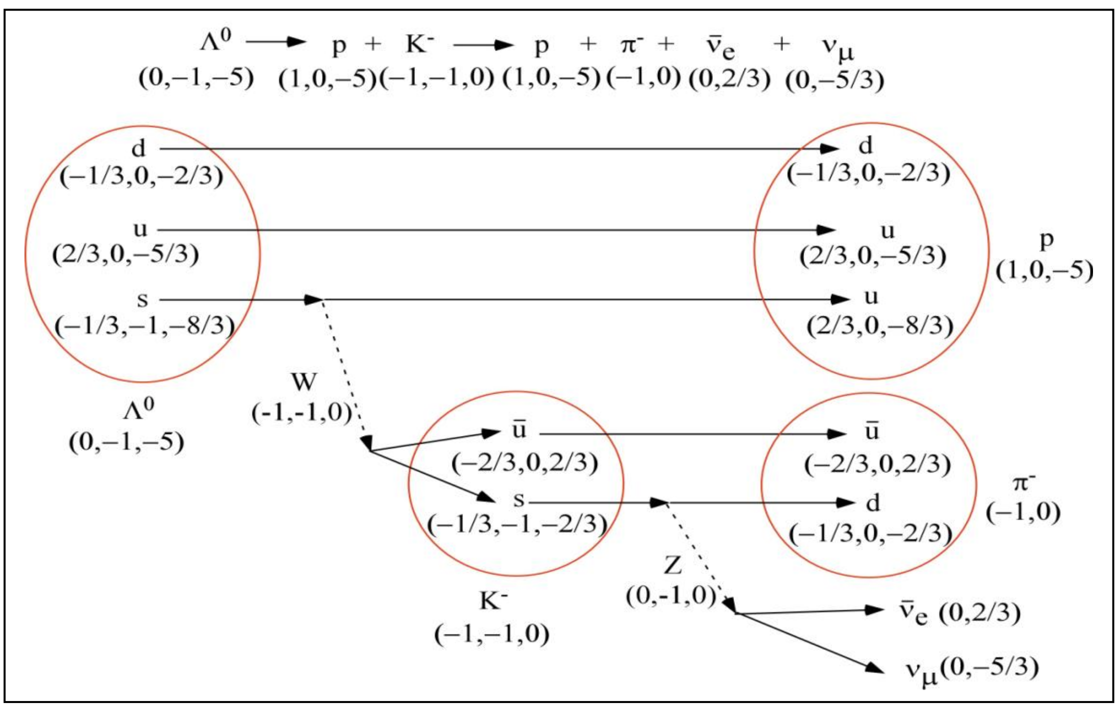
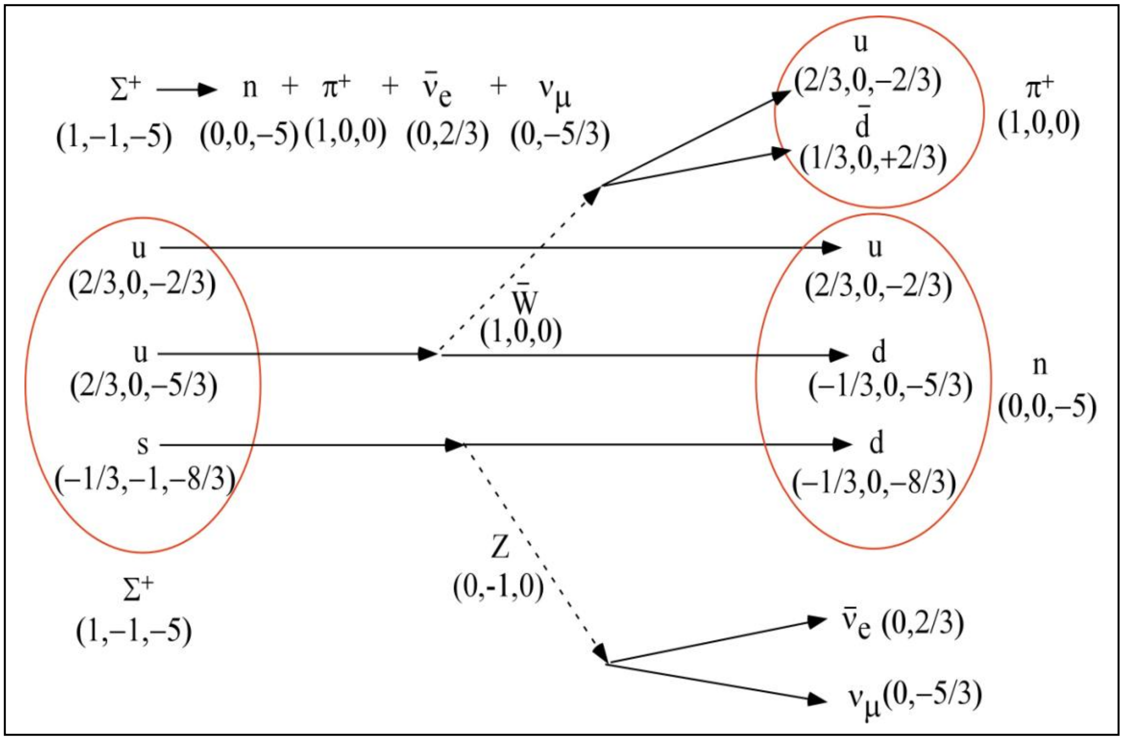
u (2/3,0,−2/3)
d (−1/3,0,−5/3)
c (2/3,−1,−8/3)
Λc+ (1,−1,−5)
W̄ (1,-1,0)
W (-1,0,0)
W̄ (1,0,0)
W (-1,-1,0)
u (2/3,0,−2/3)
u (2/3,0,−5/3)
d (−1/3,0,−8/3)
p (1,0,−5)
d̄ (1/3,0,2/3)
u (2/3,0,−2/3)
π+ (1,0,0)
ū (−2/3,0,2/3)
s (−1/3,−1,−2/3)
K− (−1,−1,0)


Λ0 → p + K- → p + π- + ν̄e + νμ
(0,−1,−5) (1,0,−5) (−1,−1,0) (1,0,−5) (−1,0) (0,2/3) (0,−5/3)
d (−1/3,0,−2/3)
u (2/3,0,−5/3)
s (−1/3,−1,−8/3)
Λ0 (0,−1,−5)
W (-1,-1,0)
ū (−2/3,0,2/3)
s (−1/3,−1,−2/3)
K- (−1,−1,0)
Z (0,-1,0)
d (−1/3,0,−2/3)
u (2/3,0,−5/3)
u (2/3,0,−8/3)
p (1,0,−5)
ū (−2/3,0,2/3)
d (−1/3,0,−2/3)
π- (−1,0)
ν̄e (0,2/3)
νμ(0,−5/3)



Σ+ → n + π+ + ν̄e + νμ
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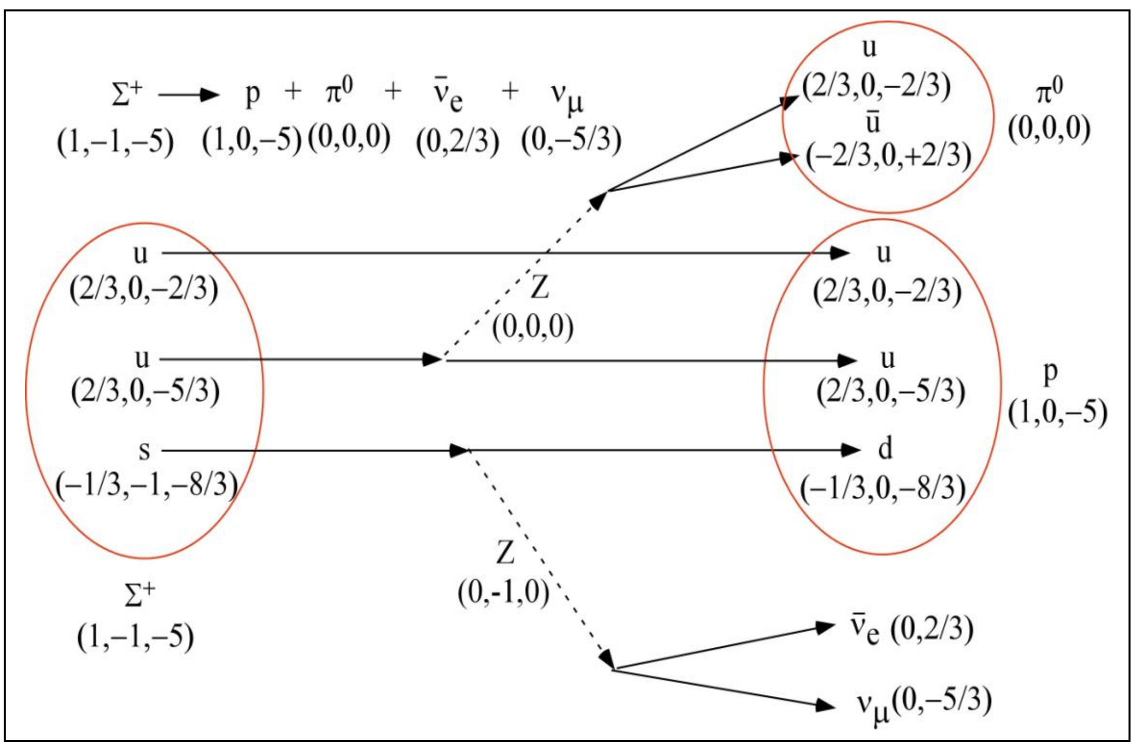
u
(2/3,0,−2/3)
d̄
(1/3,0,+2/3)
π+
(1,0,0)
u
(2/3,0,−2/3)
u
(2/3,0,−2/3)
W̄
(1,0,0)
u
(2/3,0,−5/3)
d
(−1/3,0,−5/3)
n
(0,0,−5)
s
(−1/3,−1,−8/3)
d
(−1/3,0,−8/3)
Z
(0,-1,0)
Σ+
(1,−1,−5)
ν̄e (0,2/3)
νμ(0,−5/3)



Σ+ → p + π0 + ν̄e + νμ
(1,−1,−5) (1,0,−5) (0,0,0) (0,2/3) (0,−5/3)
u
(2/3,0,−2/3)
ū
(−2/3,0,+2/3)
π0
(0,0,0)
u
(2/3,0,−2/3)
u
(2/3,0,−2/3)
Z
(0,0,0)
u
(2/3,0,−5/3)
u
(2/3,0,−5/3)
p
(1,0,−5)
s
(−1/3,−1,−8/3)
d
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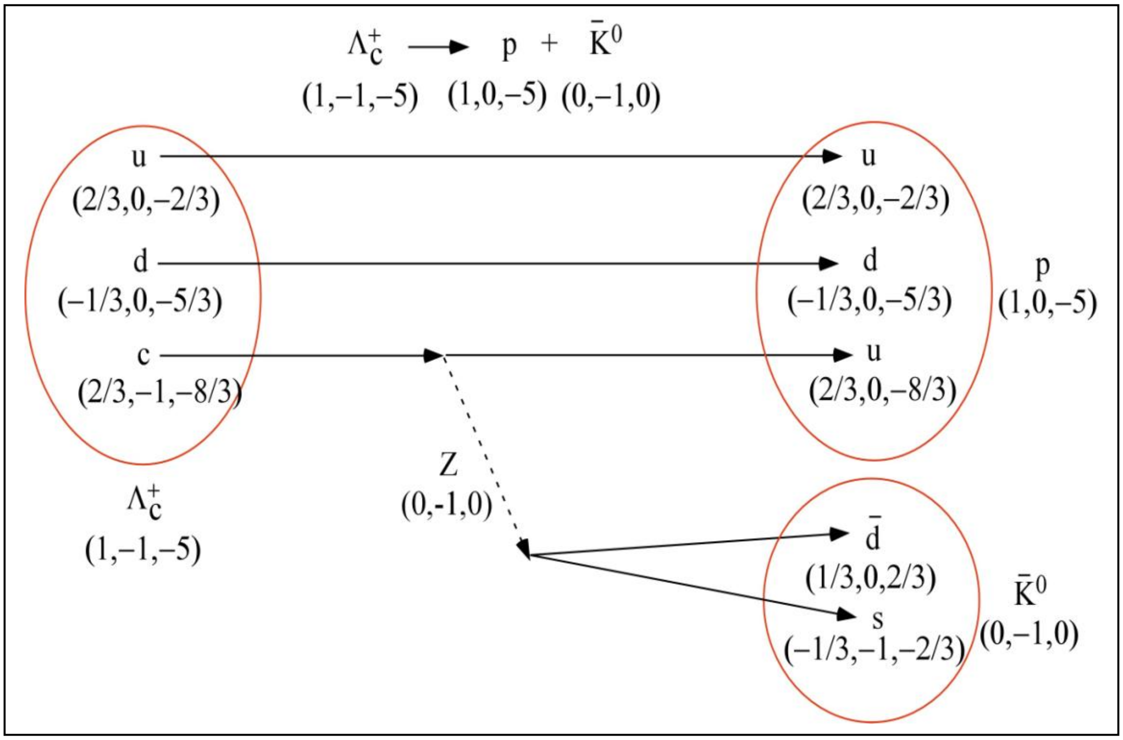
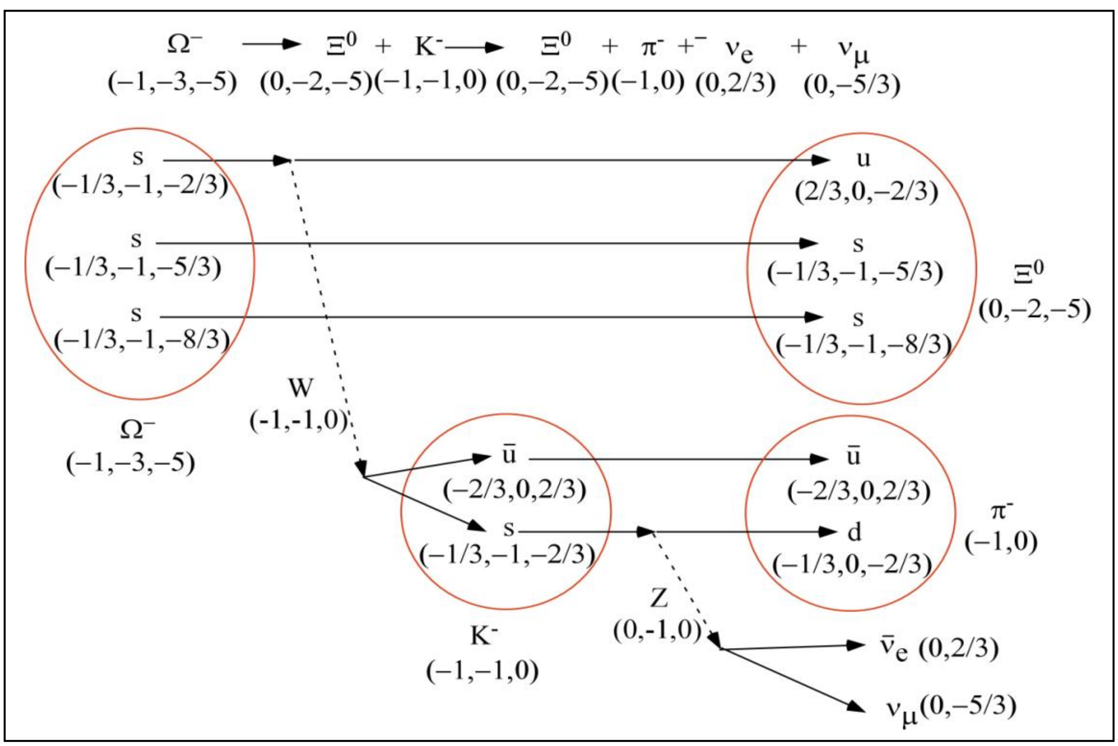
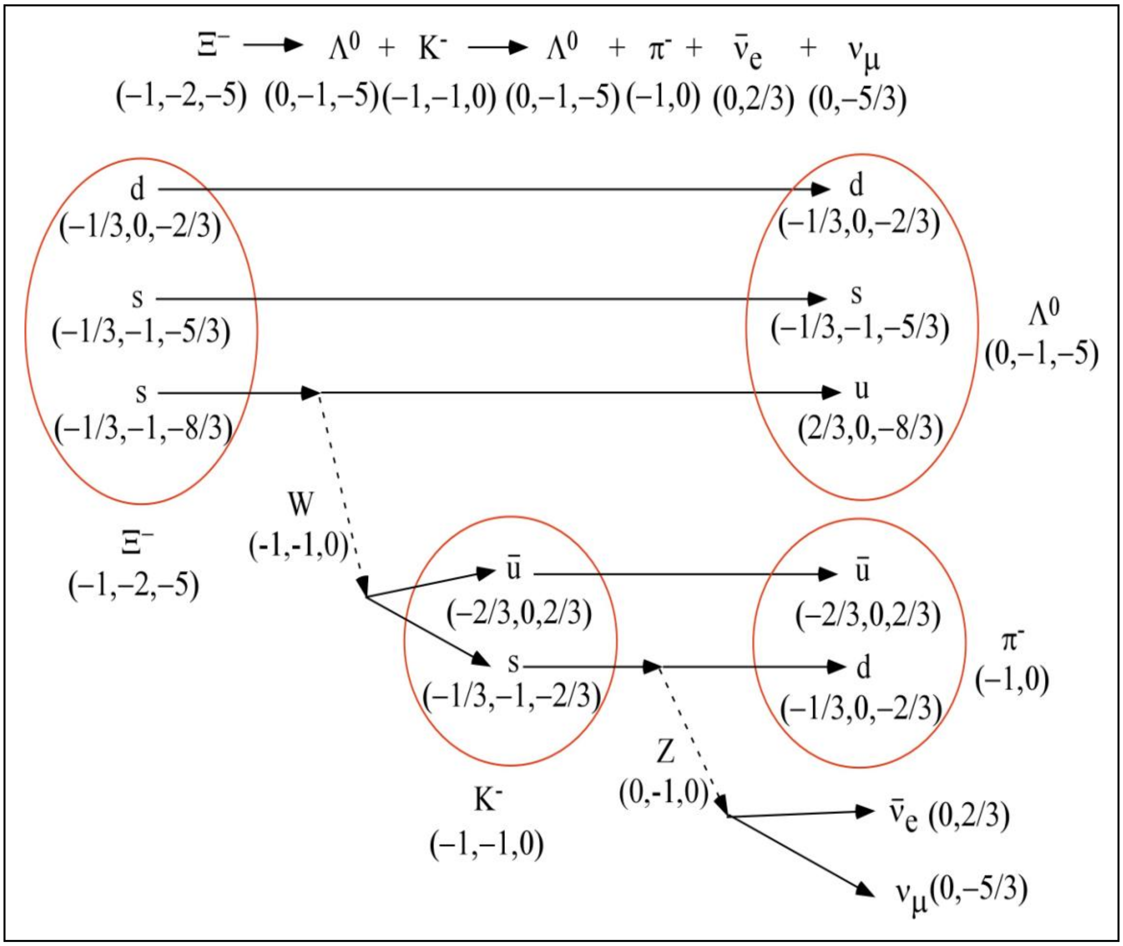
Z
(0,-1,0)
Σ+
(1,−1,−5)
ν̄e (0,2/3)
νμ(0,−5/3)


Λc+ ⟶ p + K̄0
(1,−1,−5) (1,0,−5) (0,−1,0)
u
(2/3,0,−2/3)
d
(−1/3,0,−5/3)
c
(2/3,−1,−8/3)
Λc+
(1,−1,−5)
Z
(0,-1,0)
u
(2/3,0,−2/3)
d
(−1/3,0,−5/3)
u
(2/3,0,−8/3)
p
(1,0,−5)
d̄
(1/3,0,2/3)
s
(−1/3,−1,−2/3)
K̄0
(0,−1,0)


Ω− ⟶ Ξ0 + K- ⟶ Ξ0 + π- +− νe + νμ
(−1,−3,−5) (0,−2,−5)(−1,−1,0) (0,−2,−5)(−1,0) (0,2/3) (0,−5/3)
s
(−1/3,−1,−2/3)
s
(−1/3,−1,−5/3)
s
(−1/3,−1,−8/3)
Ω−
(−1,−3,−5)
W
(-1,-1,0)
u
(2/3,0,−2/3)
s
(−1/3,−1,−5/3)
s
(−1/3,−1,−8/3)
Ξ0
(0,−2,−5)
ū
(−2/3,0,2/3)
s
(−1/3,−1,−2/3)
K-
(−1,−1,0)
ū
(−2/3,0,2/3)
d
(−1/3,0,−2/3)
π-
(−1,0)
Z
(0,-1,0)
ν̄e (0,2/3)
νμ(0,−5/3)



Ξ⁻ → Λ⁰ + K⁻ → Λ⁰ + π⁻ + ν̄e + νμ
(−1,−2,−5) (0,−1,−5)(−1,−1,0) (0,−1,−5) (−1,0) (0,2/3) (0,−5/3)
d
(−1/3,0,−2/3)
s
(−1/3,−1,−5/3)
s
(−1/3,−1,−8/3)
Ξ⁻
(−1,−2,−5)
W
(-1,-1,0)
d
(−1/3,0,−2/3)
s
(−1/3,−1,−5/3)
u
(2/3,0,−8/3)
Λ⁰
(0,−1,−5)
ū
(−2/3,0,2/3)
s
(−1/3,−1,−2/3)
K⁻
(−1,−1,0)
Z
(0,-1,0)
ū
(−2/3,0,2/3)
d
(−1/3,0,−2/3)
π⁻
(−1,0)
ν̄e (0,2/3)
νμ(0,−5/3)