Section E:

General Application to General Phenomena

"*The Earth is the cradle of the mind but we cannot live forever in a cradle*"

K. E. Tsiolkovsky (1857–1935)

Chapter 7

Applying CFLE Theory to Particle Physics

7.1 Reasons for the Existence of Various Particles and Their Characteristics

Most of the properties of chemical elements are periodic functions of the atomic number *Z*, which specifies the number of electrons in an atom of the elements. It was first emphasized by Mendeleev in 1869 that these periodicities can be made most apparent by constructing a periodic table of the elements. The quantum dynamic concepts that were developed in 1920 were able to explain the periodic table satisfactorily. At that time, the only known constituents of elements were the electrons, protons, and neutrons. With the development of the particle accelerator to decay protons and neutrons, numerous other subatomic particles were found, but current physics cannot explain why such a large variety of particles should exist and with such mass. For example, the standard model cannot explain how quarks can have $\pm\frac{1}{3}$e or $\pm\frac{2}{3}$ e, so the purpose of this chapter is to explain these facts.

The first point to be emphasized is the unit area of each force line elements. Because area is a function of velocity v [i.e., any static charge (e_e,m_g,e_w) is a function of velocity], the area of force line elements is changed when the velocity is changed, as shown in Figure 7-1-1.

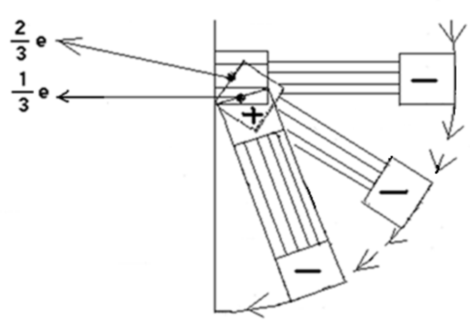


Figure 7-1-1

If this area of force line elements is reduced, the reduced area can be filled with another set of force line elements that has a smaller unit area, as shown in Figure 7-1-2.

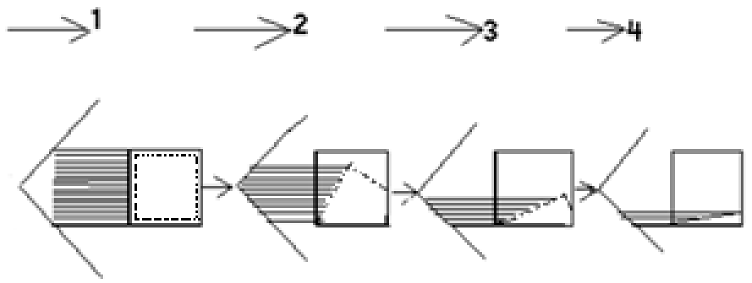


Figure 7-1-2

That is, when electromagnetic force line elements incline as shown by 1 → 2 → 3 → 4 in Figure 7-1-2, the static charge of the electromagnetism is deduced to be 1 → 2 → 3 → 4.

All unit surfaces of force line elements have 12 units, as shown in Figure 7-1-3:

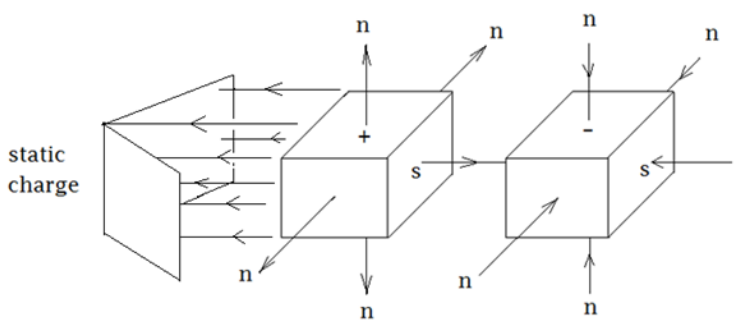


Figure 7-1-3

where *s* is the unit surface of the static charge, and *n* is the unit surface of the neutrolateral ± charge.

When the physical condition or the gauge condition changes, the force line elements are moved or curved.

Because all of the static charge surfaces are 4 units among 12 units, per every changed condition there should be a ratio of change of total static charge $R = \frac{4}{12} = \frac{1}{3}$. Therefore, most likely, the appearance of the changed static charge should be $\frac{1}{3}$e.

Finally, for example in area 3, the normal static charge 1e has changed to $\frac{1}{3}$e . At this time, another set of force line elements that has a small unit area will fill the reduced area of the electromagnetic force line elements. These are of course weak force line elements, but nevertheless give a reason for why such particles, through various mixing interactions, can have various mixing structures.

7.2 Application to the Muon $\mu^{\pm}$

7.2.1 Force line Curve of Muon $\mu^{\pm}$

The muon is a typical particle that interacts weakly, with a rest mass of 105.7 MeV/c^2. This rest mass is 206 times greater than the electron's rest mass of 0.511 MeV/c^2. In the curved force line elements (CFLE) theory, electrons and positrons are the fundamental particles and the rest mass and rest charge (static charge) of the electron is straight (i.e., there are no curves of force lines). There are no curves in the force lines and their force line elements. Therefore, we can use the rest mass of an electron as its unit mass. The rest mass of the muon can thus be expressed as

$$m_{\mu} = 206.85\, m_{\mathrm{e}} \Longrightarrow m_{\mu} = 206.85 \qquad \text{7-2-1-1}$$

However, because a particle's rest mass is only a function of the curve, and particles in nature have 4 kind of force line elements, we should be able to obtain the component curve of one force line from the total curve effect as rest mass as

$$g = \sqrt[4]{206.85} = 3.792 \qquad \text{7-2-1-2}$$

Observed neutron g factor is

$$g = -3.82608545 \qquad \text{7-2-1-3}$$

The curved angle is

$\sin\theta = \frac{3.792}{8} = 0.472, \qquad \theta = 28.29°$

This value is similar to the $\alpha_{s\mu} = 0.1$, $g = 3.772$, $\theta = 28.13°$ established in §6.4.

The only difference is that of the electrical permittivity of air at $g = 8$; that is,

$Q_e = (0.000589)\ (8) = 0.004712$

$x_e = 1.004712$

$$g = \frac{3.790}{1.004712} = 3.772 \qquad \text{7-2-1-4}$$

This force line curve observed in air is

$$g = (3.790)\ (1.000589) = 3.792 \qquad \text{7-2-1-5}$$

So, the couplings constant by muon is

$$\alpha_{s\mu} = \frac{(3.792)^2}{137.036} = \frac{14.379}{137.036} = 0.105 \qquad \text{7-2-1-6}$$

Although $\mu^{\pm}$ can interact weakly and has a static charge of 1e, the real static charge from the electron is only $\frac{1}{3}$e, because the rest static charge $\frac{2}{3}$e is from the weak charge of the weak force line elements.

According to $e = \sqrt[2]{2e_W \sin\theta_W}$, $\quad k = \frac{1}{\sqrt{1-\frac{v^2}{c^2}\alpha}}$ 7-2-1-7

When particles decay and $\mu^{\pm}$ are emitted, the $\mu^{\pm}$ are decayed as $\frac{1}{3}$e, and then rotate to 1e of an electron, whereas $\frac{2}{3}$e of neutrinos rotate to $\frac{1}{1.190208\text{x}10^7}$ e $\approx 0 \neq 0$.

The decay formula is

$\mu^{-} \rightarrow \bar{e} + \nu_e^{-} + \nu_{\mu}$

$$\mu+ \rightarrow e^{+} + \nu_e + \nu_{\mu}^{-} \qquad \text{7-2-1-8}$$

Its Feynman diagram is given in Figure 7-2-1.

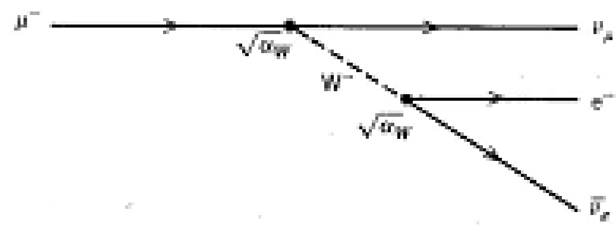


Figure 7-2-1-1. **(Source: F. Halzen and A.D. Martin. 1983. *Quarks and Leptons*, p. 22. Reproduced with permission from John Wiley & Sons © 1983.)**

When analyzed from a force line elements theoretical point of view, we can obtain the exact qualitative and quantitative components of μ^- (see Figure 7-2-2).

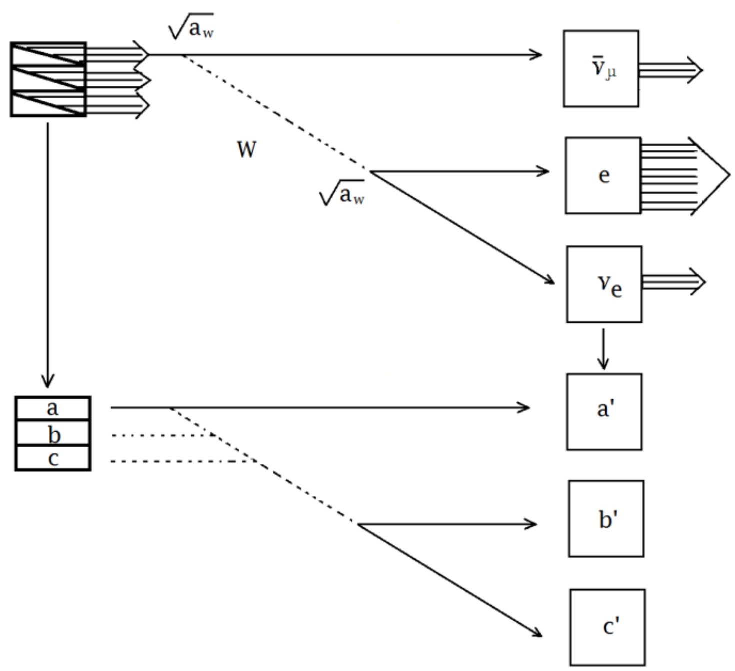


Figure 7-2-1-2

μ^- is made up of 3 constituents that are $-\frac{1}{3}$e of A because of $\frac{1}{2}$spin. According to the theory of relativity, this means that the neutrinos force line elements increase when a system of particles becomes unstable. That is, A and C are deprived of their force line elements to B and cannot stay in the system of particles. B is the original electron that takes the force line elements from A and C, and because B now has too many force line elements, the static charge B cannot stay in the system of particles, and so it becomes a regular electron with static change 1e(Anti CP violation). A and C become a regular neutrino and an anti neutrino that have weak static charges $e \approx 0 \neq 0$.

The existence of μ^{-} explains why the ratio of the magnetic moment between the neutron and proton is $\frac{\mu_n}{\mu_p} = -\frac{3.836}{5.579} = -0.68497$. Because μ^{-} is the outermost particle of a neutron, K^{+} is the outermost particle of a proton. The value of the magnetic moment ratio of a proton and neutron as predicted by the CFLE theory is $\frac{\mu_n}{\mu_p} = 0.683$. Thus, the predicted value agrees quite well with the experimental value, and we can have assurance that the CFLE theory is right.

7.2.2 Solving Problem of Anomalous Magnetic Moment of Muon by Force line Curve of Moun $g_\mu = 3.792$

Because anomalous magnetic moment of electron by Dirac equation is

$$\left(\frac{g-2}{2}\right)^{exp} = (11596577 \pm 3.5) \times 10^{-10} \qquad \text{7-2-2-1}$$

$$\left(\frac{g-2}{2}\right)^{QED} = (11596554 \pm 3.3) \times 10^{-10} \qquad \text{7-2-2-2}$$

Therefore net value of anomalous magnetic moment of electron at $g = 1$ state is

$$A_{e=0.00115965770}/_{2}$$

$$=0.00057982885 \qquad \text{7-2-2-3}$$

However, because muon decay 1 electron and two neutrino, quantity of magnetic anomalous of neutrinosA_ν should be calculated small as much as

$$A_\nu = {}^{(0.00057982885)}\Big/_{(137.04)}$$

$$=0.00000423109.2$$

$$= 423109.2 \times 10^{-11} \qquad \text{7-2-2-4}$$

This value is anomalous magnetic moment of neutrinos ν outside of muon.

For muon magnetic anomalous theoretically to calculate, we need anomalous magnetic moment of neutrinos ν inside of muon.

Because inside of muon neutrinos is in higher energy state than outside,

they has maximum force line curve $g = 8$.

related gravitational permittivity change is

$Q_g = 0.016774\times8$

$= 0.034192$

$x_g = 1.034192$

$x_g^2 = 1.286391$ 7-2-2-5

related gravitational permittivity change for $g = 1.5$is

$Q_g = 0.016774\times1.5$

$=0.025161$

$x_g = 1.025161$

$x_{g1.5}^2 = 1.050955$ 7-2-2-6

related electrical permittivity change for $g = {}^{1}/_{8}$is

$Q_{e8} = {}^{0.000589}/_{8}$

$=0.000074$

$x_8 = 1.000074$

$x_{e8}^2 = 1.000148$ 7-2-2-7

related electrical permittivity change for $g = {}^{1}/_{1.5}$ is

$Q_{e1.5} = {0.000589}/{1.5}$

$= 0.000393$

$x_{e1.5} = 1.000393$

$x_{e1.5}^2 = 1.000786$ 7-2-2-8

toatal effect is

$x_{tot}^2 = {(x_g^2 . x_{g1.5}^2 . x_{e8}^2)}/{(x_{e1.5}^2)}$

$= [(1.286391)(1.050955)(1.000148)]/[1.000786]$

$= 1.351077$ 7-2-2-9

Therefore, anomalous magnetic moment of neutrinos ν inside of muon is

$A_\nu^{IN} = {423109.2 \times 10^{-11}}/{1.351077}$

$= 313164.4 \times 10^{-11}$

A_ν^{IN} at $g = 2$ is

$A_\nu^{IN} = (313164.4 \times 10^{-11}) \times 2$

$= 626328.8 \times 10^{-11}$ 7-2-2-10

Therefore theoretical value of muon anomalous magnetic moment A_μ^{CFLE} by CFLE theory is

$A_\mu^{CFLE} = (115965770 \times 10^{-11}) + (626328.8 \times 10^{-11})$

$= 116592098.8 \times 10^{-11}$ 7-2-2-11

Experimental value A_μ^{exp} by Brookhaven National Lab (BNL) is

$A_\mu^{E821} = 116592091 \times 10^{-11}$ 7-2-2-12

Predictions value by Standard model by$A_{\mu}^{SM} = A_{\mu}^{QED} + A_{\mu}^{EW} + A_{\mu}^{Had}$ is

$A_{\mu}^{SM} = 116591803 \times 10^{-11}$ 7-2-2-13

The contradiction between experiment and theory of SM is

$\Delta a_{\mu} = a_{\mu}^{exp} - a_{\mu}^{SM} = 288\times 10^{-11}$ 7-2-2-14

This contradiction to solve by CFLE theory, we need minimal theoretical deviation $A_{\mu}^{min}$from anomalous magnetic moment of neutrinos ν.

$A_{\nu}^{mix} = 423101\times 10^{-11}$ 7-2-2-15

Because strong and electroweak contribution to a_{μ} are enhanced by ${m_{\mu}^2}/{m_e^2}$ relative toa_e, so they must be evaluated much more precisely as much as

$$A_{\mu}^{min} = {(A_{\nu}^{mix})}/{(m_{\mu}^2/m_e^2)}$$

$$= {423101 \times 10^{-11}}/{(206.85)^2}$$

$$= 9.8885\times 10^{-11} \qquad 7\text{-}2\text{-}2\text{-}16$$

This value is theoretical unavoidable deviation between experiment and theory. However, Standard Model of particle physics doesn't have prediction's ability about relativistic phenomena related general theory of relativity.

According to CFLE theory muon's force line is curved as much as g =3.792, instead curved space-time.

Therefore given deviation is increased more as much as curved force line (remember! near the Sun light is bent more as much as curved space-time). Therefore total possible deviation is

$A_{\mu}^{tot} = (9.8885\times 10^{-11})(3.792)^2$

$= 142.1\times 10^{-11}$ 7-2-2-17

A_μ^{tot} total possible deviation at $g = 2$ by CFLE theory is

A_μ^{tot} = $(142.1\times 10^{-11})(2)$

$= 284.3\times 10^{-11}$ 7-2-2-18

Observed value $\Delta a_\mu = a_\mu^{exp} - a_\mu^{SM}$ by A.Hoecker(CERN) and W.J.Marciano(BNL) in 2013 is

$\Delta a_\mu = a_\mu^{exp} - a_\mu^{SM} = 288\times 10^{-11}$ 7-2-2-19

Δa_μ by M. Davier and W.J. Marciano in 2004 is

$\Delta a_\mu = a_\mu^{exp} - a_\mu^{SM}$=$239\times 10^{-11}$ based $[e^+e^-]$ 7-2-2-20

$\Delta a_\mu = a_\mu^{exp} - a_\mu^{SM} = 239\times 10^{-11}$based $[\tau]$ 7-2-2-21

Conclusion: SM need modify by general relativity of CFLE theory.

7.3 Application to the Pion $\pi^{\pm}$, π°

7.3.1 Force line Curve of Pion $\pi^{\pm}$

The pion, as a meson that communicates a strong force, was proposed by Yukawa in 1935. In making his proposal, Yukawa was guided by two analogies available to him at that time. One was the covalent binding in molecules, and the other was organic molecules. He used the uncertainty principle and calculated the rest mass of the pion to be $m_\pi = 200 m_e \sim$ 100 MeV/c². Because the rest mass of π is $m_\pi = 273.19$, the curve of the force line element is

$g = \sqrt[4]{273.19} = 4.066$ 7-3-1-1

$\sin\theta = \frac{4.066}{8} = 0.508$ 7-3-1-2

$\theta = 30.53^{\circ}$, $\alpha_{s\pi} = \frac{(4.066)^2(1)^2}{137.036} = \frac{16.532}{137.036} = 0.121$ 7-3-1-3

For static charge of $\frac{2}{3}$e from a weak force line element with spin 0, the decay formula is

$$\pi^{-} \rightarrow \mu^{-} + \nu_{\mu}^{-}$$

$$\pi^{+} \rightarrow \mu^{+} + \nu_{\mu} \qquad \text{7-3-1-4}$$

and its Feynman diagram is as shown in Figure 7-3-1-1.

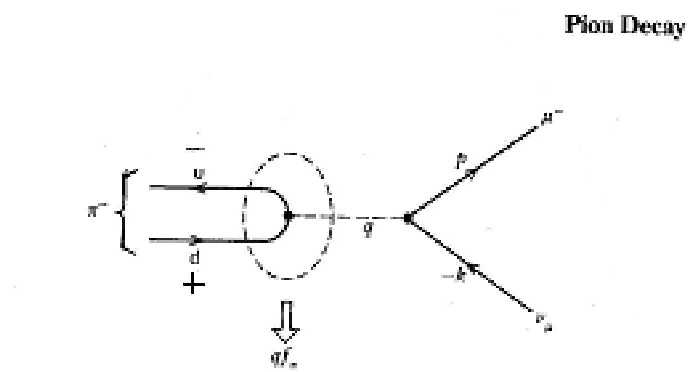


Figure 7-3-1-1 **(Source: F. Halzen and A.D. Martin. 1983. *Quarks and Leptons*, p. 265. 1983. Reproduced with permission from John Wiley & Sons © 1983.)**

Analyzed from a CFLE theoretical point of view, π is found to be made up of 4 constituent because of spin 0 ($\pi^{-} \rightarrow \mu^{-} + \nu_{\mu}^{-} \rightarrow e^{-} + \nu_{e}^{-} + \nu_{\mu} + \nu_{\mu}^{-}$) as shown in Figures 7-3-1-2 through 7-3-1-4.

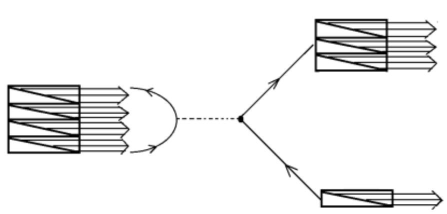


Figure 7-3-1-2

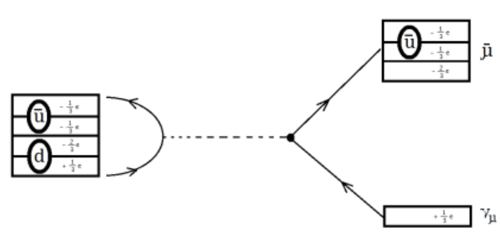


Figure 7-3-1-3

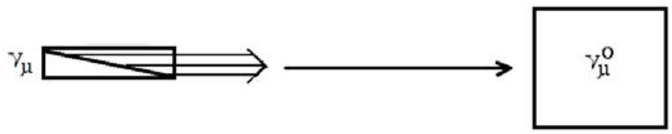


Figure 7-3-1-4

ν_μ is separated from the d quark with $+\frac{1}{3}$e and becomes a usual neutrino with e $\approx 0 \neq 0$, $m \approx 10^{-37}$ kg. The rest constituent is μ^-. But here, according to relativity theory, a d quark of $-\frac{2}{3}$e becomes $-\frac{1}{3}$e. The real electron B takes the weak force lines from the d quark of C's $-\frac{1}{3}$e and $\bar{u}$ of A's $-\frac{1}{3}$e, causing $-\frac{3}{3}$e $\rightarrow$ 1e, and so the real electron cannot stay in the system of particles. According to the relativity principle, the real electron becomes a regular electron with the characteristics of a loss in speed, a huge loss of momentum, and a large gain of rest mass. During this process, $\bar{w}$ acts as a mediating particle with its 1e coming from A's $-\frac{1}{3}$e, B's $-\frac{1}{3}$e, and C's $-\frac{1}{3}$e, and all their force lines of $-\frac{3}{3}$ are given to the electron. At the same time, every force line elements of the constituent particles are rotated, as shown in Figure 7-3-1-5.

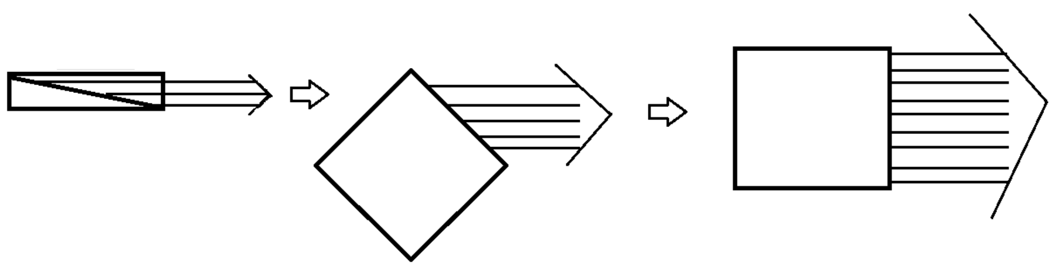


Figure 7-3-1-5

The standard model cannot explain how a quark can have a static charge of $\frac{1}{3}$e, whereas the CFLE theory can easily explain this phenomenon as occurring only by rotation of force line elements. According to the principle of relativity, if a pion's constituents were odd, they could have zero spin or integer spin (1, 2, 3….). This is a very important characteristic. Although $\mu^\pm$ and $\pi^\pm$ have very similar rest masses (m_μ = 207, m_π = 273) and very similar force line curves (g_μ = 3.8 and g_π = 4.1, respectively), their interaction strengths are very different. The $\mu^\pm$ interact with material very weakly (detectable even in deep mines), but $\pi^{\pm}$ mesons interact particularly strongly, and even if only one π meson collides with one nucleus, most of its rest mass energy goes into splitting the nucleus into fragments that fly apart energetically.

However, the standard model cannot explain why $\mu^{\pm}$ interactions are weak and why $\pi^{\pm}$ interactions are strong. CFLE theory, however, can explain this important difference between pions and muons. Because they interact differently because of spin. Protons are made up of uud quarks. However, and so the pion can interact strongly with the ud quarks of P and N. In the case of a neutron made of udd quarks, its real constituent, but because a neutron is electrically neutral, it cannot interact strongly with the $\mu^{\pm}$ or with the proton, because the muon has an constituent. Of course, muons have no part in Yukawa's theory of the origin of the strong interaction, but historically it is different, although this was not appreciated until sometime after the muon's discovery in 1956 by Anderson and Neddermeyer. These investigators found the particles as components of cosmic radiation, and they showed that the muon's rest mass is intermediate between the rest mass of an electron and that of a proton. In 1936, pions had not yet been discovered, and it was naturally assumed that the $\mu^{\pm}$ were Yukawa's meson. An ever-increasing accumulation of evidence showed however that the interaction of muons with matter was very weak; for instance, the muon in cosmic radiation can penetrate solid matter of great thickness with little attenuation, since they can be detected in deep mines. This being the case, muons could hardly be the particles responsible for strong interactions, despite the fact that their rest mass $m^{\pm}$ = 106 MeV/c² = 200 $m_e^{\pm}$ is quite close to the value predicted by Yukawa. This situation was the source of considerable confusion in the 10 years before the discovery of the pion.

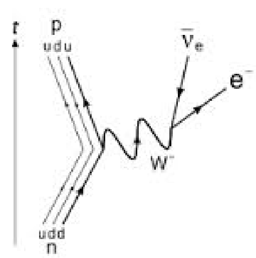


Figure 7-3-1-6

7.3.2.Disclosing Yukawa Coupling by Force line Curve of Pion $g_\pi = 4.006$

Yukawa proposed in 1935 that a nucleon frequently emits particles with appreciable rest mass, now called π mesons or pions. He could predict the mass of the pion through the following process:

$$\Delta E \Delta t \sim \hbar, \quad \Delta E \sim m_\pi c^2, \quad \Delta t \sim \frac{r'}{c}, \quad m_\pi c^2 \sim \frac{\hbar}{\Delta t} \sim \frac{\hbar c}{r'}, \quad m_\pi \sim \frac{\hbar}{r'c}$$

If r' = 2F, the rest mass of π is

$$m_\pi \sim \frac{\hbar}{r'c} \sim \frac{1 \times 10^{-34}\ \mathrm{J{\cdot}s}}{(2 \times 10^{-15}\ \mathrm{m})(3 \times 10^{8}\ \mathrm{m/s})} \sim 2 \times 10^{-28}\ \mathrm{kg} \qquad \text{7-3-2-1}$$

This can also be written as $m_\pi \sim 200 m_\mathrm{e} \sim 100\ \mathrm{MeV/c^2}$ and Yukawa's potential is

$$V(r) = V_{\mathrm{Yu}}(r) = -g_{\mathrm{Yu}}^2 \frac{\mathrm{e}^{-r/r\prime}}{r} \qquad \text{7-3-2-2}$$

where $r' = \frac{\hbar}{m_\pi c} = 1.5\mathrm{F}$

The overall strength of the potential depends on the constant g_{yu}^2, the value of which gives the best agreement with experimental observation in the form of the dimensionless quantity $\frac{g_{\mathrm{Yu}}^2}{\hbar c}$. The value so determined is

$$\frac{g^2}{\hbar c} \approx 15 \qquad \text{7-3-2-3}$$

This process shows the current address of present physics. However, the CFLE theory can predict the value of Eq. 7-3-2-7 theoretically, because as discussed in §6.3, the theory postulates that the strength of a strong force is a curved electromagnetic force and curved real strong force and so the dimensionless quantity from Yukawa's potential is

$$\alpha_{\mathrm{Yu}} = \frac{g_{\mathrm{Yu}}^2}{\hbar c} \cong 15 \implies \alpha_{\mathrm{Yu}} = \frac{\mathrm{e}_{\mathrm{yu}}^2}{\hbar c} \cong 15$$

Because the curve of the electric force line is a strong force according to CFLE theory, we can write

$$\alpha_{\mathrm{yu}} = \frac{\mathrm{e}_{\mathrm{yu}}^2}{\hbar c} \implies \alpha_{\mathrm{yu}} = \frac{g_\pi^2 \mathrm{e}_{\mathrm{yu}}^2}{\hbar c} \qquad \text{7-3-2-4}$$

However, because e_{yu}^2 is only the strength of a strong force at g_{hadron}= 1, we can rewrite this as

$$1^2 e_{yu}^2 = e_{yu}^2 \qquad 7\text{-}3\text{-}2\text{-}5$$

Thus, the possible maximum value of the couplings constant of Yukawa's potential is

$$\alpha_{yukawa} = \frac{g_{\pi}^2 e_{yu}^2}{\hbar c}$$

Because force line curve of pion is $g_{\pi} = 4.066$

$$\alpha_{yukawa} = \frac{(4.066)^2(1)^2]}{\hbar c}$$

$$= 16.53 \qquad 7\text{-}3\text{-}2\text{-}6$$

gravitational permittivity change between $g = 1$and g =4.066 is

$$Q_g = (0.016774)(4.066) = 0.068203, x_g = 1.068203, x_g^2 = 1.141058$$

electrical permittivity change between $g = 1$and g =4.066 is

$$Q_g = (0.000589)(4.066) = 0.002395, x_g = 1.002395, x_g^2 = 1.004796$$

Final value is

$$\alpha_{yukawa} = \frac{(4.066)^2(1)^2(1.004796)}{(\hbar c)(1.141058)} = 14.56 \approx 15 \qquad 7\text{-}3\text{-}2\text{-}7$$

Conclusion:

1. Physical essence of Yukawa coupling is curve of strong force line.

2. Standard Model of particle physics is modified by CFLE theory of general relativity.

7.4 Application to the Kaon $K^{\pm}$, K°

7.4.1Force line Curve of kaon $K^{\pm}$

The $K^{\pm}$ meson has a mass m_K = 493.7 MeV/c², and m_K = 966.14, so the force line curve of $K^{\pm}$ is

$g = \sqrt[4]{966.14} = 5.5752$

$m_{K^0} =$ 497.6 MeV, and $m_{K^o} = 973.78$, so the

force line curve of K^0 is

$g = \sqrt[4]{973.78} = 5.5862$ 7-4-1-1

Observed proton g factor is

g =5.585694713 7-4-1-2

This predicted value by CFLE theory agrees with the experimental value for protons, g = 5.586. The related angle is

$\sin\theta = \frac{5.575}{8} = 0.697$

$\theta = 44.18^o$

So, α_{sK} of $K^{\pm}$ is

$\alpha_{sk} = \frac{(5.575)^2(1)^2}{137.036} = 0.227$ 7-4-1-3

Here, we can find that the proton is surrounded by a K field and is much more stable then the neutron. As a meson, the kaon has a large rest mass, so its main decay modes are

(1) $K^+ \to \mu^+ + \nu_\mu$ 63.55±0.11% 7-4-1-4

(2) $K^+ \to \pi^+ + \pi^o$ 20.66±0.08% 7-4-1-5

(3) $K^+ \to \pi^+ + \pi^+ + \pi^-$ 5.59 ±0.04% 7-4-1-6

(4) $K^+ \to \pi^+ + \pi^0 + \pi^0$ 1.761±0.022% 7-4-1-7

(5) $K^+ \to \pi^0 + e^+ + \nu_e$ 5.07± 0.04% 7-4-1-8

(6) $K^+ \rightarrow \pi^0 + \mu^+ + \nu_\mu$ $3.353 \pm 0.034\%$ 7-4-1-9

Decay modes for K^- are charge conjugates of the ones above.

and its Feynman diagram is as given in Figures 7-4-1-1 through 7-4-1-3.

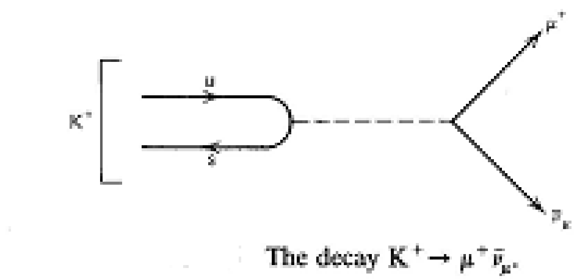


Figure 7-4-1-1. **(Source: F. Halzen and A.D. Martin. 1983. *Quarks and Leptons*, p. 280. Reproduced with permission from John Wiley & Sons © 1983.)**

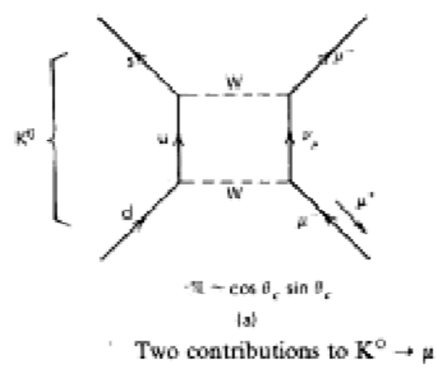


Figure 7-4-1-2. **(Source: F. Halzen and A.D. Martin. 1983. *Quarks and Leptons*, p. 282. Reproduced with permission from John Wiley & Sons © 1983.)**

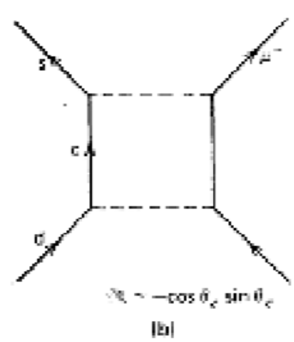


Figure 7-4-1-3. **(Source: F. Halzen and A.D. Martin. 1983. *Quarks and Leptons*, p. 282. Reproduced with permission from John Wiley & Sons © 1983.)**

Here, the important formula is

$$K^+ \rightarrow \pi^+ + \pi^0 \qquad 7\text{-}4\text{-}1\text{-}10$$

This formula explains why a proton in a stable state has a force line curve of g = 5.586. Thus, because Yukawa's theory predicted that the proton is surrounded by a pion field, the experimental proton's force line curve must be g = 4.066. However, the experimental value of proton is g = 5.586. This means that a proton is surrounded momentarily by K^+ or $\pi^+ + \pi^0$, because the experimental value is g = 5.586.

7.4.2. Solving Problem of Radius of Muonic Hydrogen by Force line Curve of Kaon

Despite that the electron is a matter-wave; we can express its revolution around a proton according to the Bohr model. Its radius of revolution is

$$r_n = 4\pi\varepsilon_o \frac{n^2\hbar^2}{m_{eZ}e^2} \quad \text{where } n = 1, 2, 3$$

When $n = 1$, $r_1 = 5.291774 \times 10^{-11}$ m

Because the Coulomb force between the proton and electron is the same, the radius of charge distribution of the proton should be a function of only its rest mass, according to Yukawa's π meson theory. So, the expected proton charge distribution radius is

$$r_p = \frac{5.291774 \times 10^{-11}\ \text{m}}{1.836109 \times 10^3} = 2.882059 \times 10^{-14}\ \text{m} \qquad 7\text{-}4\text{-}2\text{-}1$$

However, this value is much bigger than the experimental value in " Proton Structure from the measurement of 2S-2P transition frequenc ies of Muonic Hydrogen": science 25 Jan 2013 by A.Antognini ~34 researchers~R.Pohl $r_p = 8.4087 \times 10^{-16} m$. This contradiction is more serious than the dark matter phenomenon of the universe.

Such a difference cannot be explained by modern particle physics. However, CFLE theory can explain this easily by applying the force line curve g =5.5862 of a kaon.

This force line curve g =5.5862 is changed by gravitational permittivity and electrical permittivity gravitational permittivity difference by $\frac{g=2}{g=1}$ is

Q_{2g} = 0.016774× 2= 0.033548

x_{2g} = 1.033548 7-4-2-2

maximum electrical permittivity difference by $\frac{g=5.5862}{g=1}$

$Q_{5.6e}$ =0.000589 ×5.5862=0.003290

$x_{5.6e}$ =1.003290 7-4-2-3

electrical permittivity difference by $\frac{1}{3}e$ of quark is

$Q{e/_3} = \frac{0.000589}{3}$ =0.000196

$x{e/_3}$ = 1.000196 7-4-2-4

maximum electrical permittivity difference by $\frac{1}{3\times8\times1.5}$

$Q{e/_{3\cdot8\cdot1.5}} = \frac{0.000589}{36}$ =0.000016

$x{e/_{36}}$ = 1.000016 7-4-2-5

Total difference is

$$d_t = \frac{(x_{2g})(x_{5.6e})\left(x{e/_3}\right)}{(x{e/_{36}})} = \frac{(1.033548)(1.003290)(1.000196)}{(1.000016)}$$

$$= 1.037135 \qquad \text{7-4-2-6}$$

Effective value is

g_{eff} =5.5862× 1.037135

=5.7936 7-4-2-7

Exact value of g_{eff} from Eq.18-3-5 is

g_{eff} = 5.793596 7-4-2-8

This factor is called proton charge radius factor.

Inside of this radius is called nucleus of proton.

Kaon $K^0_{mix}$is builded by muon in muonic hydrogen with neutrino that comes from exiting process for Lamb shift. That is

$$\mu^-_{Hyd} + \nu^-_{exite} \rightarrow \mu^-_{Hyd} + \nu^-_{\mu} \rightarrow K^-_{exite} \qquad \text{7-4-2-9}$$

$$K^+_{proton} \rightarrow \mu^+_{proton} + \mu^+_{proton}$$

$$(\mu^+_{pro} + \mu^+_{pro})^{K^+} + (\mu^-_{Hyd} + \nu^-_{\mu})^{K^-} \rightarrow K^0_{mix} \qquad \text{7-4-2-10}$$

Because of force line curve g =5.7936, total effect for radius is

$$g^2_{K^0} = (5.7936)^2$$

$$=33.566$$

Therefore minimum radius of proton with K^0_{mix} by CFLE theory is

$$d_r = \frac{2.882059\times10^{-14}\ \text{m}}{33.566} = 8.5862 \text{ x } 10^{-16}\ \text{m} \qquad \text{7-4-2-11}$$

This theoretical value agrees with the experimental value $r_\text{p} = 8.4087 \times 10^{-16} m$ well. Proton's electrical charge distribution radius is defined $r_\text{p} = 2.882059 \times\ 10^{-14}$ m at $g = 1$, However, maximum proton's electrical charge distribution radius can be defined by maximum curve of force line of kaon by $g = 5.793596$. That is

$$r_\text{p} = 2.882059 \times\ 10^{-14}\ \text{m} / 5.793596$$

$$= 4.9745598 \times\ 10^{-15}\ \text{m} \qquad \text{7-4-2-12}$$

Another problem is that international accepted charge radius of proton by CODATA2009 is $r_\text{p} = 8.768 \times 10^{-16} m$ .However; radius of muonic hydrogen by Lamb shift 2S (1/2)-2P (1/2) is $r_\text{p} = 8.4087 \times 10^{-16} m$.

This difference becomes unsolved problems in physics what is the true charge radius of the proton. However, In CFLE theory this difference cannot becomes serious problem, because such difference occur by different experimental method. Experiment method of proton charge radius $r_{\mathrm{p}} = 8.768 \times 10^{-16}m$ is proton-electron scattering. However, Experiment method of proton charge radius $r_{\mathrm{p}} = 8.4087 \times 10^{-16}m$ is Lamb shift 2S $(1/2)$-2P $(1/2)$ by muonic hydrogen.

Nevertheless muon and electron is same lepton, but force line curve g is different. This difference of force line curve Δg result different charge radius $r_{\mathrm{p}}$of proton below.

Because force line curve of muon is $g = 3.792$. Therefore net force line curve difference for gravitational charge (mass) is

$$\Delta g = \frac{3.792}{1.5} = 2.525 \qquad \text{7-4-2-13}$$

This value is none other than residual strong nuclear force.

Related gravitational permittivity difference is

$$Q_g = 0.016774 \times 2.525 = 0.042354$$

$$x_g = 1.042354 \qquad \text{7-4-2-14}$$

Related electrical permittivity difference is

$$Q_e = \frac{0.000589}{1.5} = 0.000393$$

$$x_e = 1.000393 \qquad \text{7-4-2-15}$$

Total difference is

$$d_{tot} = x_g \cdot x_e = (1.042354)(1.000393)$$

$$=1.042764 \qquad \text{7-4-2-16}$$

Therefore proton charge radius from proton-electron scattering experiment is bigger than Lamb shift by muonic hydrogen experiment as bigger as

$$r_{\mathrm{p(scatering)}} = (r_{\mathrm{p(Lamb)}})(d_{tot})$$

$$= (8.4087 \times 10^{-16}m)(1.042764)$$

$$= 8.768 \times 10^{-16}m \qquad \text{7-4-2-17}$$

This theoretical value is agree very well with experimental CODATA value

$$r_p = 8.768 \times 10^{-16} m \qquad 7\text{-}4\text{-}2\text{-}18$$

7.5 Application to the Proton, P

7.5.1. Force line Curve of Proton

The existence of the proton is well known and it has a rest mass M_P = 1836.109 m_e. From this fact, the force line curve of the proton is

$$g = \sqrt[4]{1836.109} = 6.545979 \qquad 7\text{-}5\text{-}1\text{-}1$$

$$\sin\theta = \frac{6.546}{8} = 0.818, \quad \theta = 54.91° \qquad 7\text{-}5\text{-}1\text{-}2$$

In particular, the square of the force line curvature of the proton [g^2 = $(6.546)^2$ = 42.85] is a significant number for dark matter, and is called the number of dark matter. The curve of the proton (g = 6.546) is a specific number taken directly from the present physical situation of the universe. Sometimes, this value is used as g = 6.782970 (cf. §7.8).

Because this theoretically predicted value agrees quite well with the experimental value, we have an assurance here that the CFLE theory is right. The doubly charged Δ^{++} particle's decay formula is

$$\Delta^{++} \rightarrow P^{+} + \pi^{+} \qquad 7\text{-}5\text{-}1\text{-}3$$

and its Feynman diagram is given by Figure 7-5-1.

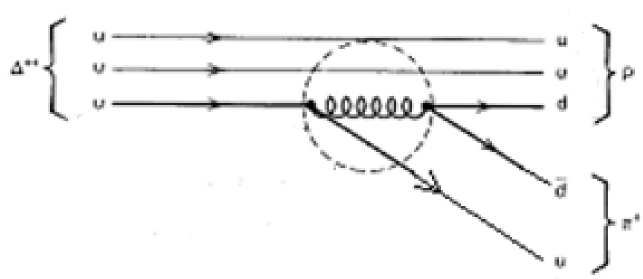


Figure 7-5-1. **(Source: F. Halzen and A.D. Martin. 1983. *Quarks and Leptons*, p. 22. Reproduced with permission from John Wiley & Sons © 1983.)**

Here, we can find the structure of the d quark. Because u quarks cannot directly change to d quarks, the d quark must only be generated by quark pair creation, $\bar{p}$p → $\bar{d}$d. That is, as discussed in §7.3, the d quark splits into $-\frac{1}{3}\mathrm{e_d} = -\frac{2}{3}\mathrm{e_d} + \frac{1}{3}\mathrm{e_d}$.

7.5.2Solving the Proton Decay Problem of a Grand Unified Gauge Theory by CFLE Theory

The electroweak SU (2) × U (1) gauge theory is in impressive agreement with the experimental results. The SU (2) × U (1) gauge group is a product of two disconnected sets of gauge transformations. The SU (2) group has coupling strength g and the U(1) group has strength g', and therefore these two couplings are not related by theory. The ratio $\frac{g'}{g}$ = tan θ_W has to be measured experimentally. Only if the SU (2) and *U* (1) gauge transformations are embedded into a larger set of transformations G can *g* and g' be related by the gauge theory. Symbolically, this is written as

G > SU (2) > U (1) 7-5-2-1

Some of the new transformations in the group G will link to previously disconnected SU(2) and U(1) subsets of gauge transformation. So, *g* and g' are related by a number (in fact, a Clebsch–Gordan coefficient of G) whose value depends on the choice of the unifying group G.

In the quest for the ultimate theory, it seems natural to attempt to unify a strong interaction with the electroweak SU (2) × U (1) interaction. That is, physicists seek a group G that also contains the color gauge group SU (3) that will successfully describe the strong interaction. They speculate that such a grand unified group G exists; then

G ⊃ SU (3) × SU(2) × U(1) 7-5-2-2

Where gauge transformations in G are also related to the electroweak couplings g,g' and to the color couplings. All the interactions would then be described by a grand unified gauge theory (GUT) with a single coupling of *g* to G to which all couplings are related in a specific way once the gauge group G has been founded. This unification is expressed in Figure 7-5-1, where the couplings are associated with the SU(3), SU(2), and U(1) subgroups by g_i (Q), with i = 3, 2, 1, respectively.

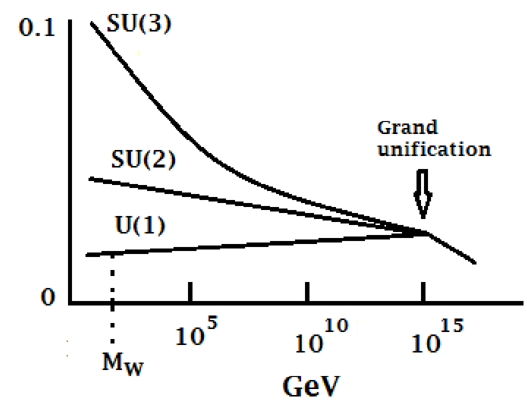


Figure 7-5-1

Figure 7-5-1 recalls the fact that the gauge coupling depends on the characteristic moment Q of the interactions. The couplings $g_2(Q)$ and $g_1(Q)$ of the non abelian group are asymptotically free, whereas the abelian coupling $g_1(Q)$ increases with increasing momentum Q, similar to the conventional charge screening of electromagnetism. Figure7-5-1 suggests that for some large-momentum scale $Q = M$, the three couplings merge into a single grand unified coupling, g_s. That is, for $Q \geq M_x$,

$$g_i\,(Q) = g_G\,(Q) \qquad \text{7-5-2-3}$$

The group G describes a unified interaction with coupling $g_G\,(Q)$, and when Q is decreased below M_x, the coupling $g(Q)$ separates and eventually gives the phenomenological coupling g,g' and α_s, which describe the interaction observed in the present-day experiments for which $Q \approx \mu \approx 10$ GeV. With a conventional choice of couplings,

$$\alpha_s\,(Q) = \frac{g_3^2(Q)}{4\pi}, \quad g\,(Q) = g_2\,(Q), \quad \text{and } g'\,(Q) = \frac{1}{C}\,g_1(Q)$$

Where C is a Clebsch-Gordan coefficient of G. From $\frac{g'}{g} = \tan\theta_W$ in terms of g' and g

$$\frac{1}{C}\frac{g_1(Q)}{g_2(Q)} = \tan\,\theta_W(Q) \qquad \text{7-5-2-4}$$

So, for $Q \gtrsim M$, where $g_1 = g_2$, C determines the Weinberg angle θ_w. Assuming that there exists a group G, we can use the phenomenological values of the coupling at $Q \simeq \mu$ to estimate the unification mass M_x. This can be done because the Q dependence of the coupling $g_i(Q)$ is prescribed by gauge theory. For instance, the Q dependence of α_s is given by

$$\alpha_S(Q^2) = \frac{\alpha_S(\mu^2)}{1+\frac{\alpha_S(\mu^2)}{12\pi}(33-2n_f)\log(\frac{Q^2}{\mu^2})} \qquad 7\text{-}5\text{-}2\text{-}5$$

Replacing α_s by g_3 and after simple rearrangements, the formula becomes

$$\frac{1}{g_3^2(\mu)} = \frac{1}{g_3^2(Q)} + 2b_3 \log\frac{Q}{\mu} \qquad 7\text{-}5\text{-}2\text{-}6$$

with $b_3 = \frac{1}{(4\pi)^2}\ (\frac{2}{3}n_f - 11)$ 7-5-2-7

where n_f is the number of quark flavor for $Q = M_x$ $g_3 = g_G$ and

$$\frac{1}{g_i^2(\mu)} = \frac{1}{g_G^2} + 2b_i \log\frac{M_x}{\mu} \qquad 7\text{-}5\text{-}2\text{-}8$$

With i = 3, this equation is applied equally well to SU (2) and U (1) coupling. The different routes, pictured in Figure 13-7-1, by which the three couplings of $g_i(Q)$ reach g_G are due to different b_i coefficients in Eq. 7-5-2-6 and we can obtain

$$b_1 = \frac{1}{(4\pi)^2}(\frac{4}{3}n_g)$$

$$b_2 = \frac{1}{(4\pi)^2}(-\frac{22}{3}) + b_1$$

$$b_3 = \frac{1}{(4\pi)^2}(-11) + b_1 \qquad 7\text{-}5\text{-}2\text{-}9$$

where n_g is the number of families of fermions. In fact, for SU(N)

$$b_N = \frac{1}{(4\pi)^2}[-\frac{11}{3}N + \frac{4}{3}n_g] \qquad 7\text{-}5\text{-}2\text{-}10$$

where the two terms correspond to the gauge boson and fermions loops. Given the Q dependence of couplings, it is straightforward to estimate M_x. By eliminating n_g and g_G with i = 1, 2, 3, a particular linear combination is formed:

$$\frac{C^2}{g_1^2} + \frac{1}{g_2^2} - \frac{(1+C^2)}{g_3^2} = 2[C^2 b_1 + b_2 - (1+C^2)b_3] \log\frac{M_x}{\mu} \qquad 7\text{-}5\text{-}2\text{-}11$$

where $g_i^2 = g_i^2(\mu)$. The left-hand side has been chosen so that it can be expressed in terms of e^2 and g_3^2, or equivalently α and α_s. Indeed,

$$\frac{C^2}{g_1^2}+\frac{1}{g_2^2}=\frac{1}{g'^2}+\frac{1}{g^2}=\frac{1}{e^2} \qquad \text{7-5-2-12}$$

Inserting the explicit expression for the b_i coefficients of Eq. 7-5-2-7 into Eq. 7-5-2-11 gives

$$\log\frac{M_x}{\mu}=\frac{3(4\pi)^2}{22(1+3c^2)}\left[\frac{1}{e^2}-(1+C^2)\frac{1}{g_3^2}\right]$$

$$=\frac{6\pi}{11(1+3C^2)}\left(\frac{1}{\alpha}-\frac{1+C^2}{\alpha_s}\right) \qquad \text{7-5-2-13}$$

For $\mu \simeq 10$ GeV, $\alpha \simeq \frac{1}{137}$, $\alpha_s \simeq 0.1$, and $C=\frac{5}{3}$,

$$M_x \simeq 5\times 10^{14}\ \text{GeV} \qquad \text{7-5-2-14}$$

Strictly speaking, we should use $\mu \sim M_W$, but the couplings are slowly varying and the order of magnitude estimates are not particularly sensitive to the "ordinary" mass chosen for μ, nor to the precise value of the Clebsch-Gordan coefficient C. The dependence of M_x on the value of α_s is shown in Table 7-5-2-1.

Table 7-5-2-1. Dependence of M_x on α_s

α_s	M_x	$\sin^2\theta_w$	T_p (years)
0.1	5×10^{14}	0.21	$\sim10^{27}$
0.2	2×10^{16}	0.19	$\sim10^{34}$

To observe such life-time of unstable protons, various experiments were attempted.

One experiment, which gave the best limit of 10^{32} years for the proton life-time, used about 8,000 tons of highly purified water viewed by particle detectors and held in a plastic container lining the walls of a huge pit dug in a very deep salt mine. It is necessary to go deep underground to eliminate the effect of cosmic rays, particularly high-energy muons. Cosmic ray neutrinos cannot be absorbed out. They produce events different to separate proton decay, and these may set a limit of about 10^{33} years on the sensitivity of the experiments. Besides the great experimental difficulty in detecting proton decay events in such a huge bulk of material, there is the problem of knowing for which decay to design the instrumentation.

Whereas the initial experiments were made particularly to detect p → e + π° as favored by SU(5), other theories suggest different decays. Other more finely grained detecting systems may do a better job on some of these other decays. It may take some time to have definitive results, but the existence of proton decay is crucial to grand unified theories. To date, there are no crucial results from any experiments. Here, however, CFLE theory can explain why there cannot be crucial results.

Because the permitted force line curve of a proton by the present universe is g = 6.545979, the coupling constant of an electromagnetic interaction is

$$\alpha = \frac{e^2}{4\pi\varepsilon_0\hbar c} = \frac{1}{137.03} \qquad 7\text{-}5\text{-}2\text{-}15$$

By CFLE theory, the change of running coupling constant of a strong interaction is

$$\alpha_s = \frac{g^2e^2}{4\pi\varepsilon_0\hbar c} = \frac{(6.546)^2}{137.036} \qquad 7\text{-}5\text{-}2\text{-}16$$

$$= 0.313 \qquad 7\text{-}5\text{-}2\text{-}17$$

This value is the allowed value of a strong couplings constant by the force line curve of the present universe. Therefore, a proton would be decayed according to the strong coupling constant α_s = 0.313.

Such strong coupling constant of 0.313 demands a great life-time of a proton. Because the proton life-time by the GUT is

$$T_p = \frac{M_X^4}{m_P^5} \qquad 7\text{-}5\text{-}2\text{-}18$$

according to the force line curve, this is changed to

$$T_p = \frac{M_X^4}{m_P^5} \quad \Longrightarrow T_p = \frac{M_X^4\,(g_{M_X})^4}{m_P^5(g_{m_P})^5} \qquad 7\text{-}5\text{-}2\text{-}19$$

Thus, because of the force line curve of a proton, this formula changes to

$$T_p = \frac{M_x^4\,(6.546)^4}{m_p^5(1)^5} \qquad 7\text{-}5\text{-}2\text{-}20$$

where $g_{M_X} = 6.546$ and $g_{m_P} = 1$ 7-5-2-21

Therefore, although $\alpha_s \approx 0.2 \approx \frac{g^2 e^2}{4\pi\varepsilon_0 \hbar c} = \frac{(5.575)^2}{137.036}$, $g = 5.575$ from the kaon and maximum $g_{Mx} = 8$ for a high-speed particle, thus the expected life-time of a proton is

$$T_p \approx (10^{34}\ \text{years}) \left(\frac{g^4_{M_X}}{g^5_{m_P}} \right) \approx (10^{34}\ \text{years}) \left(\frac{(8)^4}{(1)^5} \right)$$

$$\approx 10^{37}\ \text{years} \qquad \text{7-5-2-22}$$

According to this life-time, a 4,000 times larger scale of experiment is needed, meaning more than 10^7 ton of pure water compared with the 10^4 ton of the original experiment!

7.6 Application to the Neutron, N

7.6.1Force line Curve of Neutron

Because the mass of a neutron is $m = 1836.75$, its force line curve is

$$g = \sqrt{1836.75} = 6.546550 \qquad \text{7-6-1-1}$$

The angle θ is

$$\sin\theta = \frac{6.548}{8} = 0.818, \quad \theta = 54.93° \qquad \text{7-6-1-2}$$

Despite that the neutron has a bigger mass than the proton, the experimentally measured curve of a neutron is $g = -3.8$. This results means that a neutron's outermost particle is μ^- or that a neutron is surrounded by a μ^- field with a muon curve of $g = 3.772$. That is, the neutron is structured such that the proton has one electrically negative charged particle in the nucleus. The neutron changes according to following formulas:

$$n \longrightarrow p + \pi^- \ \text{after}\ \pi^- + P \longrightarrow n \qquad \text{7-6-1-3}$$

$$p \longrightarrow n + \pi^+ \ \text{after}\ \pi + n \longrightarrow p \qquad \text{7-6-1-4}$$

$$n \longrightarrow n + \pi° \ \text{after}\ \pi° + p \longrightarrow p \qquad \text{7-6-1-5}$$

$$p \longrightarrow p + \pi° \ \text{after}\ \pi° + n \longrightarrow n \qquad \text{7-6-1-6}$$

$p \longrightarrow p + \pi^{\circ}$ or $p \longrightarrow n + \pi^{+}$ 7-6-1-7

$n \longrightarrow n + \pi^{\circ}$ or $n \longrightarrow p + \pi^{-}$ 7-6-1-8

These formulas mean that in the nucleus, a neutron can stay stable, but because outside of the nucleus (or nucleon) a neutron cannot change its π, so the neutron decay is

$N \longrightarrow p + e^{-} + \nu_{e}^{-}$ 7-6-1-9

Figure 7-6-1 shows its Feynman diagram.

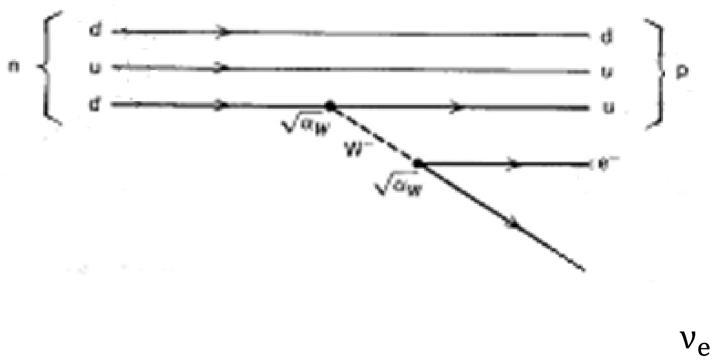


Figure 7-6-1-1. (Adapted from F. Halzen and A.D. Martin. 1983. *Quarks and Leptons*, p. 22. Reproduced with permission from John Wiley & Sons © 1983.)

Here, the important point is what the real qualitative or quantitative reason is for decay of an isolated neutron. Historically, this problem was treated by the study of β-decay. In β-decay, the decay energy E can be shared between the electron's kinetic energy K_{e} and the anti neutrino's kinetic energy K_{ν}; that is,

$K_{\mathrm{e}} + K_{\nu} = E$ 7-6-1-10

As there are very many ways in which this energy division can be made, the value of K_{e} forms a spectrum, which expressed with the momentum spectrum $R(p_{\mathrm{e}})$ is found to be

$R(p_{\mathrm{e}}) = [\frac{(K-K_{\mathrm{e}})^2 p_{\mathrm{e}}^2}{2\pi^3 \hbar^7 c^3}]\, M * M$ 7-6-1-11

$M = \int \psi_{\mathrm{f}}^{*} \beta \psi_{\mathrm{i}} dt$ 7-6-1-12

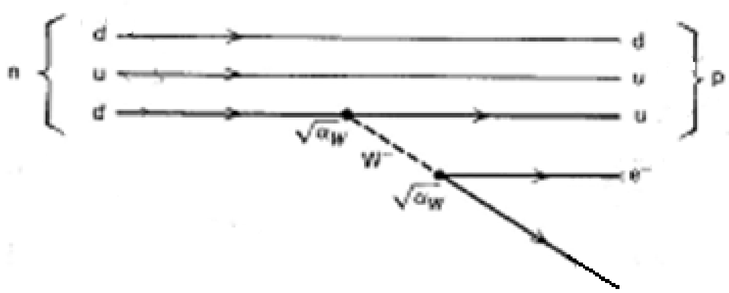
where M is the β-decay matrix. The elemental Eqs. 7-6-1-11 and 7-6-1-12 were first obtained by Fermi under the simplified assumption that the

Coulomb interaction between the nucleon and the emitted electron could be neglected. He also assumed that β is a universal constant, called the β-decay coupling constant. Of course, his assumption was right, but results of Eqs. 7-6-1-11 and 7-6-1-12 cannot explain why the Coulomb interaction in the β-decay process could be neglected, or the current situation of the present physics about the four forces (see Table 7-6-1-1).

Table 7-6-1-1. Strength and Sign of the Four Physical Forces According to Current Modern Physics

Force	Strength	Sign
Strong (nuclear)	1	Attractive overall
Electromagnetic	10^{-2}	Attractive or repulsive
Weak β-decay	10^{-14}	Not applicable
Gravitational	10^{-40}	Always attractive

CFLE theory, however, gives sufficient explanation of why the neutron decays according to the Feynman diagram of $n \rightarrow p + e + \bar{\nu}_e$ (Figure 7-6-1-2)



ν_e

Figure 7-6-1-2. W^- can emit the probability $\sqrt{\alpha_w}$ by $-\frac{1}{3}$e of the d quark, $-\frac{1}{3}$e of $\bar{\nu}_e$. (Adapted from F. Halzen and A.D. Martin. 1983. *Quarks and Leptons*, p. 22. Reproduced with permission from John Wiley & Sons © 1983.)

As discussed in §7.2 and §7.3, we can likewise find here that the decays of π^- and μ^- constituent particles interact with the repulsive neutrolateral force by weak force line elements (which are 3.772 times stronger than the Coulomb force) between the u quark ($+\frac{2}{3}$e) from the d quark ($+\frac{2}{3}$e $+\frac{1}{3}$e) and electron ($-\frac{1}{3}$e) between electron ($-\frac{1}{3}$e) and anti neutrino ($-\frac{1}{3}$e). Now, according to dipolar force line elements and seeds in CLFE theory, Table 7-6-1 can be corrected as Table 7-6-2.

Table 7-6-1-2. Strength and Sign of the Four Physical Forces According to CFLE Theory

Force	Strength	Sign
Strong (nuclear)	1	Attractive and repulsive
Electromagnetic	10^{-2}	Attractive and repulsive
Weak	10^{-14}	Attractive and repulsive
Gravitational	10^{-40}	Attractive and repulsive

7.6.2. Solving the Mystery of Ultra luminous X-ray Sources as Exotic Neutron Star constituted by Exotic Neutron. Its Muon Replaced by Kaonic Oscillon through Flavor mixing.

Ultra luminous X-ray sources (ULX) were first discovered in 1980 by the Einstein observatory; later observations were made by ROSAT. Great progress has been made by the X-ray observatories XMM-Newton and Chandra which have a much greater spectral and angular resolution. ULX are off-nuclear point sources in nearby galaxies whose X-ray luminosity exceeds the theoretical maximum for spherical in fall (the Eddington limit) onto stellar-mass black holes. Their luminosity the fact that ULXs have Eddington luminosities larger than that of stellar mass objects implies that they are black holes. However, the ULX of M82 X-2 by data from NASA's space-based X-ray telescope (NuSTAR) in Oct.9, 2014 is indicated that M82 X-2 is a pulsar, but many time brighter than the Eddington limit. This is the brightest pulsar ever recorded and it has all the power of a black hole but with much less mass. Pulsars belong to a class of neutron stars. Neutron star are the burnt-out cores of exploded stars, but puny in mass by comparison. The NuSTAR team was shocked to find that M82X-2 had a pulse. Black holes don't pulse, but pulsars do. A pulse late from M82 X-2 is 1.37252 s with a 2.51784-day sinusoidal modulation and its energy output is same as 10 million of suns. Therefore energy problem of M82X-2 becomes unsolved problem in physics how this dead star is radiating so feverishly.

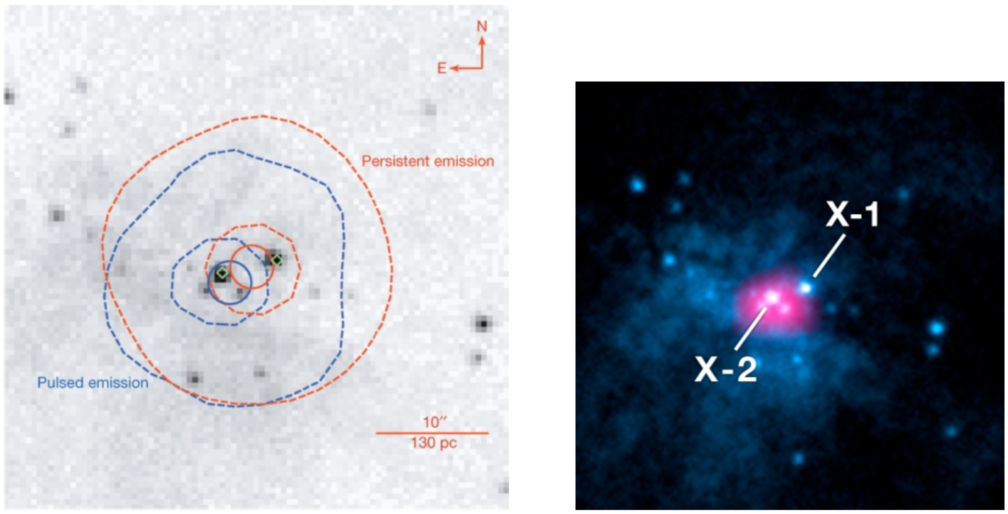


Figure 7-6-2-1

However, CFLE theory can solve this problem qualitatively and quantitatively by curve of force line.

The current accepted solar luminosity $L_{\odot}$ is

$$L_{\odot} = 3.846\times 10^{33} erg/s, L_{\odot} = 3.846\times 10^{26} W \qquad 7\text{-}6\text{-}2\text{-}1$$

In usual stellar process Eddington luminosity L_{Edd} is

$$L_x \leq L_{Edd} = 1.26 \times 10^{38} \left(\frac{M}{M_{\odot}}\right) erg/s \qquad 7\text{-}6\text{-}2\text{-}2$$

The NuSTAR(Nuclear Spectroscopic Telescope Array) high energy X-ray mission observed the galaxy M82($d_{earth} \approx 3.6Mpc$) seven time between Jan 23 and 2014 Mar 06 as part of a follow up campaign of the supernova SN2014J. The galaxy's disk contains several ULXs, the most luminous being M82X-1(not pulsar) and M82X-2(pulsar).Because the two source are separated by 5″, only Chandra X-ray telescope can resolve clearly. Brightest M82X-1(not pulsar) can reach

$$L_X(0.3 - 10keV) \sim 10^{41} ergs^{-1} \qquad 7\text{-}6\text{-}2\text{-}3$$

The second brightest being a transient, M82X-2(pulsar), which has been observed to reach

$L_X(3-30keV) \quad = 4.9\times 10^{39} ergs^{-1}$ 7-6-2-4

$L_X(0.3-10keV) = 1.8\times 10^{40} ergs^{-1}$ 7-6-2-5

During the M82 monitoring campaign, NuSTAR observed bright emission from the nuclear region containing the two ULXs. The region show moderate flux variability at the 20% level during the first 22days of observation. The flux then decreases by 60% during the final observation ~20dayslater. The peak flux, to a total 3-30 $keV F_X(3-3-keV) = 2.33\times 10^{-11} ergcm^{-2}s^{-1}$ assuming isotropic emission corresponded luminosity is

$L_{Xpeak} = 3.7\times 10^{40} ergs^{-1}$ 7-6-2-6

Effective Eddington limit is defined as the point where the gravity is balanced by the continuum force including both electron scattering and other continuum processes. That is

$L_{Eddington} = \frac{4\pi GMm_pc}{\sigma_T}$ = 1.26× $10^{38}(\frac{M}{M_\odot})erg/s$ 7-6-2-7

Where $\sigma_T$is the Thomson scattering cross-section for electron.

This means that Eddington luminosity is calculated by mass of electron at$g=1$. When Eddinton luminosity is applied to neutron and neutron star, should be considered mass difference between electron and muon. That is $\Delta g = \frac{g_{electron}=1}{g_{muon}=3.792}$

Therefore, required change of Eddington luminosity appeared in neutron and neutronstar by change of the Thomson scattering cross-section σ_T by mass difference between muon and electron $\Delta m = \Delta r = \quad \Delta g^4 = (3.792)^4 = 206.8$ is

$\sigma_T \to \sigma_\mu = \sigma_T \times 206.8$ 7-6-2-8

σ_{207} is called muon scattering cross-section.

Related change of Eddington luminosity for neutron and neutron star is

$L_{Eddington\ for\ muon} = L_{Eddington} \times 206.8$

=(1.26× $10^{38}(\frac{M}{M_\odot})erg/s$)(206.8)

$$=2.61\times 10^{40}(\frac{M}{M_{\odot}})erg/s \qquad 7\text{-}6\text{-}2\text{-}9$$

This luminosity is called muonic luminosity in CFLE theory.

Now we can calculate peak luminosity of neutron star by maximum flavor change of muon or maximum lepton mixing of muon by gravitational implosion in neutron in neutron star.

$$L_{Eddington\ for\ neutronstar} = 2.61\times 10^{40}(\frac{1.4M_{\odot}}{M_{\odot}})erg/s$$

$$=3.65\times 10^{40}\ erg/s \qquad 7\text{-}6\text{-}2\text{-}10$$

Observed value is

$$L_{Xpeak} = 3.7 \times 10^{40} ergs^{-1}$$

Kaon mass is

$m_K =$ 493.7 MeV/c², and m_K = 966.14m_e, so the force line curve of $K^{\pm}$ is

$$g_K = g = \sqrt[4]{966.14} = 5.5752 \qquad 7\text{-}6\text{-}2\text{-}11$$

Therefore mass of kaonic Oscillon (Kaonic lepton by mass oscillation of muon) and curve of force line of kaonic Oscillon is

$$m_{Kaonic\ oscillon} = 966.14 m_e$$

$$g_{Kaonic\ oscillon} = \sqrt[4]{966.14} = 5.5752 \qquad 7\text{-}6\text{-}2\text{-}12$$

Mass difference between muon and kaonic Oscillon is

$$\Delta m = \frac{m_k}{m_\mu} = \Delta g^4 = \frac{966.14}{206.8} = 4.672 \qquad 7\text{-}6\text{-}2\text{-}13$$

Therefore, Eddington luminosity for kaonic neutron star is

$$L_{Xkaonic} = (3.7 \times 10^{40} ergs^{-1})\ (4.672)$$

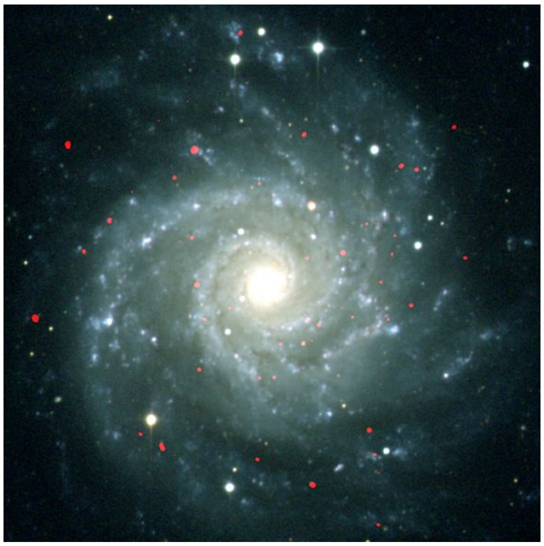
$$= 1.7 \times 10^{41} ergs^{-1} \qquad 7\text{-}6\text{-}2\text{-}14$$

This luminosity is called kaonic luminosity of neutron star in CFLE theory. Important point is that mass of this ultra luminous X-ray object is

$M_X = 1.4M_{\odot}$ 7-6-2-15

This mass means that these ultra luminous X-ray objects are usual neutron. However, this luminosity is none other than upper limit of usual ultra luminous X-ray sources that scientists are believed stellar black hole.

Researcher is believed that "the discovery of an ultra-luminous pulsar has implications for understanding the ULX population. The fraction of ULXs powered by neutron stars must be considered highly uncertain. M82 X-2 has been extensively studied; however, pulsations have eluded detection due to the limited timing capabilities of sensitive X-ray instruments, the transient nature of the pulsations, and the large amplitude of the orbital motion. Pulsars may indeed not be rare among the ULX population." However, such believe don't need any more. All of ULXs that are in ranges from$10^{39} erg\ s^{-1} \leq L_X(0.5 - 10\ keV) \leq 10^{41} ergs^{-1}$, are only exotic neutron star constituting exotic neutron. Therefore, there is no star black hole, no galactic black hole(called super massive black hole in galactic center) (cf.§11),and no Big-Bang black hole by results of WMAP's observation of CBM $g = 1$ →flat cosmos. (cf.§13.§19)



ULXs in M74

Credit: X-ray; J. Liu (U.Mich.) et al., CXC, NASA - Optical; T. Boroson (NOAO), AURA, NOAO, NSF Figure 7-6-2-2

In visual appearance, M74 is a nearly perfect face-on spiral galaxy, about 30 million light-years away toward the constellation Pisces. The red blotches seen in this composite view are ultraluminous x-ray sources (ULXs) mapped by the Chandra X-ray Observatory. The ULXs are so called because they actually do radiate 10 to 1,000 times more x-ray power than "ordinary" x-ray binary stars, which harbor a neutron star or stellar mass black hole. In fact, watching these ULXs change their x-ray brightness over periods of 2 hours or so, astronomers conclude that ULXs could well be intermediate mass black holes -- black holes with masses 10,000 times or so greater than the Sun, but still much less than the million solar mass black holes which lurk in the centers of large spiral galaxies. How did these intermediate mass black holes get there? One intriguing suggestion is that they are left over from the cores of much smaller galaxies that are merging with spiral galaxy M74.

Conclusion: there is no curved space-time theory for particle physics, for stellar physics, astronomy, and for cosmology. Therefore Einstein's theory of general relativity is useless and meaningless in this universe.

What means observed luminosity of M82X-2 $L_{M82X2}(3-30keV) = 4.9\times10^{39}ergs^{-1}$? That is

Eddington luminosity of basic neutron star is

$$L_{usual\ neutronstar} = 1.26\times10^{38}\left(\frac{1.4M_{\odot}}{M_{\odot}}\right)erg/s$$

$$= 1.76\times10^{38}\ erg/s \qquad 7\text{-}6\text{-}2\text{-}16$$

Difference between luminosity of M82-X-2 and luminosity of usual neutron star is

$$d_L = \frac{4.9\times10^{39}ergs^{-1}}{1.76\times10^{38}\ ergs^{-1}} = 27.84 \qquad 7\text{-}6\text{-}2\text{-}17$$

This difference means only degree of flavor change or degree of lepton mixing or degree of mass change. We can calculate change of curve of force line.

$$\Delta g_{fl} = \sqrt[4]{27.84} = 2.297 \qquad 7\text{-}6\text{-}2\text{-}18$$

Real change of degree of flavor change of muon is only change of curve of force line as much as $\Delta g_{\mu} = 2.297$

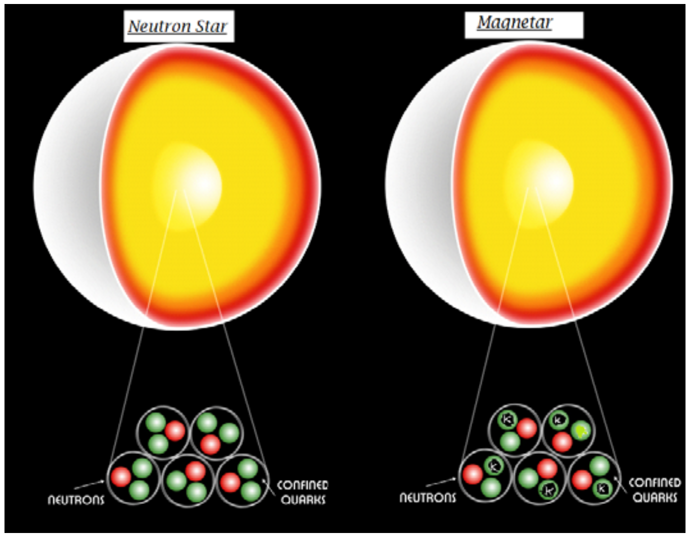


Figure 7-6-2-3

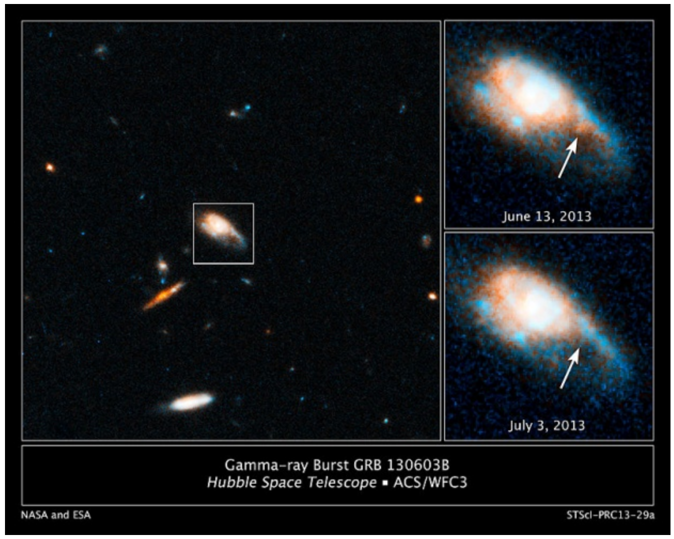
Conclusion: Ultra luminous X-ray sources is same kind of magnetar.

7.6.3. Application to Quark and Neutronic Seed Nova, Solving Origin of Short Gamma Ray Burst

Gamma- ray bursts (GRBs) are flashes of γ – rays associated with extremely energetic ($10^{51}{\sim}10^{54}erg$) explosion that has been observed in distant galaxies. they are the brightest electromagnetic events known to occur in the universe. the duration of observable emission can vary from milliseconds to tens of minutes. A short population with an average duration about 0.3 seconds and a long population with an average duration of about 30 seconds. Most observed event of 70% have duration of than two seconds and are classified as long gamma-ray bursts.

Ultra long gamma-ray bursts are the tail end of the long GRB duration distribution, lasting more than 10,000~25,000 seconds.

Gamma-ray burst were first observed in the 1967 by the U.S. Vela satellites. After discovery of GRBs, astronomers considered much distinct class of objects, including white dwarfs, pulsars, supernovae, globular cluster, Seyfert galaxies, and BL Lac objects. All such searches were unsuccessful. GRB 980425(means 25.Apr.1998!!! 30 years after first observation) was followed within a day by a coincident bright supernova SN 1998bw, indicating a clear connection between GRBs and the deaths of very massive stars. This burst provided the first strong clue about the nature of the systems that produce GRBs.



The fading glow provided key evidence that it was the decaying new type of fireball of stellar blast called a kilo nova. July 13, 2013.

Figure 7-6-3-1

The association of only some long GRBs with supernovae and the fact that their hosts galaxies are rapidly star-forming offer very strong evidence that long gamma-ray bursts are associated with massive stars.

However, to date there was still no generally accepted model for how this extremely large energy emancipations process occurs. Any successful model of GRB emission must explain the physical process for generating energy of gamma–ray emission, light curves, spectra, and other characteristics.

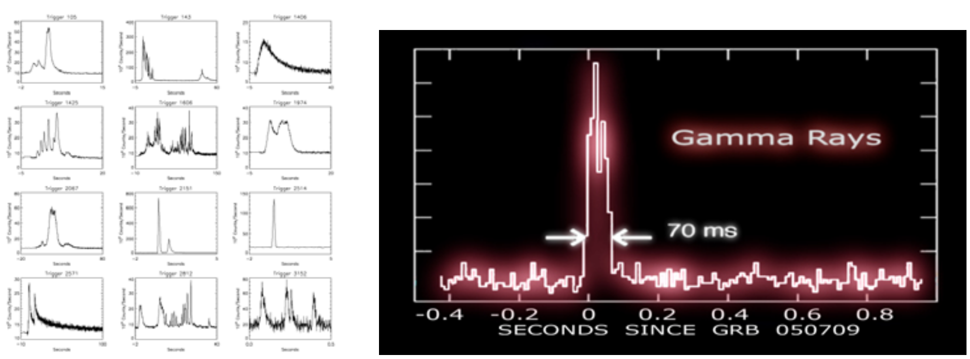


Figure 7-6-3-2

The light curves of gamma ray bursts (GRBs) plot the number of gamma rays detected against time. They reveal that GRBs can be as short as several milliseconds or as long as several minutes, with variability seen on millisecond timescales. In order to produce such rapid variations, the energy of the GRB must be emitted from a very small region, as objects cannot vary faster than the time it takes for electromagnetic radiation to travel across them. This rapid variability therefore places strong constraints on possible progenitor scenarios and energy formation mechanisms for GRBs.

GRB light curves are quite varied in shape, ranging from smooth single pulses, to multiple peaks well separated in time, to others which are highly erratic. About 25-30% of all GRB light curves are simple and contain only one pulse, while the more complex curves are generally made up of several overlapping pulses.

Therefore we can conclude that gamma ray cannot be emitted from black hole, because black hole does not pulse. However, gamma-ray burst last inside of event horizon as below of this secession.

Energy of ULXs is

$$10^{39} erg\ s^{-1} \leq L_X(0.5 - 10\ keV) \leq 10^{41} ergs^{-1} \qquad \text{7-6-3-1}$$

However, energy of gamma ray burst is

$$10^{51} erg \sim 10^{54} erg \qquad \text{7-6-3-2}$$

Energy ratio of two energy is

$$R_{energy} = 10^{12} \sim 10^{15} \approx 10^{14} \qquad \text{7-6-3-3}$$

Scale of this ratio is none other than scale of force interval constant.

This means that energy of gamma ray buster should be quark's energy.

Neutron star can be said huge gravitational neutron.

Because size of neutron star is $12 \sim 15km$, needed size for source object of gamma ray burst at least according to uncertainty principle $\frac{\hbar}{2} \leq \Delta E \Delta t$ and strong coupling constant $\frac{\alpha_s}{\alpha_e} = 137.035997$ should be

$$R_{source\ object} < \frac{15km}{137.035997} = 109m \qquad \text{7-6-3-4}$$

This means that neutron star implode by Bose-Einstein condensation at least to 109m and explode at least to $6\times 10^{8}m$ for short gamma ray burst.

However, because event horizon of neutron star according to $R_s = \frac{2GM}{c^2}$ is $R_{ENeutron\odot} = 4.2 \times 10^3 m = 4200m$, size of quark region is now smaller than this event horizon.

According to Einstein's general relativity any object can escape from inside of event horizon to outside of event horizon even photon.

Here, we can find clearly that Einstein's general relativity is wrong.

For such huge energy of short gamma ray burst as supernova explosion to explain is it needed unavoidably that super light speed of gluon should be introduced. This means that in side of quark region speed of gluon is same as light speed. However, outside of quark region speed of free gluon must be faster than light speed.

However, according to Einstein's special relativity any object cannot move faster than light. Here, we can find clearly that Einstein's special relativity is wrong.

Therefore, free gluon that builds with strong force line should be faster than light speed for huge energy of gamma ray to transport according to formula$R_s = \frac{2GM}{c^2} \rightarrow c_{light} = \sqrt{\frac{2GM}{R_s}}$

Because of strong force from strong charge and related distant is changed by strong coupling constant $\alpha_s = 137.035997$ as much as

$$c_{light} \cdot N_{\odot} = \sqrt{\frac{(2GM)(137.035997)}{(R_{shwartz\, schild})/(137.035997)}} \qquad \text{7-6-3-5}$$

Where G is used G_{newton} $=6.673838\times 10^{-11}$N. (m/kg)^2

Therefore speed of free gluon for gamma ray burst from neutronic quark star or neutronic seed nova in flat coordination system with $g = 1$is

$$c_{free\ gluon} = (c_{light})(137.035997)$$

$$= 4.10823584\times 10^{10} ms^{-1} \qquad \text{7-6-3-6}$$

Size of quark region of GR busters according to formula $R_s = \frac{2GM}{c^2}$ is

$$R_s = \frac{(2)\left(6.673838\times 10^{-11}\ \mathrm{m2}\cdot\frac{\mathrm{mkg}}{\mathrm{s2}}\cdot\mathrm{kg}^2\right)(1.4)(1.988531\times10^{30}\mathrm{kg})}{(\ 4.108236\times10^{10}ms^{-1}\ \ )^2}$$

$=2.2\times 10^{-1}m$ 7-6-3-7

For the Sun, size of quark region is

$$R_s = \frac{(2)\left(6.673838\times 10^{-11}\ \mathrm{m2}\cdot\frac{\mathrm{mkg}}{\mathrm{s2}}\cdot\mathrm{kg}^2\right)(1.988531\times10^{30}\mathrm{kg})}{(\ 4.108236\times10^{10}ms^{-1}\ \ )^2}$$

$=1.6\times 10^{-1}m$ 7-6-3-8

$$R_{atio} = \frac{4.2\times10^3 m}{2.2\times10^{-1}m} = 1.9\times 10^4 \approx 1.87788645\times 10^4$$

$N_{strong} = \sqrt{1.87788645\times 10^4}$ =137.035997 7-6-3-9

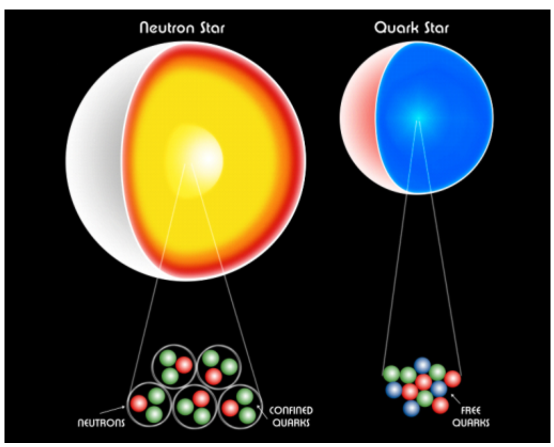


Figure 7-6-3-3

From this small region occur reverse of implosion by stellar collapse of Bose-Einstein condensate and start seed nova explosion. By this explosion is whole star broken into component particles.

7.7 Application to the Neutrino $\nu_{\mathrm{i}}^{\pm}$

7.7.1. Force line Curve and Solving Rest Mass Mystery of Neutrinos

Standard Model of particle physics assumed that neutrinos are mass less. However, the experimentally established phenomenon of neutrino oscillation,which mixes neutrino flavour states with neutrino mass states (analogously to CKM mixing), requires neutrinos to have nonzero masses. Because neutrino oscillation is phenomenon of general relativity, Standard Model of particle physics cannot predict neutrino mass.

Therefore neutrino mass problem becomes unsolved problem as the neutrino masses can be measured and do neutrinos follow Dirac or Majorana statistics.

According to CFLE theory, the rest mass is no longer a constant, but rather a function of velocity v. Of course, $m = \frac{E}{c^2}$ is correct too. However, the β-decay energy E can be shared between the electron's kinetic energy K_{e} and the anti neutrino's kinetic energy K_{an} as

$$K_{\mathrm{e}} + K_{\mathrm{an}} = E \qquad \text{7-7-1-1}$$

As there very many ways in which this energy division can be made, the value of K_{e} forms a spectrum. Consequently, the observed rest mass of a neutrino is a formed spectrum too, and therefore, in CFLE theory, the rest mass of the neutrino can be defined by the energy levels of the leptons.

Firstly, the basic rest mass of a neutrino at $g = 1$is

$$m_{\nu_{\mathrm{e}}^{-}} = \frac{m_{\mathrm{e}}}{n}$$

$$= \frac{9.109 \times 10^{-31}\ \mathrm{kg}}{1.190 \times 10^{7}}$$

$$= 7.655 \times 10^{-38}\ \mathrm{kg} \qquad \text{7-7-1-2}$$

or

$$m_{\nu_{\mathrm{e}}^{-}} = \frac{m_{\mathrm{e}}}{n}$$

$$= \frac{5.11 \times 10^{5}\ \mathrm{eV}}{1.190 \times 10^{7}}$$

$= 4.29 \times 10^{-2}$ eV

$= 0.043$ eV 7-7-1-3

This rest mass of a neutrino or an anti-neutrino must be the defined rest mass of an electron neutrino or rest mass of anti electron neutrino, at $g = 1$respectively.

Secondly, because the rest mass of the muon is $m = 206.8$, $g = 3.792$the rest mass of the muon neutrino and anti muon neutrino is defined as

$m_{\bar{\nu}e} = (3.792)(0.043)$eV

$= 0.163$ eV 7-7-1-4

Thirdly, because the rest mass of the tauon is $m_\tau = 1776.82$ MeV= $3491.2e$, $g = 7.687$, the rest mass of the tau neutrino ν_τ and anti tau neutrino is defined as

$m_{\nu t} = (7.687)(0.043)$eV

$= 0.331$ eV 7-7-1-5

Sum of 3 neutrino mass $\sum m_\nu$ by CFLE theory is

$\sum m_\nu = (0.043 + 0.163 + 0.331)$eV

$= 0.537$ eV 7-7-1-6

Observed value of one neutrino mass by C.Amsler et al, B. Kayser from Fermi lab in "The Review of particle physics: neutrino Mass, Mixing, and Flavor change, the Revised March 2008 " is

0.04 eV < Mass[Heaviest ν_i < (0.07~0.7) eV 7-7-1-7

Another observed value of sum of three neutrinos $\sum m_\nu$ by A.Goobar, S.Hannestad, E.M$\ddot{o}r$tsell,H.Tu in "The neutrino mass bound from WMAP-3 , the baryon acoustic peak, the SNLS supernovae and the Lyman-α forest: arXive:astro-ph/0602155v2 29 May 2006" is

$\sum m_\nu = 0.62$ eV (95%C.L) 7-7-1-8

Sum of three neutrino mass $\sum m_\nu$ by R.A. Battye, A. Moss in the "Evidence for massive neutrinos from CBM and lensing observations, arXiv: 1308.5870v2 [astro-ph.CO] 7.Jan 2014" for an active neutrino model with three degenerate neutrinos is

$$\sum m_\nu = (0.32 \pm 0.081)\ \text{eV} \qquad \text{7-7-1-9}$$

Because the CFLE theory allows movement with light speed, despite that an object has rest mass, the existence of rest mass for every neutrino is not a serious problem for this theory. It is, however, a serious problem for the standard model. From 1999 to 2004, the k2k, experiment designed by the Tsukuba High Energy Accelerator Research Organization produced 151 muon neutrinos, which were detected by the Super-Kamio-Kande detector that lies 250 km away in Kamio Town in the Gifu prefecture, Japan. In fact, the Super-Kamio-Kande detector detected only 108 neutrinos: the other 43 neutrinos could not be detected because they had changed to another neutrino, proving that the neutrino has mass. The CFLE theory, however, can predict these results quantitatively. The muon neutrino emitted a curve state of g = 3.772, but because the gravitational permittivity of Earth (cf. §10.6) is

$$Q_g = 0.073176$$

$$x_g = 1.073176 \qquad \text{7-7-1-10}$$

This force line curve of the neutrino is changed by Earth material to

$$g = \frac{3.772}{1.073176} = 3.515 \qquad \text{7-7-1-11}$$

Consequently, the neutrino that has maximum curve of a weak force line has more of a chance to interact with another material. Such neutrino number is

$$N = \frac{151}{3.515} = 42.959 \approx 43 \qquad \text{7-7-1-12}$$

Because this predicted value agrees well with the experimental value, we get here another assurance that the CFLE theory is correct.

7.7.2. Solving Origin of the Neutrino Oscillation by CFLE Theory

In 1920, A. Eddington, on the basis of the precise measurements of the atom by F. W. Aston, was the first to suggest that stars obtained their energy from nuclear fusion of hydrogen to helium. In 1928, George Gamow derived what is now called the Gamow factor, a quantum-mechanical formula that gave the probability of bringing two nuclei sufficiently close for the strong nuclear force to overcome the coulomb barrier. The Gamow factor was used in the decade that followed by Atkinson and Houtermans and later by Gamow himself and E. G. Teller to derive the rate at which the nuclear reaction would proceed at the high temperature believed to exist in stellar interiors.

In 1939, in a paper entitled "Energy Production in Stars," Hans Bethe analyzed the different possibility for the reaction by which hydrogen is fused into helium. He selected two processes that he believed to be the source of energy in stars. The first one was the proton–proton chain, which is the dominant energy source in stars with masses up to about the mass of the sun. The second process was the carbon-nitrogen-oxygen cycle, which was also considered by C. F. Von Weizsäcker in 1938 and is most important in more massive stars. That theory was begun by Fred Hoyle in 1946, and he followed it up in 1954 with a long paper outlining how the advanced fusion stage within stars would synthesize elements between carbon and iron in mass.

Other milestones of significant importance were by A.G.W. Cameron and by Donald D. Clayton. They introduced computers into time-dependant calculations of the evolution of a nuclear system. Clayton calculated the first time-dependant model of the S–process, the R-process, and the burning of silicon into iron group elements, and discovered radiogenic chronologies for determining the age of the element.

The entire research field expanded rapidly in the 1970s. The most important studies of reactions in stellar nucleon synthesis included hydrogen burning, helium burning, carbon burning, oxygen burning, silicon burning, neutron capture of the R-process and S-process, proton capture of the Rp–process, and photodisintegration of the P-process. During such reactions, electron neutrinos are produced in the sun as a product of nuclear fusion:

Proton–proton reaction ($4\ {}^{1}H -\ {}^{4}He$)

$$ {}^{1}\mathrm{H}(\mathrm{P}, \mathrm{e}^{+}\, \nu_{\mathrm{e}})\ {}^{2}\mathrm{D}(\mathrm{P}, \gamma)\ \ {}^{3}\mathrm{He}(\ {}^{3}\mathrm{He}, 2\mathrm{P})\ \ {}^{4}\mathrm{He} + 26.2\ \mathrm{MeV} $$

$$ {}^{3}\mathrm{He}(\alpha, \gamma)\ \ {}^{7}\mathrm{Be}(\mathrm{P}, \gamma)\ {}^{8}\mathrm{Be}(\mathrm{e}^{+}\, \nu_{\mathrm{e}})\ \ {}^{8}\mathrm{Be}\ \ {}^{*}(\alpha)\ {}^{4}\mathrm{He} + 19.7\ \mathrm{MeV} $$

$$ \mathrm{CNO} - \mathrm{cycle}\ (4\ \ {}^{1}\mathrm{H} -\ {}^{4}\mathrm{He}\ ) $$

$$ {}^{12}\mathrm{C}(\mathrm{P}, \gamma\ )\,{}^{13}\mathrm{N}(\mathrm{e}^{+}\nu_{\mathrm{e}})\,{}^{13}\mathrm{C}(\mathrm{P}\ , \gamma)\,{}^{14}\mathrm{N}(\mathrm{P}, \gamma)\,{}^{15}\mathrm{O}(\nu_{\mathrm{e}})\,{}^{15}\mathrm{N}(\mathrm{P}, \alpha)\,{}^{12}\mathrm{C} + 25.0\ \mathrm{MeV} $$

$$ {}^{15}\mathrm{N}(\mathrm{P}, \gamma)\,{}^{16}\mathrm{O}(\mathrm{P}, \gamma)\,{}^{17}\mathrm{F}\ (\mathrm{e}^{+}\nu_{\mathrm{e}})\,{}^{17}\mathrm{O}(\mathrm{p}, \gamma)\,{}^{18}\mathrm{F}(\mathrm{e}^{+}\gamma)\,{}^{18}\mathrm{F}(\mathrm{P}, \alpha)\,{}^{15}\mathrm{N} \qquad \text{7-7-2-1} $$

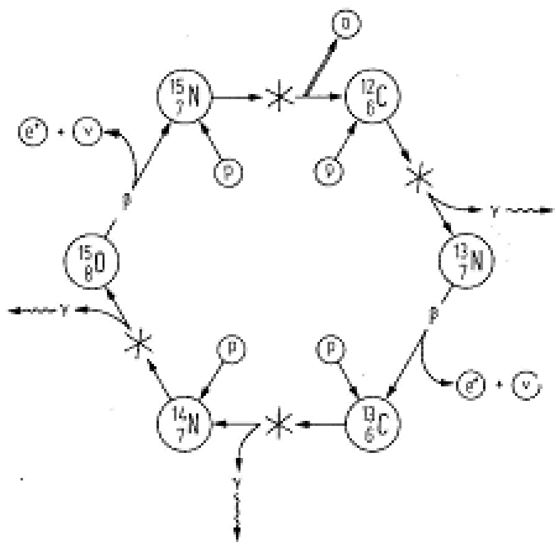


Figure 7-7-2-1. The Bethe-Weissäcker cycle.

During this process, the generated neutrinos interact weakly with other materials in the sun. Therefore, neutrinos leave from the sun. The cross-section of a neutrino is

$$ \sigma \approx 10^{-43}\ \mathrm{cm}^{2} \qquad \text{7-7-2-2} $$

Its particle density is

$$ N = 10^{26}\ \mathrm{cm}^{3}, \quad \rho = 10^{2}\ \mathrm{g/cm}^{3} \qquad \text{7-7-2-3} $$

The average free wavelength is

$$ \lambda = \frac{1}{\sigma\, N} \approx 10^{12}\ \mathrm{km!} $$

Therefore, the expected neutrino number on Earth is

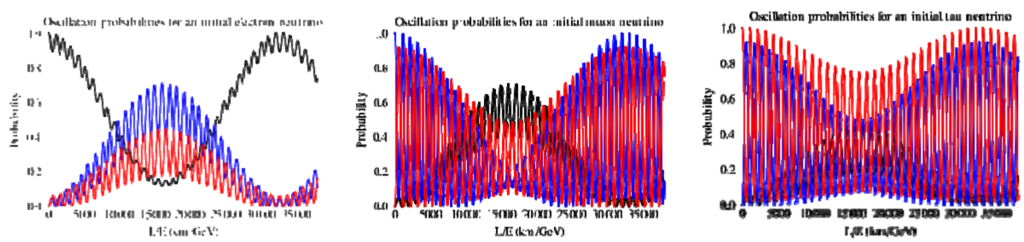
$$N = 10^{11}\ \text{cm}^2/\text{s} \qquad \text{7-7-2-4}$$

To detect these neutrinos, an experiment was started in late 1960 by R. Davis Jr. and J. N. Bahcall in the Homestake Gold Mine, South Dakota, USA. Bahcall did the theoretical calculations and Davis designed the experiment. They needed a large enough and deep enough underground targets to overcome the very small probability of successful neutrino capture, and so Davis placed a 100,000 gallon tank of perchloro-ethylene 4850 feet underground. The idea was that a chlorine atom would transform into a radioactive isotope of argon, which could then be extracted and counted, For 20 long years, Davis's figures were consistently one–third or one–fourth of theoretical predictions. This result stirred up waves in solar physics and nuclear physics, and the discrepancy in the results essentially created the so-called solar neutrino problem.

Another important experiment was carried out by the Kamioka Observatory Institute for Cosmic Ray Research, a neutrino physics laboratory located underground in the Mozumi Mine of the Kamioka Mining and Smelting Co., Japan. The experiment was named Kamioka NDE (Kamioka Decay Experiment). It basically was a large water Cerenkov detector designed to search for proton decay. The results were only 40% of the prediction value.

The next important experiment was the gallex or gallium experiment. This experiment was a radiochemical neutrino detection experiment that ran between 1991 and 1997 at the Laboratory Nazionali del Gran Sasso (LNGS), and was an international collaboration of French, German, Italian, Israeli, Polish, and American scientists led by the Max-Plank-Institute für Kern Physik, Heidelberg, Germany. They used a 101 ton gallium trichloride-hydrochloric acid solution that contained 30.3 ton of gallium. But here, the experimental value was only 60% of the prediction value.

The next neutrino experiment was the K2K (KeK to Kamioka) experiment that directed a neutrino beam from the KeK accelerator to the Super-Kamiokande observatory located ~250 km away. This experiment was designed for Super-Kamiokande to detect 151 neutrinos from KeK, but only 108 neutrinos were detected. This means that the detection value was only 72% of the prediction value. In 2001 Sudbury Neutrino Observatory provided clear evidence of neutrino flavor change.SNO provide neutrino oscillation. Neutrino oscillation is simply means that neutrino created with a specific flavor can be after time T measured to have a different flavor in analogy with neutral kaon mixing.SNO measured the flux of solar electron neutrinos to be ~34% of total neutrino flux. This result means that during the travel neutrino mass is changed and neutrino oscillate. Experimental observation of solar neutrinos, atmospheric neutrinos, reactor neutrinos and accelerator neutrinos provided evidence for neutrino oscillations, implying that neutrino has masses.



Long range **Long range** **Long range**

Oscillation of ν_e **Oscillation of ν_μ** **Oscillation of ν_τ**

Figure 7-7-2-2

Because phenomenon of mass change can be calculated by general theory of relativity, Standard Model of particle physics (in this model neutrino mass is zero) cannot calculate neutrino mass.

In the contrast CFLE theory can explain and calculation why and how this phenomenon exists. In β-decay, the weak interaction converts a neutron into proton while emitting an electron e and an anti electron-neutrino. That is,

$$\mathrm{N} \longrightarrow \mathrm{P} + \mathrm{e}^{-} + \nu_{\mathrm{e}}^{-} \qquad 7\text{-}7\text{-}2\text{-}5$$

The rest mass of a neutron is m = 939.578 MeV, and the rest mass of a proton is m = 938.280 MeV.

So, the total decay energy is

E = 939.578 MeV − 938.280 MeV

$$= 1.293 \text{ MeV} \qquad 7\text{-}7\text{-}2\text{-}6$$

However, the decay energy E can be shared between the electron kinetic energy K_e and the antineutrino kinetic energy K_ν; that is,

$$K_e + K_\nu = KE \qquad \text{7-7-2-7}$$

The energy spectrum of the electron and anti neutrino can express the total decay energy according to CFLE theory. That is,

E = [energy of electron rest mass] + [kinetic spectrum energy of electron] + [energy of anti neutrino rest mass] + [kinetic spectrum energy of anti neutrino] 7-7-2-8

where the energy of the anti neutrino rest mass is established by CFLE theory (cf. §3 and §7).

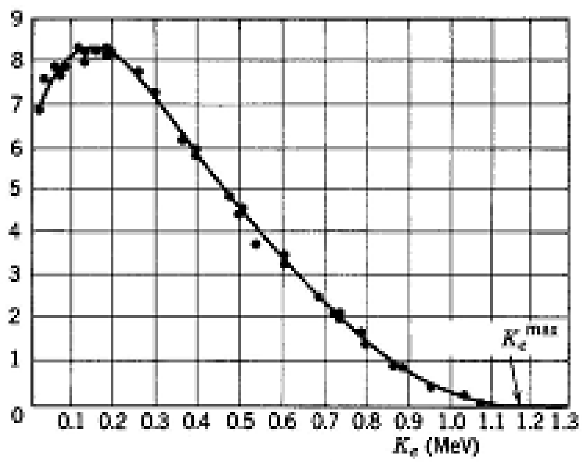


Figure 7-7-2-3

According to this formula, an anti-neutrino ought to be emitted with kinetic spectrum energy too. Moreover, according to relativity theory and quantum theory, those energy equations are

$$E = mc^2, \quad E = \hbar\nu, \quad E = (n + \tfrac{1}{2})\hbar\nu \qquad \text{7-7-2-9}$$

In CFLE theory, however, the energy equations are

$$E = \pm g\hbar\nu, \; E = \pm g(n + \tfrac{1}{2})\hbar\nu$$

Hence,

$mc^2 = \pm g\hbar\nu\,,\;\; m = \pm g\left(\frac{\hbar\nu}{c^2}\right) = g\,k$

kinetic energy is $E = \frac{1}{2}gkV^2 = gkz = g\Omega$

This formula can now be applied to the energy of the electron and the anti neutrino. Then, the total electron energy is stepped:

$E_e = g_i\Omega_i = 1\Omega - 1.667\Omega - 2.588\Omega - 3.792\Omega - 7.687\Omega$ 7-7-2-10

The total anti neutrino energy is also stepped:

$E_\nu = g_i\Omega_i = 7.687\Omega - 3.836\Omega - 2.588\Omega - 1.667\Omega - 1$ 7-7-2-11

Because, upon β-decay, the force line curve creates such a stepped energy spectrum, particles that are emitted with this stepped energy spectrum will interact with the detector at different reaction rates of energy accuracy. This detection rate is

$R = \frac{1}{3.792} \times 100 = 26\%$ 7-7-2-12

When the detection rate is low, the result appears with this low rate. This was the case in Davis's experiment when his results were consistently one-third or one-fourth of the predicted value.

The next detection rate in the stepped spectrum is

$R = \frac{1}{3 \sim 2.588} \times 100 = 33.3\% \sim 38.6\%$ 7-7-2-13

This result corresponds to the Kamioka experiment.

The next step rate is

$R = (<\frac{1}{1.5}> \sim <\frac{1}{1.667}>) \times 100 = 67\% \sim 60\%$ 7-7-2-14

where 1.667 is 1.5 × 1.110.

Q = (0.016774) (6.545979) = 0.109802

x = 1.109802

x = 1.110

This result corresponds with that of the GALLEX experiments.

Finally, the detection rate of the Super-Kamiokande experiment was

$R = (\frac{108}{151}) \times 100 = 71.5\%$ 7-7-2-15

The corresponding force line curve of the anti-neutrino in this case is

$g = \frac{1}{0.715} = 1.398$ 7-7-2-16

Because the neutrino beam was run under the Earth's surface from the Tokai accelerator to the Super-Kamiokande detector, the gravitational permittivity of

Earth has to be taken into account, which is x = 1.073176 (cf. §10.6). Here, the possible minimum force line curve is

$g = \frac{1.5}{1.073} = 1.398$ 7-7-2-17

This clear agreement between the value of CFLE theory and experimental values shows that CFLE theory qualitatively and quantitatively correct.

Therefore, CFLE theory can explain how neutrino can oscillate.

The total anti neutrino energy also stepped in EQ 7-7-2-11 is

$E_{\nu} = g_{\mathrm{i}}\Omega_{\mathrm{i}} = 7.687\Omega - 3.836\Omega - 2.588\Omega - 1.667\Omega - 1$ 7-7-2-18

This means that simply by change of curve of force line as figure 7-7-2-4

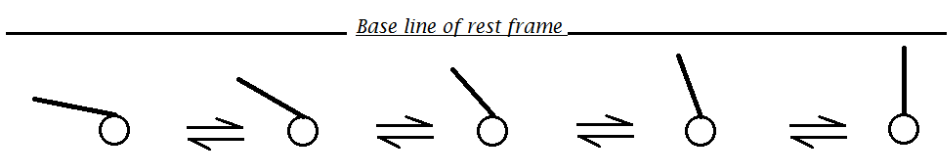


Figure 7-7-2-4

Stepped energy of neutrino $7.687\Omega - 3.836\Omega - 2.588\Omega - 1.667\Omega - 1$ is changed

$7.687\Omega \rightleftharpoons 3.836\Omega \rightleftharpoons 2.588\Omega \rightleftharpoons 1.667\Omega \rightleftharpoons 1$ 7-7-2-19 cause of oscillation is change of curve of force line as same physical base as CP violation

Therefore in CFLE Theory there can be various neutrinos that have various degree of curve of force line, are called g-oscillo-neutrino. Example, there can be 5.976-oscillo-neutrino.this means that 5.976-oscillo-neutrino is one of neutrino like electron, muon, tauon-neutrino, but its temporal value of curve of force line is $g = 5.976$ during neutrino oscillation.

Because Leptons (electron, muon and tauon) are different only degree of curve of force line (mass difference is result of difference of degree of curve of force line), there can be various lepton that have various degree of curve of force line. Therefore they can be called g- oscillon.

Example, there can be 5.976-oscillon. This means that 5.976 −oscillon is one of lepton like electron, muon and tauon, but its temporal value of curve of force line is $g = 5.976$ during the lepton mixing.

Experimental results show that all produced and observed neutrinos have left-handed helicities, and all anti-neutrinos have right-handed helicities, within the margin of error. Standard Model of particle physics cannot explain why. But CFLE theory can predict and explain why: that is, because gravitational charge (mass) conjugation symmetry is broken by CP violation. Therefore only LH neutrino and RH anti neutrino exists in this universe for violated mass symmetry to keep. In Anti-verse(cf.§13.16) there exist RH neutrinos and LH anti neutrinos for violated anti-mass symmetry to keep.

Because by force line elements must be kept charge symmetry, Neutrino has to follow Dirac statistic according to CFLE theory. This means that under such condition one particle cannot be anti-particle of one's. Figure 7-7-2-5 show how positive weak charged neutrino by positive weak charged seed is observed positive weak charged neutrino by positive weak charged force line element. Seed of every particle in CFLE theory has always strong force that enforce to last surface force line element that must be kept charge conjugation symmetry. Therefore neutrino cannot be antineutrino same times. Consequently, neutrino cannot follow majorana statistic as any Dirac fermions.

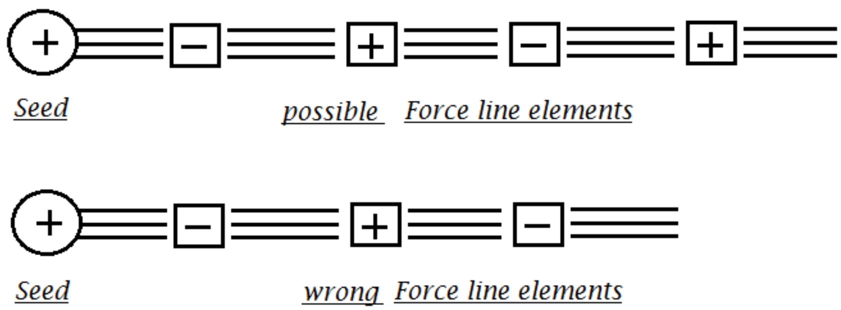


Figure 7-7-2-5

7.8 Relation Between Force line Curve and Orbital Number and Atom Number

In §7.5 and §7.6, it was discussed that the force line curve of a proton is $g = 6.546$ and that of a neutron is g = 6.548. Because the curve from $g = 6.546$ can change to $g = 1$, this change ought to be associated with the orbital number, but because the gravitational permittivity of air at $g = 2$ (cf. §10.2) is

$$Q_g = (0.016774)\ (2) = 0.033548$$

$$x_g = 1.033548$$

the electrical permittivity of air at $g = \frac{6.545979}{1.5} = 4.363986$ is

$$Q_e = (0.000589)\ (4.363986) = 0.002570$$

$$x_e = 1.002570$$

$$x_g\, x_e = (1.033548)\ (1.002570) = 1.036204$$

So, the possible maximum curve is

$$g = (6.545979)\ (1.036204) = 6.782970 \qquad 7\text{-}8\text{-}1$$

Therefore, the possible quantum number is

$$N = 2n^2 = 2(6.782970)^2 = 92.017364 \approx 92 \qquad 7\text{-}8\text{-}2$$

and the minimum distance for possible nuclear interaction occurs when the curve is g = 3.836. However, there is a 1.5 time difference between gravity and electricity, discussed in §5.3 and §7.13. So the possible maximum curve is

$$g = \frac{3.836}{1.5} = 2.557 \qquad \text{7-8-3}$$

Because the difference of the electrical permittivity of air by the factor 19.044374 (cf. §10.5) is

$Q_e = (0.000589)\ (19.044374) = 0.011217$

$x_e = 1.011217$

The electrical permittivity of air at $g = 1$ is

$Q_{e1} = 0.000589$

$x_{e1} = 1.000589$

The electrical permittivity of air at $g = \frac{1}{19.044374}$ is

$Q_{e2} = \frac{0.000589}{19.044374} = 0.000031$

$x_{e2} = 1.000031$

and therefore, the effective force line curve is

$g = (2.557)\ (1.011217)\ (1.000589)\ (1.000031) = 2.587285$

Therefore, the maximum possible nuclear number is

$$N_u = (92)\ (2.587285) \quad = 238.030220 \approx 238.030 \qquad \text{7-8-4}$$

This is the value predicted by CFLE theory.

The observed value is

$N_u = 238.029$

Because this value agrees well with the observed value, CFLE theory can say that “this nuclear number is the possible maximum nuclear number of the heaviest natural element that is permitted by the present universe.”

7.9 Disclosing the Identity of Dark Matter in the Universe by CFLE Theory

When the mass density is $d = \rho$, and the radius is $r = R$, the mass of a sphere is

$$M = \frac{4\pi R^3}{3}\rho \qquad 7\text{-}9\text{-}1$$

Here, the potential energy of an object with mass m is

$$E_p = -\frac{mMG}{R} = -\frac{4\pi R^3}{3}\rho G \qquad 7\text{-}9\text{-}2$$

If R is the radius of the universe, ρ is the density of the galaxies, and m is the mass of a galaxy, then in the kinetic energy equation of the mass, the velocity term is $v = HR$, where H is the Hubble constant. The kinetic energy is therefore

$$E_k = \frac{1}{2}mv^2 = \frac{1}{2}mH^2R^2 \qquad 7\text{-}9\text{-}3$$

Because the total energy is the sum of the kinetic energy and potential energy

$$E = \frac{1}{2}mH^2R^2 - \frac{4\pi}{3}mR^2\rho G$$

$$= mR^2(\frac{1}{2}H^2 - \frac{4}{3}\pi\rho G) \qquad 7\text{-}9\text{-}4$$

For the universe to expand, the energy of its system should be $E > 0$ or minimally $E = 0$, a condition whereupon the critical expanding energy would be

$$\frac{1}{2}H^2 = \frac{4}{3}\pi\rho G \qquad 7\text{-}9\text{-}5$$

According to Eq. 7-9-5, the critical expanding density should be

$$\rho_c = \frac{3}{8}\frac{H_o^2}{\pi G} \qquad 7\text{-}9\text{-}6$$

With the observed Hubble constant of H_o = 75 km·sec^{-1}·Mpc^{-1} and the gravitational constant of $G = 6.673 \times 10^{-8}$ cm^3·gm^{-1}·s^{-2}, the required critical expanding density is

$$\rho_c = \frac{3}{8}\ \frac{\frac{H_0}{75\ \text{km·s}^{-1}\text{·Mpc}^{-1}}}{(\pi)(6.673 \times 10^{-8}\ \text{cm}^3\text{·gm}^{-1}\text{·s}^{-2})}$$

$$= (1.1 \times 10^{-29}\ \text{g/cm}^3)\left(\frac{H_0}{75\ \text{km·s}^{-1}\text{·Mpc}^{-1}}\right)^2 \qquad 7\text{-}9\text{-}7$$

However, the present observed value of the mass density ρ_G is [1]

$$\boldsymbol{L} \cong 2.2 \times 10^{-10}\ L_\odot/\text{pc}^3 \left(\frac{H_0}{75\ \text{km·s}^{-1}\text{·Mpc}^{-1}}\right)$$

$$\rho_G = \left(\frac{\boldsymbol{L}}{L_\odot}\right)\left(\frac{M/L}{M_\odot/L_\odot}\right) M_\odot$$

$$= 4.6 \times 10^{-9}\ M_\odot/\text{pc}^3 \left(\frac{H_0}{75\ \text{km·s}^{-1}\text{·Mpc}^{-1}}\right)^2$$

$$= (3.1 \times 10^{-31}\ \text{g/cm}^3)\left(\frac{H_0}{75\ \text{km·s}^{-1}\text{·Mpc}^{-1}}\right)^2 \qquad 7\text{-}9\text{-}8$$

This value is smaller than the minimum critical expanding mass density; that is,

$$\frac{\rho_G}{\rho_c} \cong 0.028 = 2.8\%$$

$$\frac{\rho_c}{\rho_G} \cong \frac{1}{0.028} = 35.71 \qquad 7\text{-}9\text{-}9$$

Therefore, there has been a huge fuss to find this missing mass (so-called dark matter). In the CFLE theory, however, this mass density difference is a natural phenomenon, because when the force line curve size of an object becomes smaller, density will increase proportionally as depicted in Figure 7-9-1.

1. Equation 7-9-8 extracted from Weinberg, Steven. 1972. *Gravitation and Cosmology: Principles and Applications of the General Theory of Relativity*, p. 478. Reproduced with permission from John Wiley & Sons, Inc. © 1972.

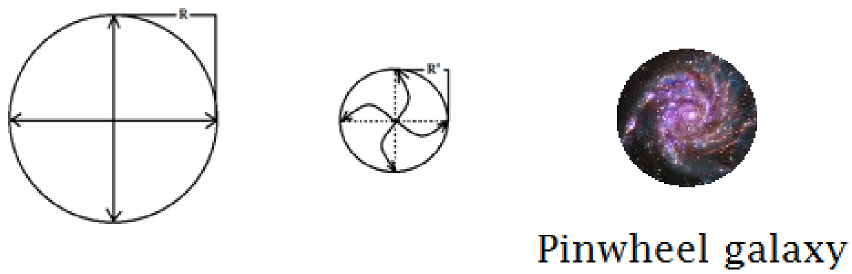


Figure 7-9-1

So, the problematic difference is converted by the factor

$$d\rho = \frac{1}{0.028} = 35.71$$

$$g^2 = 35.71, \quad g = \sqrt{35.71} = 5.976 \qquad 7\text{-}9\text{-}10$$

This force line curve is proton radius factor of Eq. 7-4-2-2

$$g_{eff} = 5.793596 \qquad 7\text{-}4\text{-}2\text{-}2$$

Difference between two values is

$$d = \frac{5.976}{5.973} = 1.0005 \approx 1.000589$$

This means that only electrical permittivity of air make this difference.

In other word, for such problems related to gravitational force (for mass) and electromagnetic force (light, for observation), the effect of each force line and its force line element should be separated so that the effect of the force line curve is g = 5.976.

Therefore, despite that the observed rest mass of the universe is small, this mass has enough force for expansions interaction and is called the neutrolateral force by a curved force and its force line elements:

Therefore, we get assurance here that the CFLE theory gives both quantitative and qualitative explanations about the dark matter problem. Because the curved force line becomes the volume of the smaller particle, the particle should have a bigger mass density effect by as much as the force line curve g =5.976. So, the real mass density of the universe is

$\rho_{\text{real}} = (3.1 \times 10^{-31}\ \text{g/cm}^3)\ (5.976)^2 = 1.107 \times 10^{-29}\ \text{g/cm}^3$ 7-9-11

This theoretical density is in agreement with the mass density required for universe expansion. The WMAP satellite has determined that an ordinary atom makes up only 4.6% of the universe (to within 0.1% precision), but the CFLE theory can predict this pure value theoretically. Because an ordinary atom has a gravitational; force line curve of $g = \frac{6.545976}{1.5}$ =4.363986

gravitational permittivity at $g = 4.363986$ is

$Q_g = 0.016774 \times 4.364986 = 0.073202$

$x_g = 1.073202$ 7-9-12

electrical permittivity at $g = 4.363986$ is

$Q_e = 0.000589 \times 6.545979 = 0.003856$

$x_e = 1.003856$ 7-9-13

Total difference is

$d_{tot} = \frac{x_g}{x_e} = \frac{1.073202}{1.003856} = 1.069080$ 7-9-14

effective value is

$g_{eff} = g \cdot d_{tot} = (4.363986)(1.069080) = 4.665450$

$g_{eff}^2 = (4.665450)^2 = 21.7664$

$\rho_{\text{MW}} = \frac{1}{g_{eff}^2} = \frac{1}{21.7664} = 0.04594$

$= 4.594\ \%$

$\approx 4.6\%$ 7-9-15

These values agree very well with the value determined by NASA's WMAP. Essence of difference between value of $\frac{\rho_G}{\rho_C} \cong 2.8\%$ and $\rho_{\text{MW}} = 4.6\%$ is only change of degree of charge screening. Result of $\rho_{\text{MW}} = 4.6\%$ is gained from Big-Bang remnant. But result of

$\frac{\rho_G}{\rho_c} \cong 2.8\%$ is gained by mass- luminosity relation. This means that degree of nowadays charge screening of universe is bigger that age of Big-Bang universe.

According to the mass screening theory by force line elements discussed in §4, $\Delta m \Delta x = 1$ is the maximum mass screening state. At this state, the degree of uncertainty of position Δx reaches its maximum value, whereas the degree of uncertainty of mass Δm becomes its minimum value. Finally, according to the force line theory of relativity, the $\left|\frac{\hbar}{v}\right| = 1$ state gives the maximum rest velocity, because in the mass screening theory, when $\Delta m \Delta x = 1$ the degree of uncertainty of position Δx and of mass Δm must be inversely proportional too.

Therefore,

$$x_{\Delta co} = \frac{1}{9.109534 \times 10^{-31}} = 1.097751 \times 10^{30} \text{ m} \qquad 7\text{-}9\text{-}16$$

Because $\lambda \nu = c$, and $\nu = 1$, $\lambda = 2.99792458 \times 10^{8}$ m.

However, a photon is a shell bundle of electric dipolar force lines, so the real length of the force line radius of one particle is

$$c_\lambda = \frac{2.99792458 \text{ x } 10^{8} \text{ m}}{4} = 7.494811 \times 10^{7} \text{ m} \qquad 7\text{-}9\text{-}17$$

Between gravity and electricity, there is the difference of $d_c = 1.686044 \times 10^{21}$, so the maximum length of this particle is

$$c_\lambda = (7.494811 \times 10^{7})\,(1.686044 \times 10^{21} \text{ m})$$

$$= 1.263658 \times 10^{29} \text{ m} \qquad 7\text{-}9\text{-}18$$

But, because the maximum force line curvature is $g = 8$, and its gravitational permittivity is

$$g = \frac{6.545979}{1.5} = 4.363986$$

$$Q_{g1} = (0.016774)\,(4.363986) = 0.073202, \quad x_{g1} = 1.073202$$

$$Q_{g2} = \frac{0.016774}{1.5} = 0.011183, \quad x_{g2} = 1.011183 \qquad 7\text{-}9\text{-}19$$

The electrical permittivity of air at $g = \frac{1}{(3.836)^2}$ of the pion force is

$Q_e = \frac{0.000589}{14.71} = 0.000040$

$x_e = 1.000040$ 7-9-20

The real maximum length is

$c = (1.263658 \times 10^{29}\ \text{m})\ (8)\ (1.073202)\ (1.011183)\ (1.000589)\ (1.000040)$

$\cong 1.097751 \times 10^{30}\ \text{m}$ 7-9-21

Therefore, introducing the state of $\Delta m \Delta x \leq 1$ confirms quantitatively when the force line elements perfectly screen the seed mass, thus giving a physical justification of the mass screening theory by force line elements(proof from another viewpoint cf§17,§18).That is, when $\Delta m \Delta x \leq 1$, we have a "perfect mass screening state," which we can call either the "start limit of establishment of relativity principle" or the "end limit of establishment of the uncertainty principle."

Because the total possible range of mass change by the relativity theory is

$R_{\Delta m} = \frac{m_s}{m_p} = \frac{1.535908 \times 10^{-9}\text{kg}}{9.109534 \times 10^{-31}\text{kg}} = 1.686044 \times 10^{21}$ (cf. §3) 7-9-22

thus the total possible range of speed by the charge screening theory is

$R_{\Delta v} = \frac{C}{\Delta V_o} = \frac{2.99782458 \times 10^{8}\text{m/s}}{1.054589 \times 10^{-34}\text{m/s}} = 2.842742 \times 10^{42}$ (cf. §3) 7-9-23

The total possible range of the *mv* change is

$R_{\Delta mv} = (1.686044 \times 10^{21})\ (2.842742 \times 10^{42})$ 7-9-24

$= 4.792988 \times 10^{63}$

Therefore, the total possible range of force line length change should be

$R_{\Delta x} = \frac{x_{\text{maximum}}}{x_{\text{seed}}} = 4.792988 \times 10^{63}$ 7-9-25

According to the result of special relativity of CFLE theory, the maximum contracted length of an electron (cf. §3) is

$x_{\Delta co}$ = 1.145105 × 10^{-34} m 7-9-26

Therefore, the maximum rest force line length of an electron is

$x_{\Delta co}$ = (1.145105 × 10^{-34} m) (4.792988 × 10^{63})

= 5.488475 × 10^{29} m 7-9-27

Because the start force line curve is g = 2, the real maximum rest length is

$x_{\Delta co}$ = 2(5.488475 × 10^{29} m) = 1.097695 × 10^{30} m 7-9-28

The difference between Eq. 7-10-11-2 and Eq. 7-10-11-9 is

$d = \frac{1.097751 \times 10^{30}\ \mathrm{m}}{1.097695 \times 10^{30}\ \mathrm{m}}$

= 1.000051

This difference is only the electrical permittivity difference at $g = \frac{1}{8 \times 1.5}$

$Q = \frac{0.000589}{12}$ = 0.000050, x = 1.000050

$d \approx x_{\Delta co}$ 7-9-29

Therefore, charge screening theory proves the established limits of the uncertainty principle and the relativity principle, the essential reason being that the changed force line has charge screening ability.

Conversely, when $\Delta m \Delta x \geq \frac{\hbar}{c}$, we can call this the "perfect bar mass state," and is the state that we can also call either the "end limit of establishment of the relativity principle" or the "start limit of establishment of the uncertainty principle."

Therefore, the established range of the mass screening theory ought to be limited:

$\frac{\hbar}{c} \leq \Delta m \Delta x \leq 1$ 7-9-30

And related limited establishment of relativity principle and uncertainty principle is a conclusion of the mass screening theory. The electron radius is r = 1.145105 × 10^{-34} m (obtained in §3) and the charge distribution radius of the proton(cf.Eq.7−4−2−12) is

$$R_{\Delta co} = 4.9745598 \times 10^{-15} \text{ m} \qquad 7\text{-}4\text{-}2\text{-}12$$

and the expected minimum radius must be

$$R_{\Delta co} = 1.145105 \times 10^{-34} \text{ m}$$

However, the result is

$$R_{\Delta co} = \frac{4.974560 \times 10^{-15} \text{ m}}{1.686044 \times 10^{21}} = 2.950433 \times 10^{-36} \text{ m} \qquad 7\text{-}9\text{-}31$$

Again, such difference cannot be explained by modern physics, but it can be by CFLE theory.

Through curved force lines and their elements, with curvature g = 6.545979, the difference is

$$d_r = \frac{1.145105 \times 10^{-34} \text{ m}}{2.950433 \times 10^{-36} \text{ m}} = 38.811422 \qquad 7\text{-}9\text{-}32$$

$$g = \sqrt{38.811422} = 6.229881 \qquad 7\text{-}9\text{-}33$$

This value is essentially

$$g^2 = (6.546)^2 = 42.850 \qquad 7\text{-}9\text{-}34$$

The difference of the force line curve is

$$d_g = \frac{6.545979}{6.229881} = 1.050739 \qquad 7\text{-}9\text{-}35$$

This difference is essentially only the difference of the gravitational permittivity of factors c_c = 1.5 and g = 2 for the neutrolateral force. That is,

$$Q_{g3} = (0.016774)\,(1.5\times 2) = 0.050322$$

$$x_{g3} = 1.050322$$

$$Q_{e/1.5} = \frac{0.000589}{(1.5)} = 0.000393$$

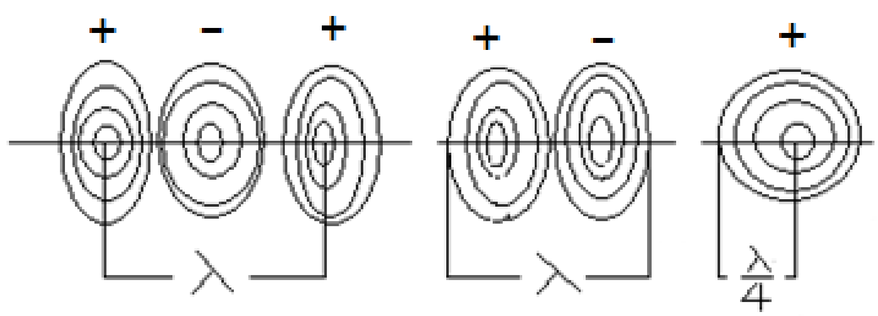
$$x_{e/1.5} = 1.000393$$

$Q_{e/144} = \frac{0.000589}{(8\times1.5)(8\times1.5)} = 0.000004$

$x_{e/144} = 1.000004$

$x_{g3} \cdot x_{e/1.5} \cdot x_{e/144} = (1.050322)(1.000393)(1.000004) = 1.050739$ 7-9-36

So, here again, the logical consistency of CFLE theory is confirmed. According to the mass screening theory, the degree of mass screening is proportional to the force line length, because $\lambda\nu = c$, $\nu = 1$, $\lambda = 2.99792488 \times 10^8$ m (the speed of light $c = 2.99792458 \times 10^8$ m/s) and because the electromagnetic wave bundle of the shell material is from the electric dipolar force line of the particles (Figure 7-9-2).



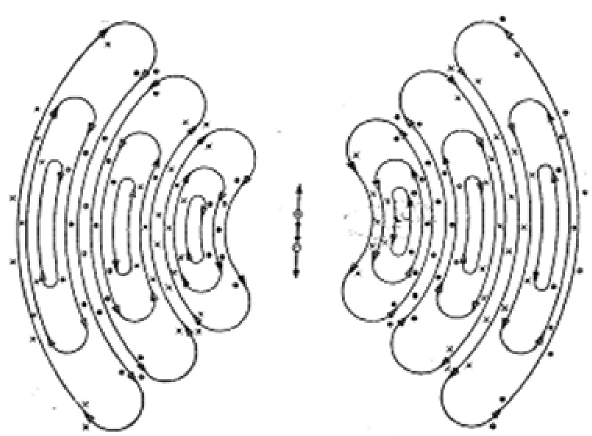


Figure 7-9-2

The force line length corresponding to the radius of a monopole particle is

$$r = \frac{2.99792458 \times 10^8 \text{ m}}{4} = 7.494811 \times 10^7 \text{ m} \qquad \text{7-9-37}$$

But, because $g = \frac{r}{n}$, rearranging gives $n = \frac{r}{g}$, and therefore the required force line length for the full degree of mass screening is

$$n = \frac{7.494811 \times 10^7}{6.545979} = 1.144949 \times 10^7 \qquad \text{7-9-38}$$

When considering the gravitational permittivity of air at g = 2 and g = 1.5,

Q_{g1} = (0.016774) (2) = 0.033548

x_{g1} = 1.033548

Q_{g2} = (0.016774) (1.5) = 0.02 5161

x_{g2} = 1.025161

With the electrical permittivity of air at g = 2 and g = 8 for a neutrolateral force,

Q_{e1} = (0.000589) (2) = 0.001178

x_{e1} = 1.001178

Q_{e2} = (0.000589) (8) = 0.004712

x_{e2} = 1.004712

The magnetic permittivity of air is

Q_m = (0.000589) (0.183) = 0.000108

x_m = 1.000108 7-9-39

where 0.183 is from $g = \frac{1.464}{8}$ for magnetic permittivity.

Therefore, the required force line length for the full degree of mass screening is

$$n = \frac{(1.144949 \times 10^7)(1.033548)(1.004712)(1.001178)}{1.000108}$$

$$= 1.190208 \times 10^7 \qquad \text{7-9-40}$$

This value is none other than the force quantization constant discussed in §3. Once again, this proves correct the discussion of CFLE theory about mass screening according to the force line length.

7.10 Supplement for Quantum Dynamics Defect by CFLE Theory

There are only a limited number of potentials for which it is possible to obtain solutions to the Schrödinger equation by analytical techniques. The potential of a harmonic oscillator is one of these, and is a case for which a perfect solution is known. The simple harmonic oscillator is of tremendous importance in physics and to all fields based on physics, because it is the prototype for any system involving oscillations and can be used generally to describe almost any system in which an entity is executing small vibrations about a point of stable equilibrium. The time independent Schrödinger equation is

$$-\frac{\hbar^2}{2m}\frac{d^2\psi}{dx^2}+\frac{1}{2}kx^2\psi = E\psi \qquad \text{7-10-1}$$

and the Hamiltonian is

$$H = -\frac{\hbar^2}{2m}\frac{d^2}{dx^2}+\frac{1}{2}kx^2 \qquad \text{7-10-2}$$

$$\psi_n = N_n H_n(y)\, e^{-\frac{y2}{2}} = N_n H_n\left(\frac{x}{\sqrt{\frac{\hbar}{m\omega}}}\right) e^{-\frac{x^2}{2}\left(\frac{m\omega}{\hbar}\right)} \qquad \text{7-10-3}$$

So, the eigen value of this Hamiltonian is

$$E_n = \frac{1}{2}\hbar\sqrt{\frac{k}{m}}\,\varepsilon = \hbar\omega\left(n+\frac{1}{2}\right), \quad n = 0,1,2,3\ldots \qquad \text{7-10-4}$$

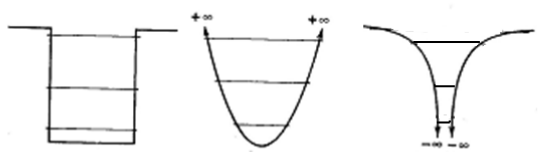
and the minimum value is not $\hbar$w, but $\frac{1}{2}\hbar$w. This result is coincidently correct to CFLE theory; that is,

$$E_n = \frac{1}{2}\hbar\sqrt{\frac{k}{m}}\,\varepsilon \Longrightarrow$$

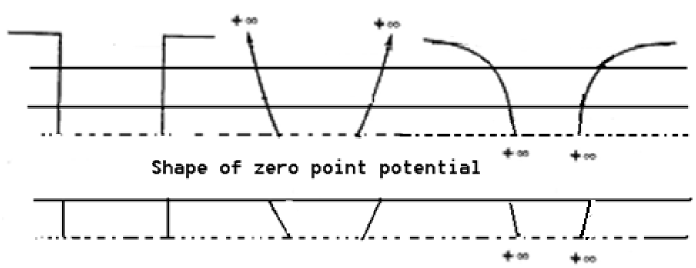
$$= \pm g\,\hbar\omega\left(n+\frac{1}{2}\right), \quad n = 0,1,2,3\ldots \qquad \text{7-10-5}$$

Because this potential can be used generally around a minimum value of an arbitrary potential (e.g., Coulomb potential, square well potential), it ought to be used as the energy level of an atom and the results must be the same as the potential of a harmonic oscillator. This similarity of potential can be expressed as in Figures 7-10-1 and 7-10-2.

Figure 7-10-1



The overall shape of the three potentials is very different.



Now, the resultant shape of the three zero potentials is almost the same

Figure 7-10-2

However, the results between the harmonic oscillator and the other potentials are different. In the case of the Bohr model, the energy level is quantized:

$$E_n = -\frac{mz^2e^4}{(4\pi\varepsilon_o)^2 2n^2\hbar^2}, \quad n = 1,2,3\ldots \qquad \text{7-10-6}$$

$$r_n = n^2 r_1, \qquad n = 1,2,3\ldots \qquad \text{7-10-7}$$

The Schrödinger equation is also quantized (square potential):

$$E_n = \frac{\hbar^2 k_n^2}{2m} = \frac{\pi^2\hbar^2 n^2}{2ma^2}, \qquad n = 1,2,3,\ldots \qquad \text{7-10-8}$$

Likewise, zero-point energy is quantized:

$$E_1 = \frac{\pi^2\hbar^2}{2ma^2} \qquad \text{7-10-9}$$

In this result, we cannot find any logical inconsistency between the simple harmonic oscillator and another regular potential. Of course, this result agrees very well with experimental fact, but we need to introduce the spin of the electron as a separate postulate (Note: Schrödinger's quantum theory disagrees with the Stern−Gerlach experiment). Dirac developed a relativistic theory of quantum mechanics in 1929 using the same postulate as Schrödinger's theory, but he replaced the energy equation by its relativistic form:

$$E = \pm(c^2p^2 + m_0^2c^4)^{1/2} + V_p \qquad \text{7-10-10}$$

Dirac showed that an electron must have an intrinsic $s = \frac{1}{2}$ angular momentum and an intrinsic magnetic dipole moment with a g-factor of 2. This was a great triumph for relativistic theory. It put electron spin on a firm theoretical foundation and showed that electron spin is intimately connected with relativity. However, even Dirac's quantum field theory could not explain what the physical essence of the g-factor is and why an electron has $g = 2$, a proton has $g = 5.765 = (5.575 \times 1.034)$, and a neutron has $g = -3.836$, and it also cannot explain the meaning of the following equation:

$$\mu = -\frac{e}{2m}\sigma \equiv -g\frac{e}{2m}s = -\frac{e}{2m}(1 + \frac{\alpha}{2\pi})\sigma$$

$$\frac{g-2}{2} = \frac{1}{2}(\frac{\alpha}{\pi}) - 0.32848(\frac{\alpha}{\pi})^2 + (1.49 \pm 0.2)(\frac{\alpha}{\pi})^3 + \ldots$$

$$= (1159655.4 \pm 3.3) \times 10^{-9} \qquad \text{7-10-11}$$

The experimental value is

$$(\frac{g-2}{2})_{exp} = (1159657.7 \pm 3.5) \times 10^{-9} \qquad \text{7-10-12}$$

Again, CFLE theory can solve this problem, where "in Schrödinger's quantum mechanics, there should be an energy formula that is the same as that of a simple harmonic oscillator." That is,

$E_n = \pm g\,\hbar\omega\,(n + \frac{1}{2}), \quad n = 0,1,2,3\cdots$ 7-10-13

Using this formula, the state $n = 0$ exists. But, because a g-factor of 2 does not have the energy state $E = \frac{1}{2}\hbar\omega$, it really becomes the energy state $E = \hbar\omega$ in Schrödinger's theory. The energy state $E_1 n_1$ is not only in

$$E_0 = \pm g\hbar\omega(n + \tfrac{1}{2})$$

$$= 2\hbar\omega(0 + \tfrac{1}{2}) = \hbar\omega \quad \text{for} \quad n = 0, \quad g = 2 \text{ (CFLE theory)}$$

$$= \frac{mz^2e^4}{(4\pi\varepsilon_o)^2 2\hbar^2} = \hbar\omega \quad \text{for} \quad n = 1, \quad g = 1 \text{ (Bohr's model)}$$

$$= \frac{\pi^2\hbar^2}{2ma^2} = \hbar\omega \quad \text{for} \quad n=1, \quad g = 1 \text{ (Schrödinger's equation)}$$

but also

$$E_1 = \pm g\hbar\omega(n + \tfrac{1}{2})$$

$$= 1.5\,\hbar\omega \quad \text{for} \quad n=1, \quad g = 1 \text{ (CFLE theory)} \qquad \text{7-10-14}$$

This difference of $\frac{1}{2}\hbar\omega$ cancels out in most applications of Bohr's model and Schrödinger's equation, because they involve only differences between two energy levels. But soon there are observable quantities that show Bohr's model and Schrödinger's equation, which do not account for special relativity and general relativity, are in error because they do not contain the possible permitted minimum energy $E_{n=0} = \frac{1}{2}\hbar\omega$ as spin and the zeropoint energy at $n = 0, g = 2$. Even Dirac's equation does not perfectly account for general relativity (cf.§9, §11, §18& §19). In CFLE theory, however, the harmonic oscillator potential is used instead of the coulomb potential near the zeropoint energy state, the reason for which is discussed in §19. Therefore, knowledge of this 1.5 times difference from $d = \frac{1.5\hbar\omega}{\hbar\omega}$ is tremendously important for serious contradictions to solve. In formula $E_i = \pm g\hbar\omega(n_A + \frac{1}{2_B})$ is called term of n_A Bohr's term or energy term of flat frame of reference.

However, ternm of $\frac{1}{2_B}$ is called spin term or energy term of curved frame of reference(cf.§19.4) according to CFLE theory.

Historically, Bohr said that "in hydrogen the energy level *n* cannot be 0," because Bohr did not know what the physical essence of *g* was, nor even Schrödinger and Dirac. But CFLE theory reveals that Bohr's postulate is incorrect. Therefore, CFLE theory does not need the extra introduction of spin and its *g*-factor of 2.

7.11.Relation Between the Inertial Constant and Force Line Curve *g*

The inertial moment of an object about a given axis describes how difficult it is to change its angular motion about the axis. Therefore, it encompasses not just how much mass the object has overall, but also how each bit of mass is from the axis, based on dimensional analysis alone. The moment of inertia of a non-point object must take the form

$$I = KML^2 \qquad \text{7-11-1}$$

where M is the mass, and L is a length dimension taken from the center of the mass (in some cases, the length of the object is used instead). K is a dimensionless constant called the inertial constant that varies with the object in consideration, so the inertial constant is used to account for the difference in the placement of the mass from the center of rotation. Examples include a $K = 1$ thin ring or a thin-walled cylinder around its center, a $K = \frac{2}{5}$ homogenous sphere around its center, and a $K = \frac{1}{12}$ rod center ($w = L$, $h = 0$) (refer to any lists of inertial moment).

When $K = 1$, the length is called the radius of gyration. In CFLE theory, the inertial constant of an object is different, because every object has a different force line curve state. An example is the sun's inertial constant

$$K_\odot = \frac{1}{16.9} \qquad \text{7-11-2}$$

This value relates with the general inertial constant

$$K = \frac{2}{5} \qquad \text{7-11-3}$$

However, because the sun has a maximum force line curve state of g = 6.546, its inertial constant becomes

$$K_{\odot} = \left(\frac{1}{2.5}\right)\left(\frac{1}{6.546 \times 1.034}\right) = \frac{1}{16.9}, \quad (6.546)\,(1.034) = 6.769 \qquad \text{7-11-4}$$

where 6.546 is the sun's force line curve (g = 6.546), and 1.034 is the gravitational permittivity of air at g = 2 for an Earth observer

$Q_{\mathrm{g}} = (0.017)\,(2) = 0.034, \quad x_{\mathrm{g}} = 1.034$

In the case of a spiral galaxy, its inertial constant is related to the rod center $K = \frac{1}{12}$, and so the inertial constant is

$$K_{\otimes} = \left(\frac{1}{12}\right)\left(\frac{1}{6.769}\right) = \frac{1}{81.23} \qquad \text{7-11-5}$$

Finally, because the inertial constant of Earth is

$$K_{\oplus} = \frac{1}{3.0248} = 0.3306$$

$$K_{\oplus} = \frac{1}{3.0349} = 0.3295 \qquad \text{7-11-6}$$

the force line curve of Earth is therefore

$$\frac{1}{3.030} = \left(\frac{2}{5}\right)\left(\frac{1}{K_{\oplus}}\right)$$

Hence, $\frac{1}{K_{\oplus}} = \frac{1}{1.212}$ 7-11-7

The curve of Earth is

$$g = 1.212 \qquad \text{7-11-8}$$

7.12 The Minimum Theoretical Clue That Leads to Quantization of Gravity

After the confirmation of De Broglie's matter-wave theory by C. Davisson, the L. Germer experiment could not avoid the duality of any object being on the one side of wave nature and on the other side of particle nature, and so it concluded that a particle must be a wave packet. A wave packet superposes an infinitely large number of sinusoidal component waves in Δx, where Δx is the degree of uncertainty of x. Outside of Δx, the sum of the component waves is zero by offset. Between wave components, therefore, for superposition of the component wave, the Fourier integral is used, so

$$\psi = \int_0^{\infty} A(k)\cos 2\pi k dx \qquad 7\text{-}12\text{-}1$$

$$\psi = 2\Delta k \cos 2\pi K_o x (\frac{\sin 2\pi\Delta kx}{2\pi\Delta kx}) \qquad 7\text{-}12\text{-}2$$

and we obtain

$$\Delta x \Delta k \geq \frac{1}{4\pi} \qquad 7\text{-}12\text{-}3$$

Because $p = \frac{h}{\lambda}$,

$$\Delta x \Delta k = \Delta x\ \Delta(\frac{1}{\lambda}) \geq \frac{1}{4\pi} \qquad 7\text{-}12\text{-}4$$

$$\Delta x \Delta(\frac{p}{h}) = \left(\frac{1}{h}\right) \Delta x \Delta P \geq \frac{1}{4\pi} \qquad 7\text{-}12\text{-}5$$

$$\Delta x \Delta mv \geq \frac{\hbar}{2} \qquad 7\text{-}12\text{-}6$$

Here, Δm represents the range of mass uncertainty degree related to the matter-wave length. Therefore, an astronomically huge object (e.g., sun, Earth, star, etc.) that was considered classically in the past can be thought of as being a tremendously huge wave packet, and because such astronomical object is a group of particles and a particle is a wave packet so to speak, then there should be no hindrance. If an astronomical object is analyzed to be a huge wave packet that is superposed by an infinite number of component matter-waves with huge wavelengths (gravitational wave and related gravitational wavelength and gravitational field with related gravitational force lines and its elements), then the question is how can such an analysis be possible? The answer is because

$$\Delta x \Delta k \geq \frac{1}{4\pi}, \qquad \Delta t \Delta \nu \geq \frac{1}{4\pi} \qquad 7\text{-}12\text{-}7$$

$\Delta x \Delta mv \geq \frac{\hbar}{2}$ are universal properties of all waves. Now, because every particle cannot avoid its universal wave property, if the analyzed case were physically just (which of course it is) and if the mass density ρ were constant ($\rho \approx K$) universally, then there must exist a huge energy quantum $\hbar_{\mathrm{H}}$ in the universe, according to the discussion below: If the existence of a huge $\hbar_{\mathrm{H}}$ in the universe were impossible, then it would be impossible to quantize the macro world and the micro world (but the micro world is already quantized). Therefore, this calls for the securing of a "minimum theoretical clue" feasibility. When an atom is in a stable orbit, its radius R is the Bohr radius. That is,

$$R = 5.292 \times 10^{-11} \text{ m} \quad \text{7-12-8}$$

Its mass is

$$m = 1.673 \times 10^{-27} \text{ kg} \quad \text{7-12-9}$$

So, the density is

$$\rho = 6.295 \times 10^{3} \text{ kg/m}^3 \quad \text{7-12-10}$$

Corresponding to this stable orbit state of an atom, in the case of the sun having the orbit state of Mercury, its radius is

$$R = 5.384 \times 10^{10} \text{ m} \quad \text{7-12-11}$$

The sun's mass is

$$M_{\odot} = 1.989 \times 10^{30} \text{ kg}$$

So, the mass density ρ is

$$\rho = 2.391 \times 10^{-3} \text{ kg/m}^3 \quad \text{7-12-12}$$

The difference of the two values is

$$d = \frac{2.695 \times 10^3}{2.391 \times 10^{-3}} = 1.127 \times 10^6 \quad \text{7-12-13}$$

The difference of one dimension is

$$d = \sqrt[3]{1.127 \times 10^6}$$

$$= 1.0407 \times 10^2 = 104.07 \quad \text{7-12-14}$$

Because the electrical permittivity of $c_c = 1.5$ and $g = \frac{6.546}{1.5} = 4.364$ is

$$Q_{e1} = (0.000589)(1.5) = 0.000884, \quad x_{e1} = 1.000884$$

$$Q_{e2} = \frac{0.000589}{4.364} = 0.000135, \quad x_{e2} = 1.000135$$

The observed value is

$$d = \frac{104.07}{(1.000884 \times 1.000135)} = 103.96 \qquad 7\text{-}12\text{-}15$$

The essential reason for this difference is only because the gravitational force line curve of the sun is $g^2 = (6.546)^2 = 42.85$ (like in §7.8, called dark factor) and the correspondence number (cf. §7.13) is $c_c^2 = (1.5)^2 = 2.25$

$$g^2\ c_c^2 = (6.546)^2(1.5)^2 = (42.85)\ (2.25) = 96.41 \qquad 7\text{-}12\text{-}16$$

The difference of the gravitational permittivity of air at $g = 2$ and electrical permittivity of air at $g = 8$ for a neutrolateral force is

$$Q_g = (0.016774)\ (2) = 0.033548$$

$$x_g = 1.033548 \qquad 7\text{-}12\text{-}17$$

$$Q_e = (0.000589)\ (8) = 0.004712$$

$$x_e = 1.004712 \qquad 7\text{-}12\text{-}18$$

$$x_g x_e = x_t = (1.033548)\ (1.004712) = 1.038418$$

$$x_e^2 = 1.073312 \qquad 7\text{-}12\text{-}19$$

The total possible value of force line curve is

$$g^2 c_c^2 x^2 = (6.546)^2\ (1.5)^2\ (1.038418)^2$$

$$= (42.85)\ (2.25)\ (1.073312)$$

$$= 103.96 \qquad 7\text{-}12\text{-}20$$

The two values are the same:

$$d = 103.96 \Rightarrow g^2 c_c^2 x^2 = 103.96 \qquad 7\text{-}12\text{-}21$$

Because the possible maximum density of the sun is

$$\rho = (2.391 \times 10^{-3})\ (1.127 \times 10^6) = 2.695 \times 10^3\ \text{kg/m}^3 \qquad 7\text{-}12\text{-}22$$

if we did not know that the sun's dark factor is $df_{\odot} = 96.41 \sim 104.05$, then we would not be able to recognize that the mass density is constant between the atom system and the solar system. Therefore, with a huge mass uncertainty degree of Δm and a huge wave packet uncertainty degree of Δx, a related huge energy quantum $\hbar_{\odot}$ can be expected.

This is the minimum expectation for a huge mass system to be gravitationally quantized. Now, because the mass density ρ is constant

$$\rho = \frac{\Delta m}{\frac{4}{3}\pi(\Delta x)^3} = K \qquad \text{7-12-23}$$

$$\Delta m = Z\Delta x^3\rho, \qquad \text{7-12-24}$$

where $Z = \frac{4}{3}\pi$, $\quad \Delta m v \Delta x \geq \hbar$ 7-12-25

Inserting Eq. 7-15-23 into Eq. 7-15-24, we obtain

$$(Z\Delta x^3\rho)\, v\, \Delta x \;\geq \hbar$$

and hence we obtain the formula

$$\rho = K = \frac{\hbar}{Z\Delta x^3 \rho V \Delta x} \qquad \text{7-12-26}$$

According to Eq. 7-12-23, when the range of a component wave of uncertainty degree (Δx) becomes huge, because the mass density ρ is constant, the energy quantum $\hbar_{\mathrm{H}}$ must also become huge, according to the longer Δx. From the next chapters to the last chapter of this book, this surprising result of Eq. 7-12-23 of another huge energy quantum $\hbar_{\mathrm{H}}$ will be discovered, and the physical justification of these huge energy quanta $\hbar_{\mathrm{H}}$ will be confirmed both quantitatively and qualitatively.

We can imagine the wave nature of matter as being a gathering of many electrons or photons as a group in enough given place, and the group moves in a wave-like fashion. But the wave nature of the electron or photon in quantum mechanics does not exhibit such wave-like group movement. Despite that the wave nature of the electron or photon appears to be from one electron or one photon only, we cannot deny that each electron or photon has individual particular nature as one system too (e.g., the photoelectric effect). Even Einstein angsted about the nature of the quantized photon, according to his own admission (cf. book of J.S. Rigden).

The electron appears to exist as a spreading sphere in space. Upon closer observation, however, we can see that the electron uses a tool (the photon) to obtain energy and reacts according to $\Delta x \Delta mv \geq \frac{\hbar}{2} = \frac{p\lambda}{4\pi}$, with the result that it appears as $\Delta x \Delta mv$. This is none other than the particular nature of the electron. The physical background of such phenomenon is the force lines of the electron and the force line elements that screen the super-gravitational charge (the tremendous big mass that is stronger that electrostatic charge) of the seed of the electron. Because Maxwell's electrodynamics, Schrödinger's quantum mechanics, and Einstein's relativistic mechanics do not enbody force line elements and magnetic monopoles, even Einstein could not understand and accept the duality of matter—why and how electrons have wave nature.

The answer based on CFLE theory is simple. The electron is one system constituting one seed and many force line elements that can spread spherically in space, and from the maximum possible electron radius of $\sim 10^{30}$ to $\sim 10^{-34}$ m, the related mass of the electron is from $\sim 10^{-3}$ to 10^{-31} kg.

On an astronomical scale, such duality appears as in Figure 7-15-1

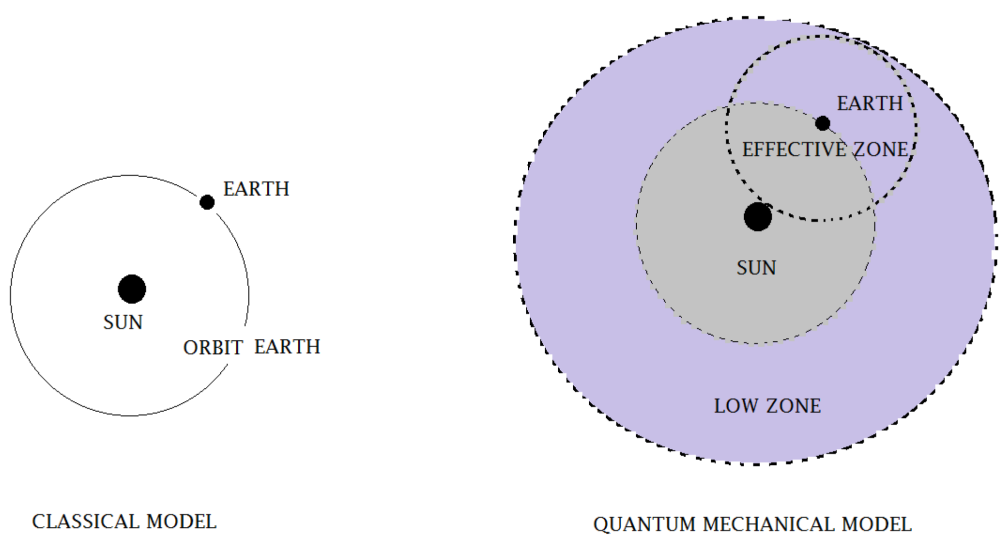


Figure 7-12-1

In the classical astronomical model, the Sun, Earth, and Earth orbit can be distinguished cleary, as seen in Figure 7-12-1. But in the quantum mechanical model, the distinction is not as clear, as shown on the right side of the figure. Any point inside and outside of the Earth orbit can exist, through its gravitational force line, as an electric field and a magnetic field with energy of classical electrodynamics, $W = \frac{\epsilon_o}{2} \int E^2 d\tau$, $W = \frac{1}{2\mu_o} \int B^2 d\tau$. The integral range of these fields is all space! Here, E and B are not mathematical concepts but physical real objects, as light, as Maxwell predicted. Therefore, we must accept the fact that the force line from any object is an extended part of the object (cf.§17.4), much in the same way that the long hair of a woman is part of her body. When the wind blows and the long hair moves up vertically on the woman's head, the height of her body is effectively increased; so we should conclude that her height is uncertain or that we cannot always know exactly the woman's height.

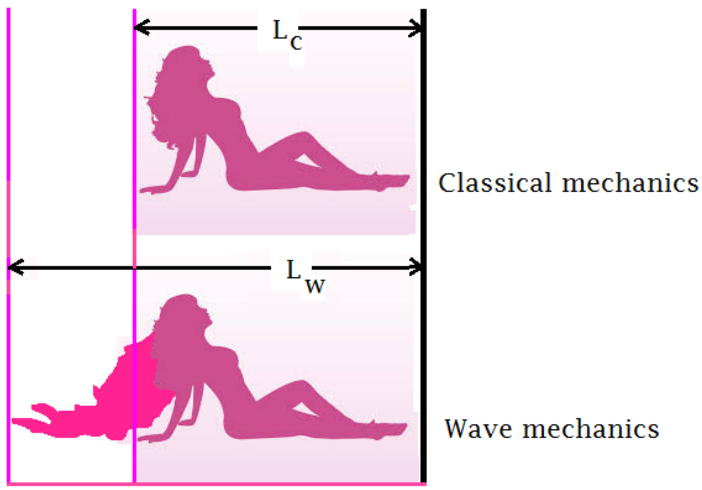


Figure 7-12-2

Finally, one could question what the relations of body, height, hair, uncertainty, same times, exactness, and measurement are to the energy quantum. Such question and answer is the main theme from Chapters 8 to 18. In the early history of quantum mechanics, scientists could not easily understand and accept micro-quantum mechanics for particles, because the constant of the electromagnetic energy quantum is very small, $h_e \sim 10^{-34}$ Js. Likewise, present scientists cannot easily understand and accept macro-quantum mechanics for astronomical objects, because the constant of the gravitomagnetic energy quantum is so gigantic, $h_{\text{galaxy}} \sim 10^{77}$. However, in the universe, there are many observable evidence of $\sim 10^{11}$ and that astronomical objects can have wave nature and particle nature (cf. §11).