Chapter 17

Applying CFLE Theory to Classical Physics

17.1 Testimony of the Existence of the Magnetic Monopole by CFLE Theory

According to classical electromagnetic theory, a multipole expansion is required in order to develop an approximate formula for the vector potential of a localized current distribution that is valid at distant points.

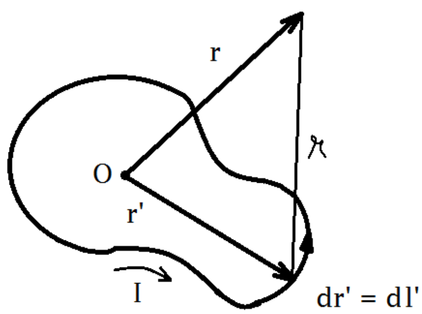


Figure 17-1-1

To achieve this, the potential is written in the form of a power series in $\frac{1}{r}$, where r is the distance to the points. If r is large enough, then the series will be dominated by the lowest non vanishing contribution.

That is,[1]

$$\frac{1}{\mathcal{R}} = \frac{1}{\sqrt{r^2 + (r')^2 - 2rr'\cos\theta}} = \frac{1}{r}\sum_{n=0}^{\infty} \left(\frac{r'}{r}\right)^n P_n(\cos\theta) \qquad \text{17-1-1}$$

The vector potential of a current loop is

$$\mathbf{A}(\mathbf{r}) = \frac{\mu_0 I}{4\pi}\oint \frac{1}{\mathcal{R}}\, d\mathbf{l} = \frac{\mu_0 I}{4\pi}\sum_{n=0}^{\infty} \left(\frac{1}{r^{n+1}}\right) \oint (r')^n\, P_n(\cos\theta) d\mathbf{l} \qquad \text{17-1-2}$$

1. Equations 17-1-1 to 17-1-4 adapted from Griffiths, David J. 1989. *Introduction to Electrodynamics*, p. 243, 3rd Edition. © 1989 Prentice-Hall, Inc., Upper Saddle River, New Jersey.

Equation 17-1-2 is expanded to

$$\mathbf{A}(\mathbf{r}) = \frac{\mu_0}{4}\frac{I}{\pi}[\frac{1}{r}\oint d\mathbf{I} + \frac{1}{r^2}\oint r'\cos\theta d\mathbf{I} + \frac{1}{r^3}\oint (r')^2\left(\frac{3}{2}\cos^2\theta - \frac{1}{2}\right)d\mathbf{I} + \cdots] \qquad 17\text{-}1\text{-}3$$

where $\frac{1}{r}$ is the monopole term, $\frac{1}{r^2}$ is the dipole term, $\frac{1}{r^3}$ is the quadrupole term, *etc*. The classical assumption has been that because the integral is simply the total vector displacement around a closed loop, this will result in the magnetic monopole term to be always equal to 0.

That is,

$$\oint d\mathbf{l} = 0 \qquad 17\text{-}1\text{-}4$$

Therefore, the classical belief is that "this reflects the fact that there are no magnetic monopoles in nature (an assumption) contained in Maxwell's equation $\nabla \cdot \mathbf{B} = 0$, on which the entire theory of vector potential is predicate." [2] Such results are predicated according to the fundamental theorem of calculus. That is,

$$\int_a^b F(x)dx = f(b) - f(a) \qquad 17\text{-}1\text{-}5$$

In a closed curve, $a = b$, and therefore, the result is

$$f(b) - f(a) = 0 \qquad 17\text{-}1\text{-}6$$

Namely,

$$a = b, \quad a - b = 0 \qquad 17\text{-}1\text{-}7$$

This, however, is not true, because according to the uncertainty principle, we cannot calculate exactly two points at the same time.

$$\Delta mv\Delta x \geq \hbar \qquad 17\text{-}1\text{-}8$$

Because the problematic loop is a real conductor, the uncertainty principle prevents us from applying speculative Euclidian geometry unconditionally to a real object of real physics. Therefore, correction of the fundamental theorem of calculus is needed. That is (cf. §3),

$$b - a = 0 \implies b - a \neq 0 \implies b - a = \frac{\pm x_{\Delta o}}{2} \qquad 17\text{-}1\text{-}9$$

2. Extract from Griffiths, David J. 1989. *Introduction to Electrodynamics*, p. 243, 3rd Edition. © 1989 Prentice-Hall, Inc., Upper Saddle River, New Jersey.

This means that the orbital of a component particle in the loop becomes the curve of pursuit, and therefore the real physical result of $\oint dl$ is

$$\int_a^b F(x)dx = f(b) - f(a) = z \neq 0 \qquad 17\text{-}1\text{-}10$$

The monopole term is thus

$$A = \frac{\mu_0}{4}\frac{I}{\pi r}\oint dl = \frac{\mu_0}{4}\frac{IZ}{\pi r} \neq 0 \qquad 17\text{-}1\text{-}11$$

Therefore, the magnetic monopole can exist.

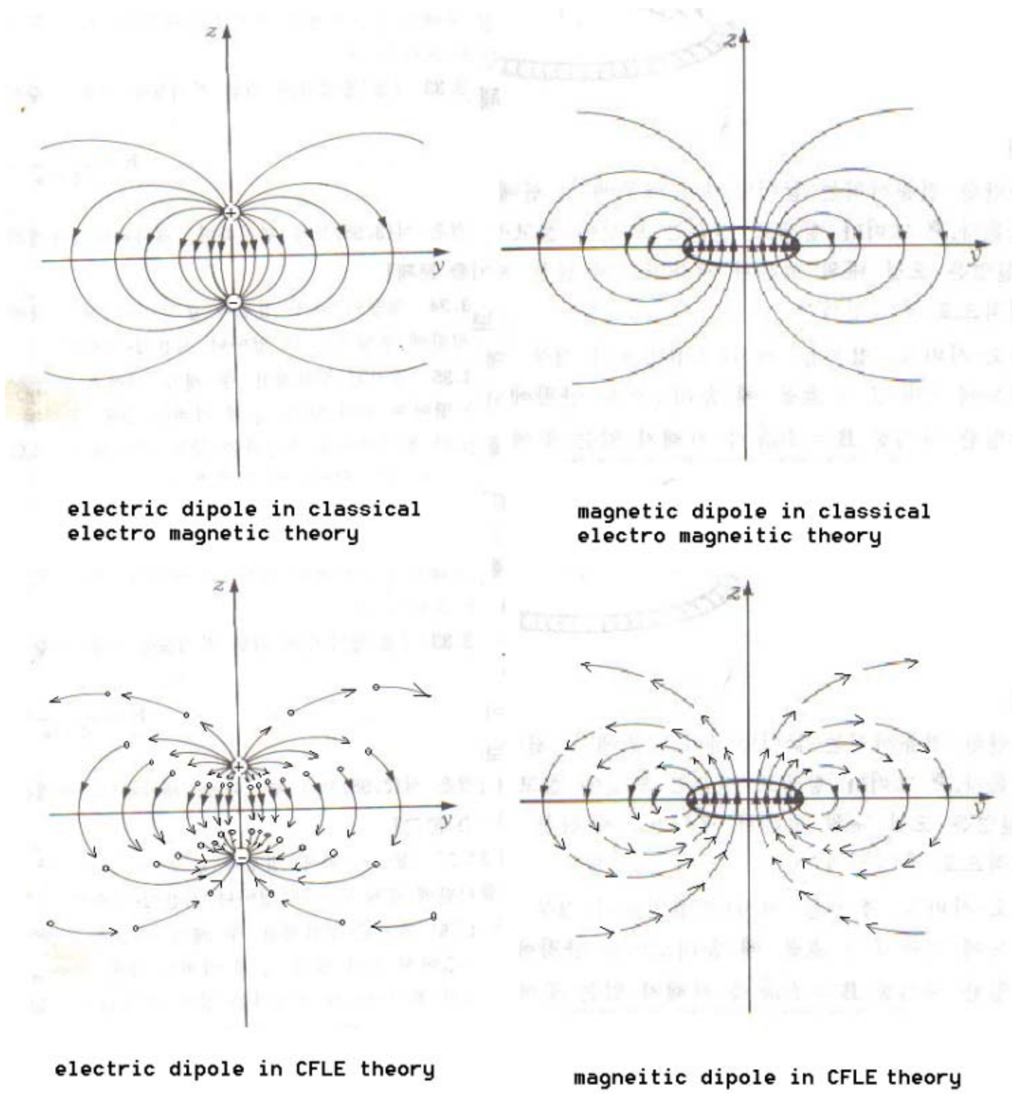


Figure 17-1-2

The uncertainty principle essentially says that the "magnetic monopole ought to exist," because the universe is not unlimitedly large; that is, $V_S = 0$ is not permitted, despite that a magnetic monopole can result from the fin-like motion of surface force line elements. If the existence of magnetic monopoles were not permitted by nature, then the dipolar force line elements and force lines discussed in §4 could not be introduced. Figure 17-1-2 compares the electric fields of dipole moments as described by classical electromagnetic theory and by CFLE theory.

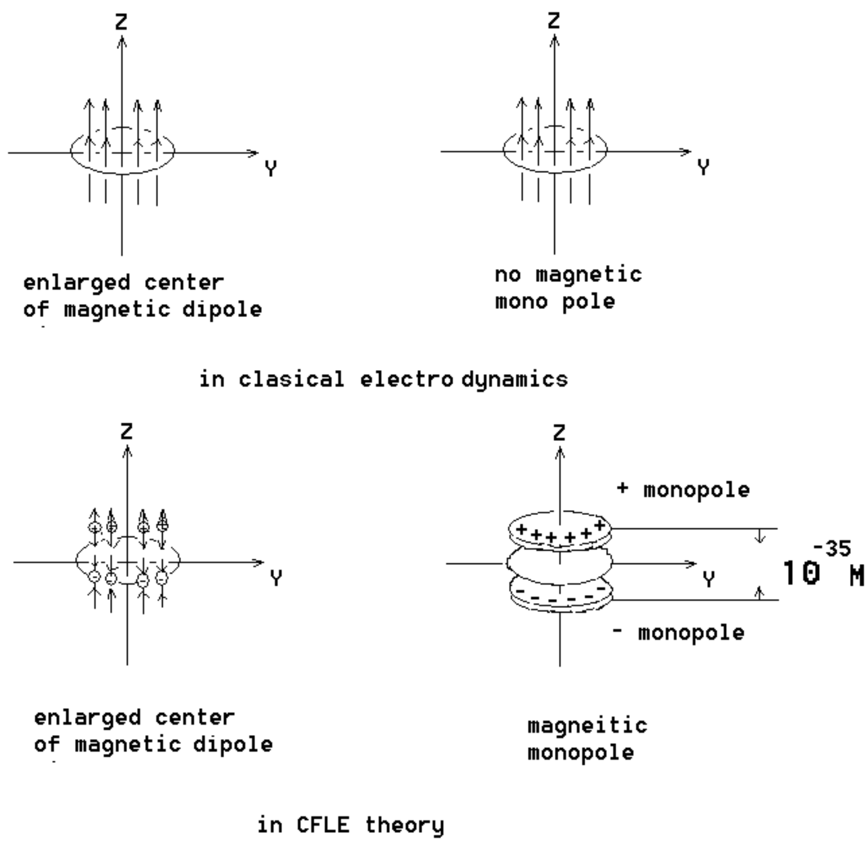


Figure 17-1-3

The previous discussion can be demonstrated by establishing in a Bohr model. That is, when an electron revolves around a proton with $R = 5.2918 \times 10^{-11}$ m, and width of $w \approx 10^{-11}$ m, the orbital does not form a closed curve (see Figure 17-1-3).

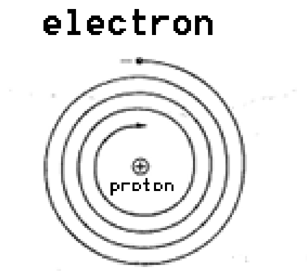


Figure 17-1-4

In the ~10^{-11} m width size at ~10^{-35} m from the seed of the electron, the orbital forms an open curve (Figure 17-1-4).

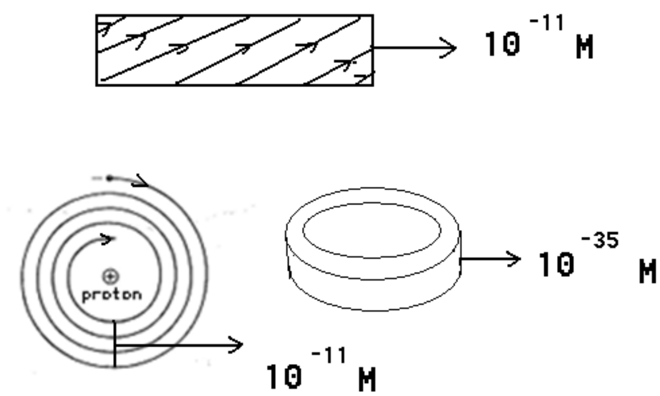


Figure 17-1-5

The possible number of revolutions of the electron is

$$n = \frac{10^{-11}\ \text{m}}{10^{-35}\ \text{m}} = 10^{24} \qquad 17\text{-}1\text{-}12$$

The total possible time for revolution of the electron is

$$t = (1.3 \times 10^{-17}\ \text{s})\,(10^{24})$$

$$= 1.3 \times 10^{7}\ \text{s} \qquad 17\text{-}1\text{-}13$$

At the ~10^{-35} m height from the seed of the electron, an open curved orbital forms with a possible number of revolutions of

$$n = \frac{10^{-11}\ \text{m}}{10^{-35}\ \text{m}} = 10^{24}$$

The total possible time in this case is

$$T = (1.3 \times 10^7 \text{ s})(10^{24})$$
$$\approx 10^{31} \text{ s}$$
$$\approx 4.1 \times 10^{23} \text{ years} \qquad 17\text{-}1\text{-}14$$

Therefore, the classical fundamental theorem of vector calculus cannot be believed quantitatively. That theorem can be used only approximately. Because the calculation of classical electrodynamics is pursuant to unpermitted excessive accuracy by nature, it cannot bring out real, physical, and meaningful results.

Now particle is stopped, but there should be divergence of magnetic field by force line element that has to have N pole and S pole. Therefore

17.2 Force Line Arrangement to Ensure the Curve of Pursuit and Magnetic Monopole

§15 discussed the arrangement of force lines for helicity. The two possible directions are given in Figure 17-2-1.

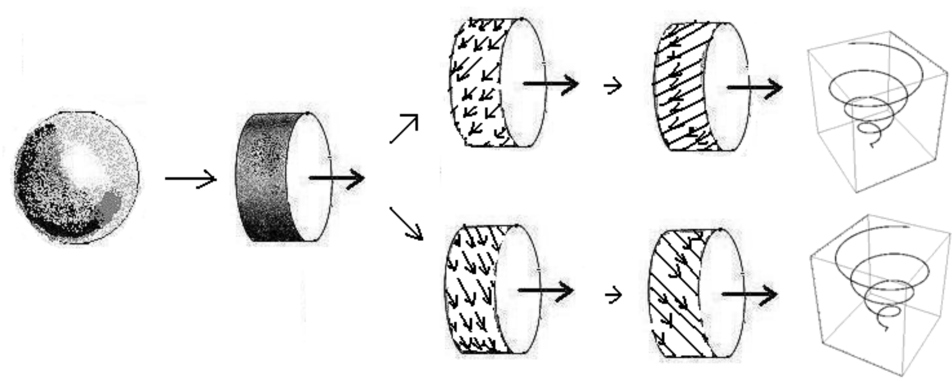


Figure 17-2-1

Now, observe the surface force line elements and deep force line elements shown in Figure 17-2-2.

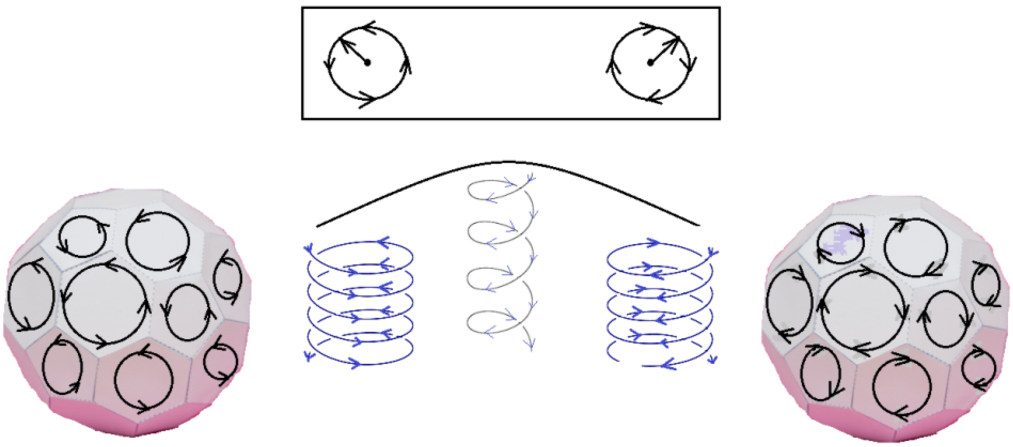
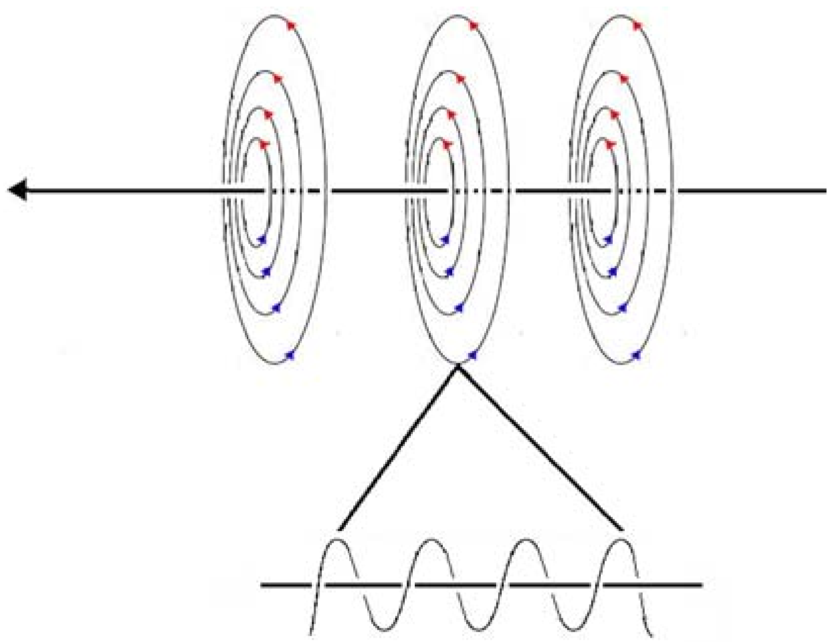


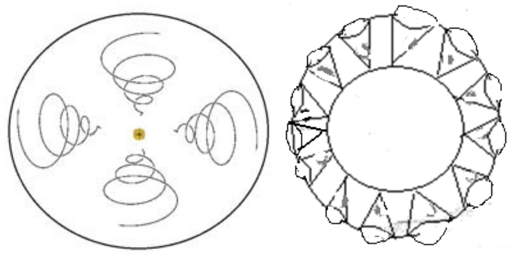
Figure 17-2-2

Such arrangement of force line elements gives rise to on open curved magnetic field. In CFLE theory, we cannot avoid the speculation that a magnetic monopole ought to exist. Now, in the path of a linear current electric charge, such open curved magnetic field occurs too (Figure 17-2-3).



The expanded situation looks like a closed curved magnetic field

Figure 17-2-3



Between [V = 0] ~ [$V \cong$ 0]

Figure 17-2-4

When an observer and particle make one rest system, the surface force line elements move under the speed condition of between $V_S = 0$ and $V_S \cong 0$. Under such speed condition, the particle does not need to move its whole system along with its seed and all of its shell materials, because the inertial force distributes movement of the particle and maintains gauge symmetry of the particle. Therefore, the surface force line elements move ceaselessly according to the inertial state to maintain gauge symmetry, much like the fin movement of a fish temporary stopped under water. Figure 17-2-5 shows an enlarged view of the movement of a few surface force line elements by helix structure of force line.

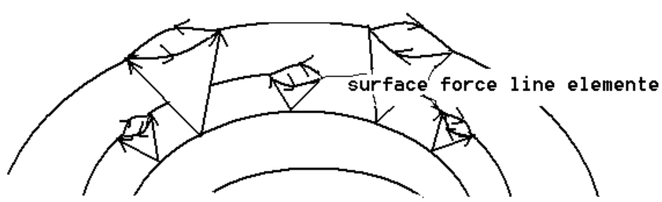


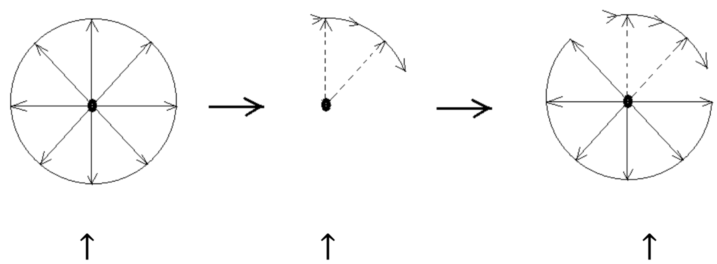
Figure 17-2-5. Fin–like motion of surface force line elements

Totally, in the whole particle system, a near-zero magnetic monopole term can exist. Because $\nabla \cdot B \neq 0$ and $B = \frac{V}{C^2} \times E$, we can establish that

$$\nabla \cdot B = \nabla \cdot (\frac{V}{C^2} \times E) \neq 0 \qquad \text{17-2-1}$$

The particle is now stopped, but there should be a curl of the magnetic field and divergence of the electric field, formed by force lines helix, that must have an N pole and an S pole. Therefore, the particle should have a curl of the electric field and divergence of magnetic field, formed qualitatively by the same helix force lines elements(Figure 17-

2-2) of the magnetic field per Eq. 17-2-1, as shown in Figure 17-2-6 and Figure 17-3-6 . Thus, the electric force line must be formed by monopole force line elements that correspond to the magnetic monopoles of N and S.



State of $\nabla \cdot \boldsymbol{B} \neq \mathbf{0}$ → State of $\frac{\boldsymbol{V}}{\boldsymbol{C}^2} \times \boldsymbol{E}$ → State of $\nabla \cdot \boldsymbol{B} = \frac{\boldsymbol{V}}{\boldsymbol{C}^2} \times \boldsymbol{E}$

Figure 17-2-6

In the situation of Figure 17-2-6, the curl of the electric force line elements toward any direction cannot distinguish the divergence of the magnetic force line elements.

Because there are magnetic monopoles of S and N, two kinds of related electric monopoles must exist, which traditionally we have used the $\pm$ sign to represent. ($\pm$ electric dipolar force line elements are introduced in §4.) However, because $\nabla \cdot B = 0$ in the Maxwell equation, Maxwell could not introduce monopolar force line elements as a source of the neutrolateral force and asymptotic freedom.

The existence of magnetic monopoles also means that the relativity principle and uncertainty principle have an established limit, because both these principles are established by a change of force lines. Outside of the limit of electric force line elements or of the limit of the magnetic monopoles, there does not exist any force line that can be a function by any physical quantities. In the viewpoint of charge screening theory, the existence of magnetic monopoles means the existence of a maximum force line length of particles. Cosmologically speaking, this means that in the universe, there are only a limited given quantity of force line elements. Therefore, when a particle stops, it can have a uniform minimum rest mass, which means that a maximum uncertainty degree of particle length must be existing. Consequently, in order for such a stopped state of a particle to satisfy the uncertainty principle, the particle must have a minimum speed.

Given that the constant is $\frac{\hbar}{2\pi}=\frac{6.626176\times10^{-34}\,\mathrm{Js}}{2\pi}$, the related critical minimum speed is

$$v = s\left(\frac{6.626176\times10^{-34}}{2\pi}\right)\mathrm{m/s} \qquad 7\text{-}2\text{-}2$$

Therefore, we can establish that

$$\Delta x\Delta m = \frac{\hbar}{v} = \frac{\frac{6.626176\times10^{-34}\,\mathrm{Js}}{2\pi}}{\left(\frac{6.626176\times10^{-34}}{2\pi}\right)\mathrm{m/s}} = 1,\ \Delta x\Delta m = 1 \qquad 17\text{-}2\text{-}3$$

17.3 Correction of the Maxwell Equation by CFLE Theory

Because the monopole term is not always 0 and a stationary source for *B* exists, a correction of the Maxwell equation is needed. The original equation is

$$\nabla\cdot\mathbf{E} = \frac{1}{\varepsilon_0}\rho,\ \ \nabla\cdot\mathbf{B} = 0,\ \ \nabla\times\mathbf{E} = -\frac{dB}{dt} \qquad 17\text{-}3\text{-}1$$

$$\nabla\times\mathbf{B} = \mu_0 J + \mu_0\varepsilon_0\frac{dE}{dt},\ \ \nabla\cdot\mathbf{J} = -\frac{d\rho}{dt} \qquad 17\text{-}3\text{-}2$$

The corrected equations are

$$\nabla\cdot\mathbf{E} = \frac{1}{\varepsilon_0}\rho,\ \ \nabla\cdot\mathbf{B} = \mu_0\eta,\ \ \nabla\times\mathbf{E} = -\mu_0 K - \frac{dB}{dt} \qquad 17\text{-}3\text{-}3$$

$$\nabla\times\mathbf{B} = \mu_0 J + \varepsilon_0\mu_0\frac{dE}{dt},\ \ \nabla\cdot\mathbf{K} = -\frac{d\eta}{dt} \qquad 17\text{-}3\text{-}4$$

Force is changed by magnetic charge

$$F = (q_e E) + (q_e v\times B) + (q_m B) - \left(q_m v\times\frac{E}{c^2}\right) \qquad 17\text{-}3\text{-}5$$

where ρ is the density of the electric charge, η is the density of the magnetic charge, *J* is the current of the electric charge, and *K* is the current of the magnetic charge.

Here, physical change process of force line elements from equation $\nabla\cdot\mathbf{B} = 0$ to equation $\nabla\cdot\mathbf{B} = \mu_0\eta$ can be visualized by behavior of monopole force line elements as magnetic monopole as below.

According to classical electrodynamics equation $\nabla \cdot \mathbf{B} = 0$ means only curl of magnetic field as figure 17-3-1.

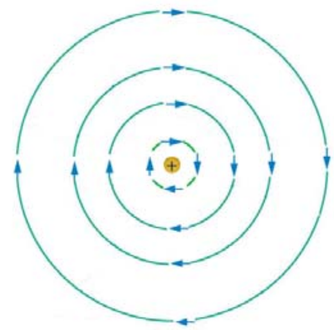


Figure 17-3-1

In Figure 17-3-1 we cannot find any divergence of magnetic field When such cure of force line (or field line) analyze by each movement of force line monopole elements as figure 17-3-2, we can get same result of curl as Figure 17-3-1

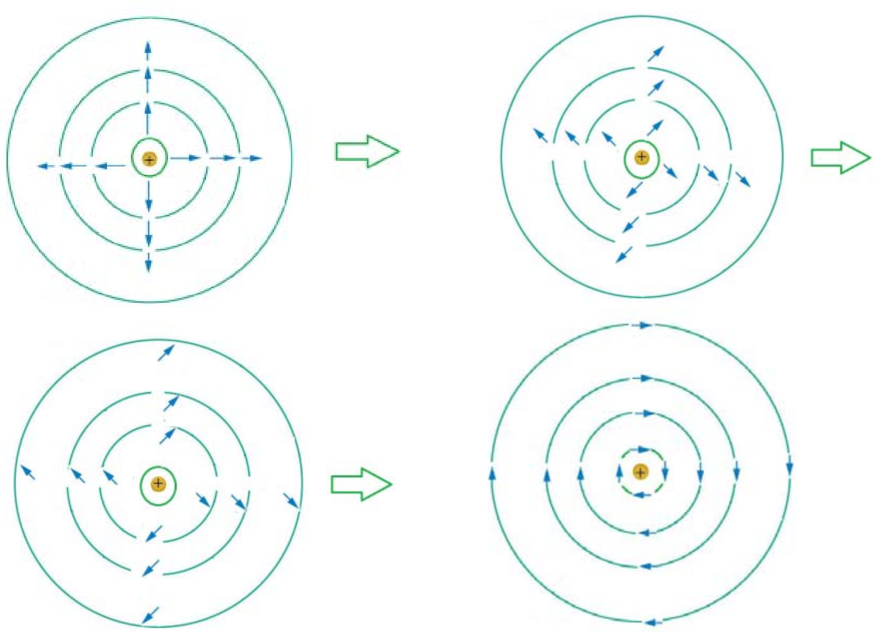


Figure 17-3-2

However, finer analyze of curl of force line by each movement of force line monopole elements give another result that is so called magnetic charge up phenomenon by exiting potential ΔV (cf.§4)as figure 17-3-3.

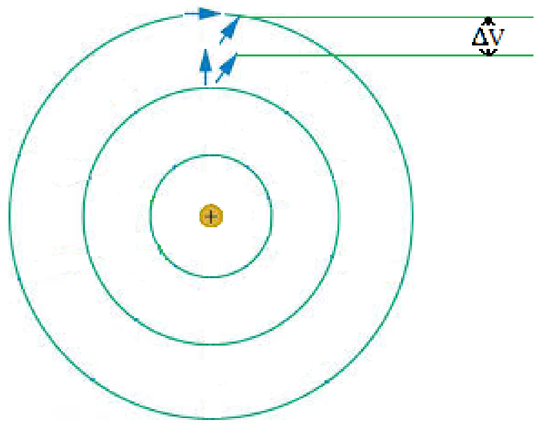


Figure 17-3-3

When such result of one monopole element express with whole elements, appear divergence of magnetic field $\nabla \cdot \mathbf{B} = \mu_0 \eta \neq 0$ as figure 17-3-4

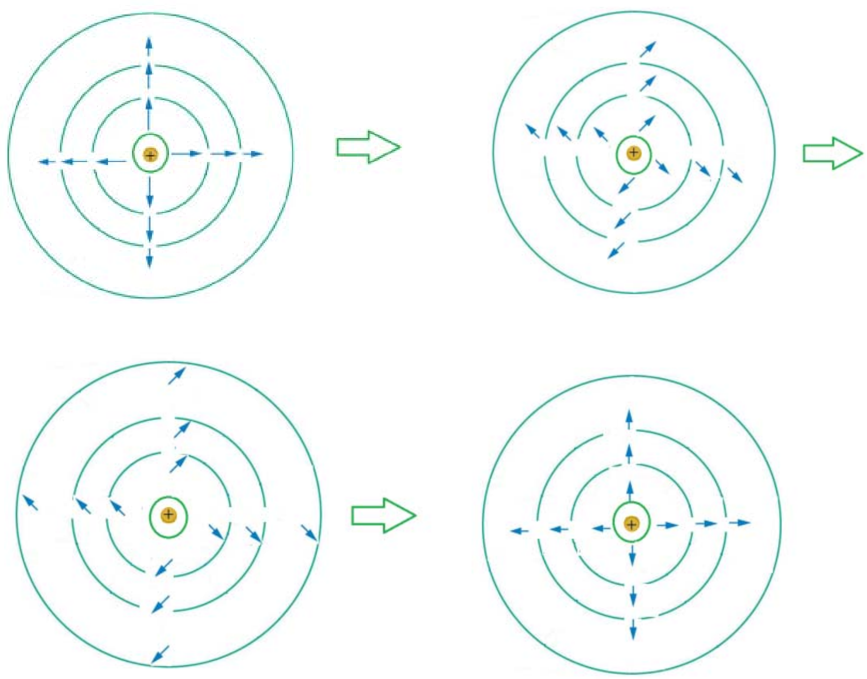


Figure 17-3-4

When to result of figure 17-3-4 give direction of magnetic charge up, divergence of magnetic field appear clearly as figure 17-3-5

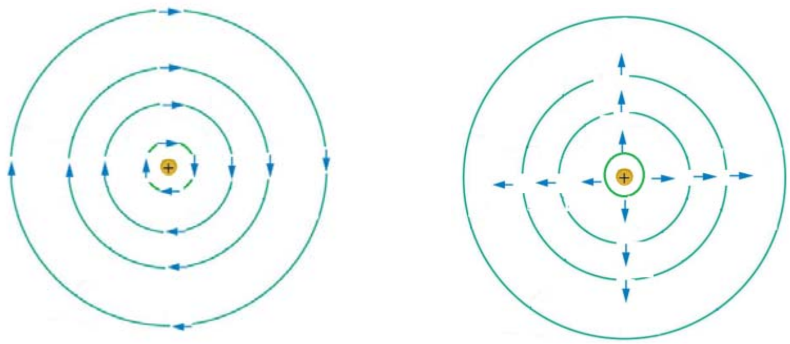


Figure 17-3-5

This is none other than divergence of magnetic field $\nabla \cdot \mathbf{B}$ or simply called magnetic divergence by density of magnetic charge"η". Because this density of magnetic charge"η" and current of magnetic charge "k" is tremendously small, divergence of magnetic field $\nabla \cdot \mathbf{B} = \mu_0 \eta \cong \mathbf{0}$ cannot be detected and related contradictions appear not seriously even important its necessity and meaning cannot be recognized 150 years long.

Because monopole force line elements (Figure 17-2-2) has helix structure, static electric field$\nabla \cdot E = \frac{\rho}{\varepsilon_o}$ can have curl $\nabla \times E \neq 0 = -\mu_0 K$ as figure 17-3-6.

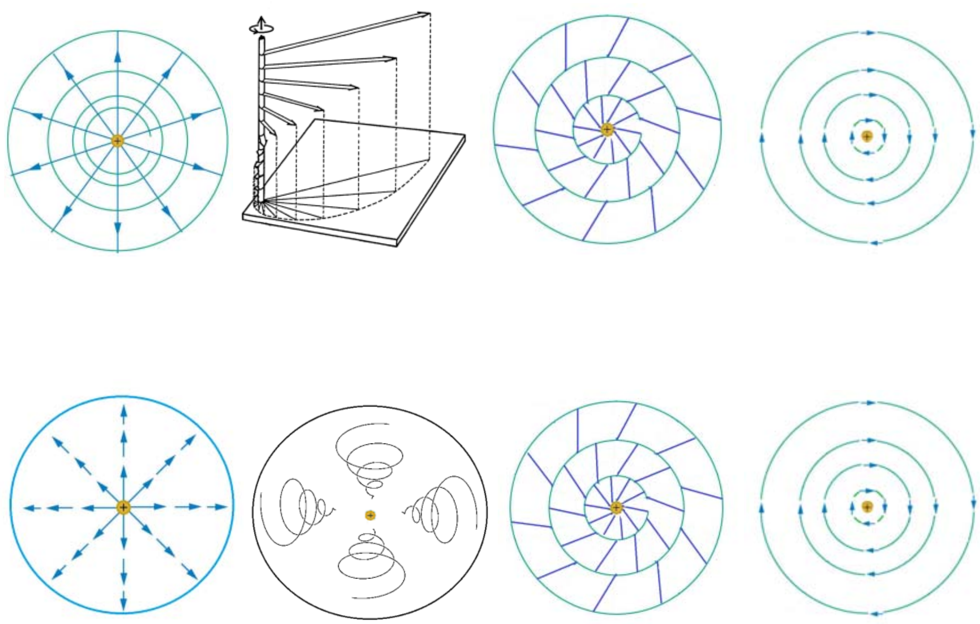


Figure 17-3-6

This result means that electromagnetism has two separate facets: electric fields and magnetic fields. Namely magnetic force line and its elements are same. Therefore, electricity and magnetism is dual.

In other word electron and proton can be called dualon like dyon that were first proposed by Julian Schwinger in 1969 as a phenomenological alternative to quarks.

When particle stay in one position,arrangement of monopole elements is normal state as figure 7-3-7.

When particle move with v, electric force line element rotate as $\frac{v}{c^2} \times E$. This is none other than magnetic field B. because this component of B is very weak and size of force line element is very small, appear only curl of magnetic field $\nabla \times B$ as figure 17-3-8.

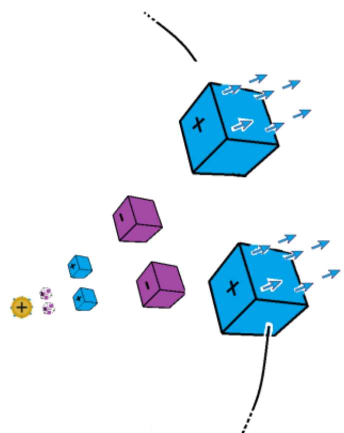


Figure 17-3-7

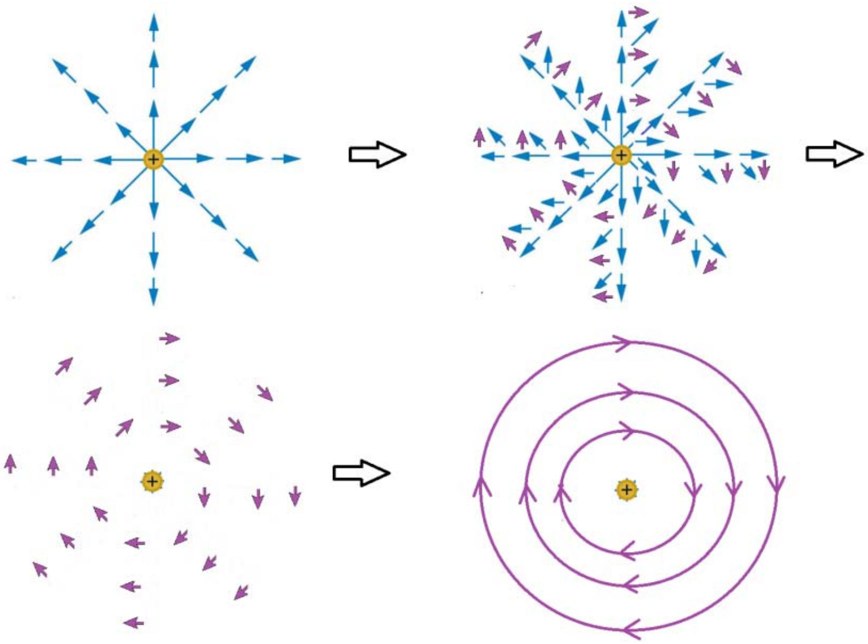


Figure 17-3-8

Because of small size of magnetic monopole as quark pair, is produced dipolar magnet as bar magnet.

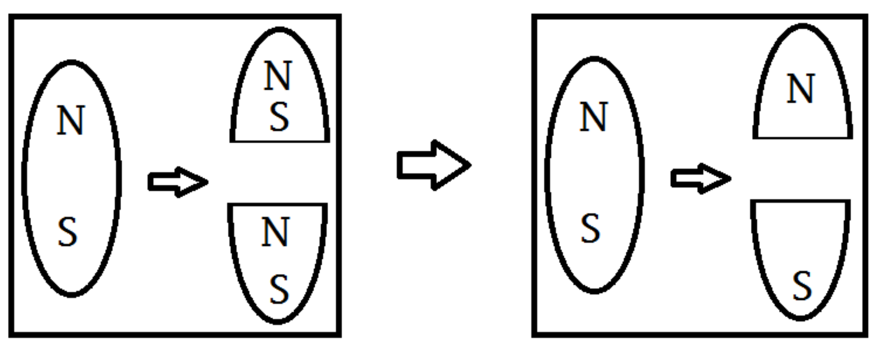


Figure 17-3-9

However, velocity is changed faster and faster angle of curl is reached 90^o and appear magnetic monopole appear as figure 17-3-10.

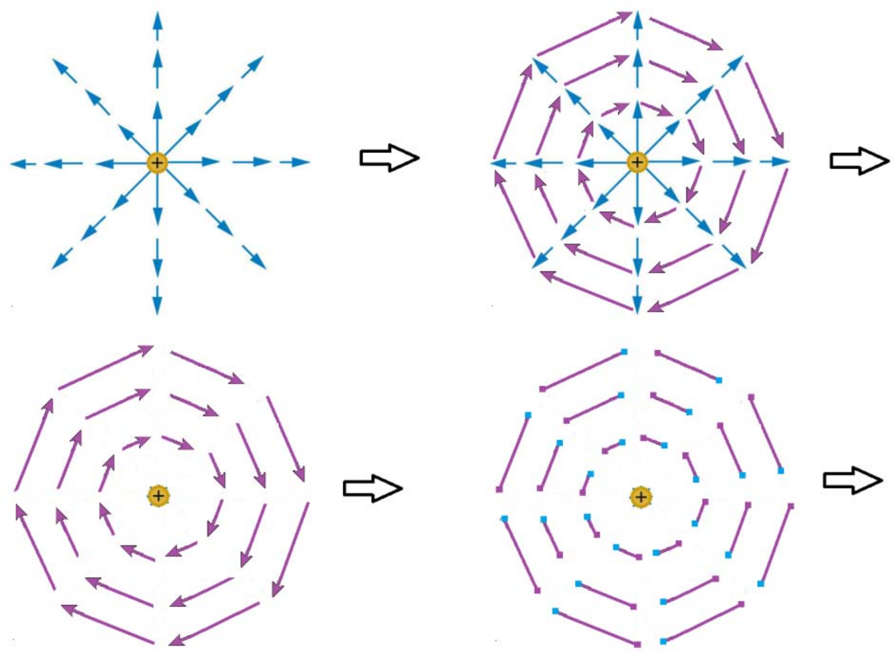


Figure 17-3-10

At this time position of monopole element is changed from figure 17-3-7 to figure 17-3-12

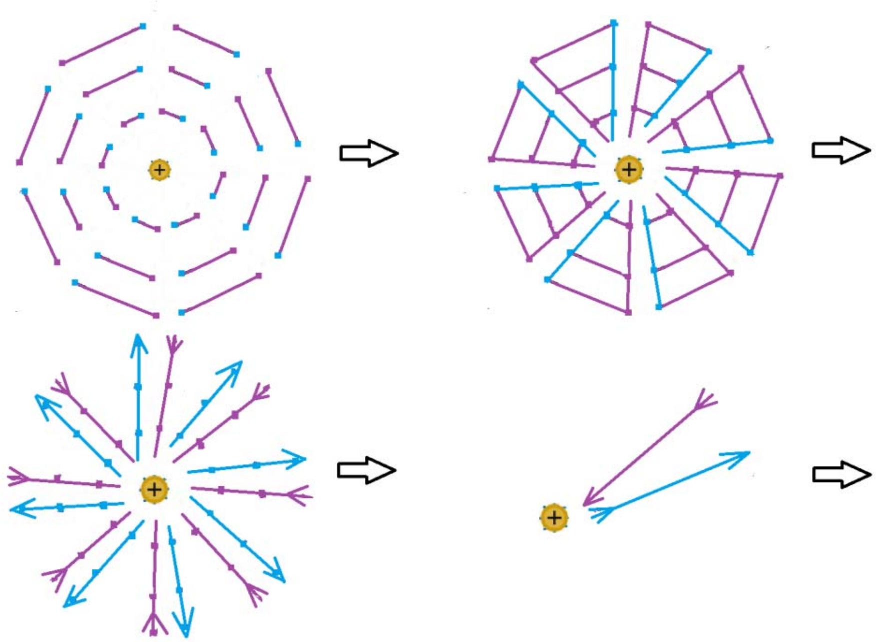


Figure 17-3-11

Figure 17-3-10 shows changed monopole positions as different two lines.

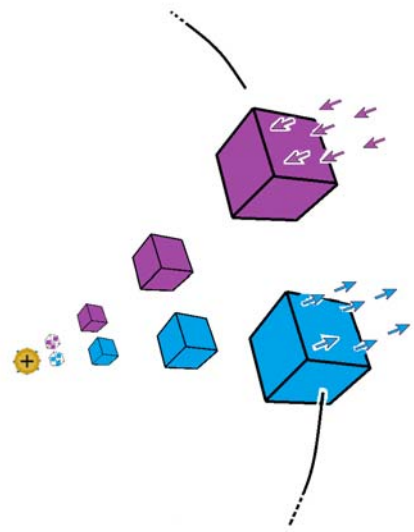


Figure 17-3-12

Figure 17-3-12 shows changed position by monopole elements.

In this figure 17-3-12 component of B appear clearly with magnetic monopole. Because of this monopole force is changed as

$$F = (q_e E) + (q_e v \times B) + (q_m B) - (q_m v \times \frac{E}{c^2}) \qquad 17\text{-}3\text{-}5$$

However, this magnetic monopole is none other than negative electric monopole element. Therefore, correspondence term of $(q_e v \times B)$ should be negative as term of [$-(q_m v \times \frac{E}{c^2})$].

Because in classical electrodynamics force line elements didn't introduced, such electromagnetic duality cannot be perfect.

However, electromagnetic duality exists always from early universe.

By such electromagnetic duality is guaranteed physical justification of

- The electric field (**E**) is the dual of the magnetizing field (**H**).
- The electric displacement field (**D**) is the dual of the magnetic flux density (**B**).

- Faraday's law of induction is the dual of Ampère's circuital law.
- Gauss's law for electric field is the dual of Gauss's law for magnetism.
- The electric potential is the dual of the magnetic potential.
- Permittivity is the dual of permeability.
- Electrostriction is the dual of magnetostriction.
- Piezoelectricity is the dual of piezomagnetism.
- Ferroelectricity is the dual of ferromagnetism.
- An electrostatic motor is the dual of a magnetic motor.
- Electrets are the dual of permanent magnets.
- The Faraday effect is the dual of the Kerr effect.
- The Aharonov–Casher effect is the dual to the Aharonov–Bohm effect.
- Charge of magnetic monopole of CFLE theory is the dual of electric charge.
- Magnetic monopole of CFLE theory is the dual of electric monopole.

Now, therefore, the gravito magnetic equation is

$$\nabla \cdot \mathbb{E} = G_0 \rho, \quad \nabla \cdot \mathbb{B} = \frac{1}{I_0} \eta_o \qquad 17\text{-}3\text{-}6$$

$$\nabla \times \mathbb{E} = -\frac{1}{I_0} K - \frac{d\mathbb{B}}{dt}, \quad \nabla \times \mathbb{B} = \frac{1}{I_0} J_0 + \frac{1}{I_0}\frac{1}{G_0}\frac{d\mathbb{E}}{dt} \qquad 17\text{-}3\text{-}7$$

$$\nabla \cdot \mathbf{K} = \frac{d\eta_0}{dt}, \quad \nabla \cdot \mathbf{J} = \frac{d\rho}{dt} \qquad 17\text{-}3\text{-}8$$

where $\mathbb{E}$ is the gravitational field, $\mathbb{B}$ is the gravitomagnetic field, ρ is the mass density, η_o is the magnetic mass density, K_o is the magnetic mass current, and J_o is the gravitational mass current.

Because existence of monopole of mass magnet force is changed as

$$F = (m_g \mathbb{E}) + (m_g v \times \mathbb{B}) + (m_m \mathbb{B}) - (m_m v \times \frac{\mathbb{E}}{c^2}) \qquad 17\text{-}3\text{-}9$$

17.4 Testimony of the Existence of a Gravitational $\pm$Charge by Gauge Theory and the Meaning of Dirac's Equation

In §4.2, I introduced the gravitational $\pm$monopolar force line element and discussed the reason for its introduction using a gauge theory explanation in §5.1 and the uncertainty principle in §8. However, these explanations need to be further elaborated by considering the energy conservation point of view. In classical electromagnetic theory, to establish the energy conservation law, it is necessary to introduce gauge invariance and charge conservation. This is also a prerequisite for its establishment by classical electromagnetic theory. However, if in gauge transformation the expectations value of the momentum of an electron $<p> = \psi^* \frac{\hbar}{2\pi i}\frac{d\psi}{dx}$ were changed and an electromagnetic field $A(x)$ were inserted for maintaining gauge symmetry, then the gravitomagnetic field should also have a corresponding momentum and momentum conservation law according to the correspondence property of force line elements. Because of this requirement, a gravitational force should have gauge invariance, and mass conservation is needed.

To conserve mass, much like in the pair product and pair annihilation of positrons and electrons, a positive charge and a negative charge as well as positive mass and negative mass are needed. In other words, mass is not newly created, and it does not disappear. A positive mass and negative mass should exist in the same quantity. Otherwise, the pair creation and pair annihilation of electrons and positrons could never be explained.

According to this mass conservation law, the total mass of the universe should be constant. This is a prerequisite of gravitomagnetic theory, and therefore, positive and negative monopoles force line elements and their corresponding positive and negative forces and positive mass and negative mass are introduced. Because there is no analogy with electromagnetic theory in Newtonian theory and Einsteinian theory, there is essentially no energy conservations law. In 1929, Dirac developed a relativistic theory of quantum mechanics utilizing essentially the same postulate as the Schrödinger theory, except that

$E = \frac{P^2}{2m} + V$ was replaced by the relativistic form

$$E^2 = c^2P^2 + (m_o c^2)^2, \quad E = \pm\sqrt{c^2P^2 + (m_o c^2)^2} + V$$

Dirac's theory reduces to the Schrödinger theory in the low velocity limit, where m_o is the electron rest mass. This is simply the solution of relativistic energy E, but the solution with the minus sign corresponds to a negative total relativistic energy — a concept as foreign to relativistic mechanics as a negative total energy is to classical mechanics.

Instead of just throwing away the negative part on the grounds that it is not physically realistic, Dirac pursued the consequence of the entire equation. He found that without the negative sign, his equation was not complete. Therefore, he introduced the concept that "a vacuum consists of a sea of electrons in a negative energy level." This energy level ranges from $+m_0c^2$ to $-m_0c^2$.

According to this energy level, there should be a positively charged e^+ (called a positron) associated with the absence of an electron of negative charge e^-. The important fact is that as a pair production process, the positron e^+ was observed experimentally by Anderson three years after its theoretical prediction by Dirac. That means $-m_0c^2$ is physically real. But in reality vacuum is empty space, so Dirac's vision of a vacuum consisting of a sea of electrons in a negative energy level is not physically real. If anti-mass were not real, mass of positronium must be observed as double mass of electron. However, nobody can observe double mass of positronium to date. This means that mass of electron annihillated by anti-mass of positron.

We know that Dirac's equation actually says "negative mass must exist as a physically real quantity." The actual existence of the positron according to Dirac's equation infers that gravitational monopoles must exist. Thus, according to CFLE theory, we can replace Dirac's definition of a vacuum with "gravitational and electrical monopole symmetry breaking" for harmonization with gauge invariance.

When pair annihilation has occurred following the collision between an electron and a positron, no observable physical property of both particles remains. The only possible cause of this perfect neutralization is that not only electrical neutralization but also gravitational neutralization must occur same times. Otherwise, pair production could not result in two particles forming as an electron and a positron. Therefore, it should be concluded that the positron mass is required as the anti mass of the electron. In other words, pair annihilation and pair production dictate that a dipole of gravitational charge (mass and anti mass) must exist.

But many scientists cannot fathom the idea of gravitational monopoles and anti gravitation, simply out of fear that if they accept $\pm$mass, they have to abandon Einstein's general theory of relativity. In this regard, George Gamow thoughts were,

> "One can say, however, that if future experiment should show that anti particles have a negative gravitational mass, it would deliver a painful blow to the entire Einstein theory of gravity by disproving the principle of equivalence. In fact, if an observer inside an accelerated Einstein chamber released an apple having a negative gravitational mass, the apple would 'fall upward' (in respect to the space ship), and, as observed from outside, would move with an acceleration twice that of the space ship without being subject to any outside forces."

The 1998 I_a supernova experiments by Saul Perlmutter, Brian P. Schmidt, and Adam G. Riess revealed the accelerating expansion of the universe, a significant finding that deservedly earned these three physicists the 2011 Nobel Prize in Physics. This result can only mean that the universe must be formed of $\pm$mass.

Added to this, according to the Standard Model, the vacuum is filled with a condensate of Higgs particles. Leptons, hadrons, quarks, and W and Z bosons collide with the Higgs fields as they travel through so-called vacuum. In vacuum, the Higgs condensate rolls like molasses slowly down anything that interacts with it. The stronger the interactions between these other particles and the Higgs particles, the heaver the particles become. In other words "the coupling to the Higgs boson is proportional to the mass." According to CFLE theory, the condensate of Higgs particle is the "absolute coordination system of the universe that is required to be found experimentally (cf. §12) and the inertial frame that is required to exist physically (cf. §14), as Isaac Newton wanted to find." However, CFLE theory proposes that the existence of the Higgs boson also establishes the existence of a gravitational dipole made up of gravitational $\pm$ charge ($\pm mass$). According to the Standard Model, the most general, non-trivial, renormalizable scalar potential V is

$$V = \frac{1}{2}\mu^2\phi^2 + \frac{1}{4}\lambda\phi^4 \qquad \text{17-4-1}$$

where λ is the couple of the four-boson vertex.

Here, vacuum is the minimum value of the scalar potential V

$$\phi(\mu^2 + \lambda\phi^2) = 0 \qquad \text{17-4-2}$$

where μ is the mass of scalar particles.

When $\mu^2 > 0$, the minimum value of vacuum is also $\phi_{min} = 0$, as shown in Figure 17-4-1:

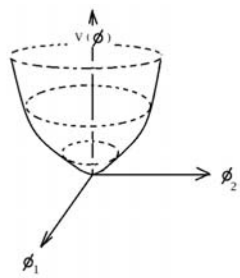


Figure 17-4-1

When $\mu^2 < 0$, the minimum value of the scalar potential V is as in Figure 17-4-2:

$$\phi_{min} = \pm v = \pm\sqrt{-\frac{\mu^2}{\lambda}} \qquad 17\text{-}4\text{-}3$$

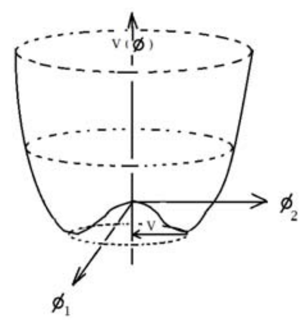


Figure 17-4-2

These two minima in one dimension correspond to a continuum of minimum values in SU(2).

Now, the point $\phi = 0$ is unstable. Choosing the minimum value at $+v$ gives vacuum a preferred direction in isospin space. That is none than spontaneous symmetry breaking.

From the lagrangian $\mathcal{L} = \frac{1}{2}(\partial_\mu\phi)^2 - \frac{1}{2}\mu^2\phi^2 - \frac{1}{4}\lambda\phi^4$ around the minimum, $\phi = v + \sigma(x)$ gives

$$\mathcal{L} = \frac{1}{2}(\partial_\mu\sigma)^2 - \lambda v^2\sigma^2 - \lambda\left(v\sigma^3 + \frac{1}{4}\sigma^4\right) \qquad 17\text{-}4\text{-}4$$

Therefore, the massive scalar from term of $\lambda v^2\sigma^2$ and the self-interacting form of the term $\lambda(v\sigma^3 + \frac{1}{4}\sigma^4)$ can be obtained as the Higgs boson. By spontaneous symmetry breaking, the gauge boson mass m^2 generated is

$$m^2 = (\sqrt{2\lambda v^2})^2 = (\sqrt{-2\mu^2})^2 \approx (126\ \text{GeV})^2 \qquad 17\text{-}4\text{-}5$$

The Higgs boson found in the LHC at CERN on 14th March 2013 is a physical reality, and the 2013 Nobel Prize in Physics deservedly goes to Peter Higgs and Francois Englert for predicting the existence of the Higgs boson.

Now, the important point is that in the Higgs mechanism, the negative potential energy is used to generate the gauge boson mass, much like the negative energy in Dirac's equation $E = \pm\sqrt{c^2P^2 + (m_oc^2)^2}$. Because the existence of the Higgs boson and the negative energy in Higgs scalar potential are physical facts, so too must the related negative mass be accepted to exist. In other words, gravitational$\pm$ charge is likewise real.

Because $\mu^2 < 0$ is an unavoidable condition for establishing the Higgs mechanism, the $\pm m$ and $\pm im$ entities appear as

$$\mu^2 < 0 \Leftrightarrow [(+m)\,(-m)] < 0 \text{ or } [(im)\,(im)] < 0 \text{ or } \ldots \qquad 17\text{-}4\text{-}6$$

where $\pm m$ is none other than the gravitational $\pm$charge.

And so it is that through one of the greatest achievements of the 21st century, namely the Higgs boson experiments at CERN, the Higgs boson is no longer a big mystery, despite the excitement from the continuing results of ATLAS and CMS.

However, the theoretical and experimental evidence for the existence of gravitational $\pm$charge ($\pm m$) is still a colossal mystery.

According to modern physics (as old physics), the negative sign of $-m$ or im is mathematically incorrect. However, without the physical reality of $-m$ or im, it would be impossible to have both gauge field symmetry as well as for a mass less gauge particle to be a massive gauge particle. Otherwise, vacuum as real empty space should have the same massive Higgs boson as physical real particles.

Spontaneous symmetry breaking generates the gauge boson mass "m_{sb}^2", where "sb" means "mass by symmetry breaking" as Figure 17-4-3 depicts.

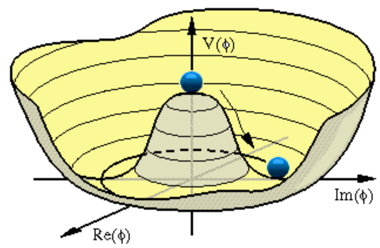


Figure 17-4-3

To remove this mass (so-called principal symmetry restoration) — meaning to restore principally from a spontaneous symmetry breaking (massive) state to a gauge symmetry (mass less) state — would absolutely require the restoration mass "$-m_{sr}^2$" to be a real physical mass, where "sr" means the mass by symmetry restoration as depicted in Figure 17-4-4.

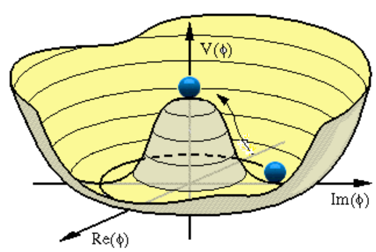


Figure 17-4-4

That is

$(m_{sb}^2) + (-m_{sr}^2) = 0$ → symmetry (mass less) state 17-4-7

Generation of the restoration mass "$-m_{sr}^2$" requires the negative gravitational charge $(-m)$ to be a real physical mass, because the positive gravitational charge $(+m)$ is a real physical mass, and it is physically, theoretically, and mathematically impossible in this given universe to find any physical mathematical substitutions for the negative gravitational charge $(-m)$ as a negative electromagnetic charge $(-e)$.

$-m_{sr}^2 = (m)\,(-m)$ or $-m_{sr}^2 = (im)(im)$ or … 17-4-8

Otherwise we are faced with a direct mismatch between the experimentally measured real energy density of vacuum (ρ_{vac}) and the vacuum energy density contribution of the Higgs field ($\rho_{\text{vac}}^{\text{Higgs}}$).

The measured value of the real energy density of vacuum when $\Omega_m \approx 30\%$, $\Omega_\Lambda \approx 70\%$ is

$$\rho_{\text{vac}} \sim 10^{-46}\ \text{GeV}^4 \qquad \text{17-4-9}$$

This means that vacuum is really quite empty space.

However, the theoretical energy contribution of the Higgs field to ρ_{vac} when even $m_h >$ 114.4 GeV/ c^2 in Einstein's equation $\Lambda = \frac{8\pi G_N}{c^4}\rho_{\text{vac}}$, the so-called cosmological constant, is

$$V_{min} = V(v)$$

$$= \frac{1}{2}\mu^2 v^2 + \frac{1}{4}\lambda v^4, \quad \mu^2 = -\lambda v^2$$

$$= -\frac{1}{4}\lambda v^4,\ m_h^2 = \lambda v^2$$

$$= -\frac{1}{8}m_h^2 v^2 \qquad \text{17-4-10}$$

$$\rho_{\text{vac}}^{\text{Higgs}} = \frac{1}{8}m_h^2 v^2$$

$$> 1 \times 10^8\ \text{GeV}^4 \quad (\text{and since GeV} = \tfrac{1}{r})$$

$$> 1 \times 10^8\ \text{GeV}/r^3 \qquad \text{17-4-11}$$

The order of magnitude of the mismatch between ρ_{vac} and $\rho_{\text{Vac}}^{\text{Higgs}}$ is

$$M_m = \frac{10^8}{10^{-46}}$$

$$= 10^{54}\ !!! \qquad \text{17-4-12}$$

Such a colossal mismatch cannot be simply a result of any existing proven physical theory, despite the theoretical Higgs boson being successfully observed as a real particle by historically the most expensive experiments. This means that vacuum symmetry is not broken spontaneously, as the Standard Model asserts.

Therefore, we have to conclude that the negative sign of $-m$ or im cannot be an incorrect physical sign as old physics asserts, especially if we are to maintain the multi extra-dimensional unified field theory made up of the space–time continuum, and to avert the problem of renormalizability of the theory (i.e., breaking the Euclidian point definition to create sophisticated extra dimensions; breaking vacuum symmetry to avert the problem of renormalizability of the theory; or introducing metaphysical strings to avoid the problem of infinity). On the contrary, we have to accept the physical reality of the negative sign of $-m$ or im in order to make principal symmetry restoration possible. New physics is thus required to retain the pure three-dimensional unified field theory (CFLE theory) made up of multi extra force line elements without the problem of renormalizability of the theory (e.g., instead of breaking the Euclidian point definition, we introduce each force line element; instead of breaking vacuum symmetry, we introduce gravitational monopole symmetry breaking by $\pm$mass; and instead of metaphysical strings, we introduce the quantized Seed of each particle).

When we introduce anti-Higgs field by anti-gravitational charge and related anti-potential as figure 17-4-5, we can understand spontaneously symmetry breaking easily without serious side symptom

(instability of vacuum by quantum fluctuation).

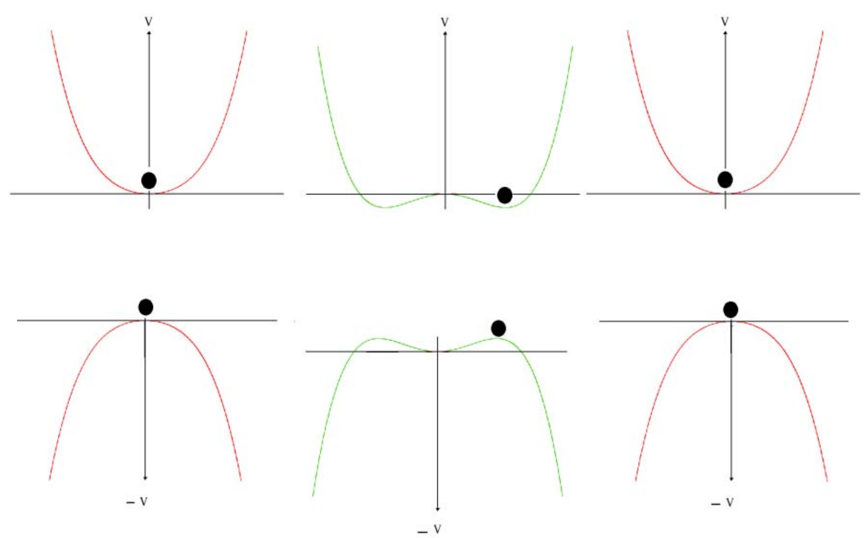


Figure 17-4-5

Final result of recovery from $\pm$ spontaneous symmetry breaking is resulting of gravitational CP violation in this universe.

Because Einstein's special relativity and general relativity is wrong, relation between symmetry breaking and tachyon is no more related.

By mass of Higgs boson whole universe must be pulled without anti-gravity and related anti-mass. However, our universe is still expanding. Therefore, for such contradiction to avoid is required anti-gravity and must be accepted anti-mass.

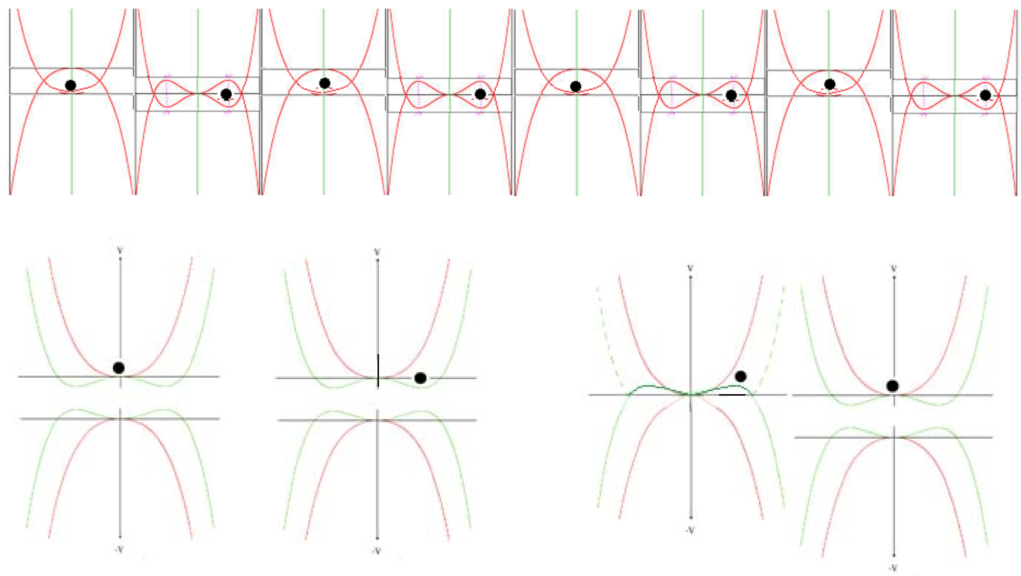


Figure 17-4-6

Over figure of 17-4-6 shows lattice vibration by quantum fluctuation with related$\pm$ potential fluctuation like water wave of ocean surface.

In CFLE theory, the imaginary variable i has real physical meaning, where it can be used mathematically to physically change the $\pm$ sign of any charge (gravitational charge, electromagnetic charge, weak charge, or color charge) or force, by the collective rotation of dipolar force line elements (cf. §6). Therefore, the final physical effect of i always appears as i^2 because the force between two charges reacts by $F = C\,\frac{ch \cdot ch}{r^2}$, where C is a constant, r is the distance, and ch is the charge.

$\frac{C}{r^2}$ is the total effective perpendicular surface of fore line elements for a reaction without empty space.

In modern physics, as in old physics since the Schrödinger era (i.e., the beginning of quantum mechanics), the wave function $\Psi(x,t) = \cos(kx - \omega t) + i\, sin(kx - \omega t)$ as a complex function has always been asserted:

"That is, it contains the imaginary variable i. Recall that this behavior was forced upon us! The fact that wave functions are complex functions should not be considered a weak point of quantum mechanical theory. In fact, it is a desirable feature because it makes it immediately apparent that we should not attempt to give wave functions physical existence in the same sense that water waves have a physical existence. The reason is that a complex quantity cannot be measured by any actual physical instrument. The "real" world (using the term in its nonmathematical sense) is the world of "real" quantities (using the term in its mathematical sense). Therefore, we should not try to answer or even pose the question 'Exactly what is waving, and what is it waving in?' "

Simply speaking, such an assertion is wrong according to CFLE theory. In CFLE theory, the quantity of "$iych$" in the physically complex quantity $Q = xch + iych$ is expressed only when given the latent quantity of action strength of force line elements (cf. §6). When this given latent quantity $iych$ reacts by $F = \frac{ch \cdot ch}{r^2}$, the real reaction quantity $(xch)^2$ can be influenced by a change of one possible reaction channel, namely $(\pm iych)(\pm iych) = \pm(ych)^2$, into the real apparent influential quantity $Q^2 = (xch)^2 \pm (ych)^2$. This results means that force lines and their elements arbitrate or interfere with the reaction between particles by a different direction of rotation (different gauge condition by i^2). Therefore, in the quantum theory fields, these could be sometimes called force particles, intermediate particles, carrier particles, or gauge particles. Old physics asserts that "because a complex quantity cannot be measured by any actual physical instruments, we should not attempt to give to wave functions a physical existence in the same sense that water wave have a physical existence." However, the relation between physical measurement and physical existence cannot be so simply decided. A good physical example is pair production and pair annihilation. After pair annihilation of $\pm$electrons, we cannot measure where these particles are because ultimately no physical property remains to observe. But after pair production of $\pm$electrons, we can under given conditions know from where it appears despite that we cannot physically measure where it was in a vacuum. Another example is the neutron. We cannot measure the electricity of a neutron using any physical instruments, but the neutron does have magnetic moment. Furthermore, outside of the nucleus, the neutron decays to physically measurable protons ($+e$), electrons ($-e$), and neutrinos.

In CFLE theory, the Higgs mechanism can be explained very simply as being the emission and absorption of the gauge boson (Higgs boson) by a perfect neutral inertialinium (I^0) that is consistent with $\pm$ inertino $I^{\pm}$ ($\pm m$, $\pm e$, $\pm$weak charge, $\pm$ strong charge, $\pm$inertial charge, especially $\varepsilon_o = 1$, $\mu_o = 1$), as shown in Figure 17-4-5.

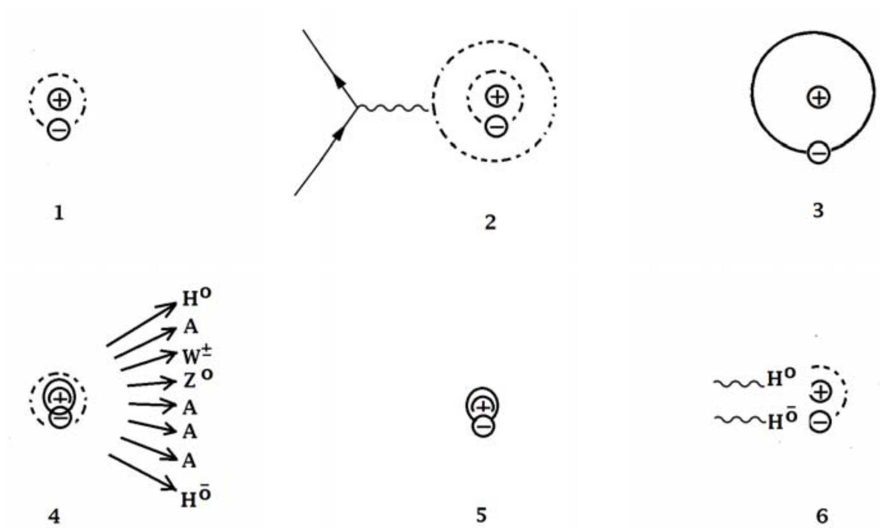


Figure 17-4-7

Phase 1 shows the perfect neutral state of the inertialinium, Phase 2 shows regular reaction. Phase 3 shows the exiting state of the inertialinium energy level corresponding to the vacuum expectation value of $\mu^2 < 0$ for positive gravitational matter, $\mu^2 > 0$ for negative gravitational anti matter by the $\pm$ inertino ($I^{\pm}$) into $\pm$spontaneous symmetry breaking state. This energy state is very unstable. Phase 4 shows emission of the gravitational charged (massive) gauge boson and mass less gauge boson of $W^{\pm}, \gamma,\ Z^0, H^o, \gamma, \gamma, \gamma, H^{\bar{o}}$.

Phase 5 shows negative inertino absorb more deep, because Higgs bosons and gauge bosons take energy as mass.

Phase 6 shows Higgs bosonH^{o} and $H^{\bar{o}}$ is reabsorbed for stability for vacuum and inertialinium become gravitationally neutral.

Such processes can be possible only by $\pm$ gravitational mass of CFLE theory. However, is it inapplicable to the general relativity by the curve of the space and time, because there are only positive mass by equivalence principle. Because the direction of rotations of weak force line elements of gauge bosons are fixed (only one permitted rotation direction as β-decay), they can take more gravitational energy of the inertialinium by the reaction channel $-(iych)^2= +(ych)^2$, as in Phase 4. This extra energy of $+(ych)^2$ appears as the massive Higgs boson asserted by the Higgs mechanism of the Standard Model. Because the general relativity of the curved space–time continuum cannot be unified with the Standard Model of particle physics, the Higgs mechanism (without the correct general relativity of CFLE theory) can explain only up to Phase 4. However, the special relativity of CFLE theory can quantitatively and qualitatively predict and explain the final fate of this colossal problem remaining over the massive Higgs boson.

Phase 5 shows the irregular deep energy state of the inertialinium after emission of all gauge bosons, where the direction of symmetry breaking of the weak gauge boson occurs as β-decay with the reaction channel $-(iych)^2$=$+(ych)^2$. Now the neutral inertialinium is in an irregular gravitational deep energy state. Therefore, the remaining Higgs bosons $H^{o}, H^{\bar{o}}$ can be "eaten" by the irregular inertialnium, as in Phase 6.

This process is none other than the principal symmetry restoration depicted in Figure 17-4-4. By this process, the vacuum can recover its pure symmetry state as Eq. 17-4-9; consequently, because absolute vacuum is pure empty space, any theory that requires a cosmological constant of vacuum ($\Lambda = \frac{8\pi G_N}{c^4}\rho_{\text{vac}}$), as in Einstein's equation, must be wrong according to the process of Phase 6.
The weak gauge boson mass reported by J. Beringer *et al.* (2012) is

$M_{W^{\pm}}$ = 80.385 $\pm$ 0.015 GeV

$M_{Z^{0}}$ = 91.187 $\pm$ 0.0021 GeV 17-4-13

The total weak boson mass interacting between the weak gauge boson and the inertialinium is

$M_{W^{\pm}} + M_{Z^{o}}$ = 80.385 GeV + 80.385 GeV + 91.187 GeV

= 251.957 GeV 17-4-14

This maximum mass ($+\frac{2}{3}m$) from the weak force strength (corresponding to $+\frac{2}{3}e$) by the curve of gravitational force line elements should be as in B of Figure 17-4-6, according to the quark model (permitted charge is either $\pm\frac{1}{3}\,e$ or $\pm\frac{2}{3}e$).

Therefore, the permitted minimum mass ($+\frac{1}{3}m$) of the Higgs boson from the inertialinium (corresponding to $+\frac{1}{3}e$) as predicted by CFLE theory is

M_{H^0} = 251.957 GeV ($\frac{1/3}{2/3}$)

= 125.979 GeV

≈ 126.0 GeV 17-4-15

The observed values at the LHC of CERN are

M_{H^0} = 125.3±0.4 ±0.5 GeV (from the CMS 2012 results) 17-4-16

M_{H^0} = 126.0±0.4 ±0.5 GeV (from the ATLAS 2012 results) 17-4-17

Because historically, mathematicians and physicists did not know about the existence of force line elements and the related physical property of force line elements, they are unable to apply the instance of the mathematical number i in the real world, and so the number was called an "imaginary number" similarly in Riemann zeta function $\zeta(s) = \sum_{n=1}^{\infty} n^{-s}$ spacing between zeros controlled by 1-($\frac{sin\pi u}{\pi u}$)^2 (pure mathematic about prime number) same times spacing between energy levels,i.e., eigenvalues of Hamiltonians describing big nucleuses same function 1-($\frac{sin\pi u}{\pi u}$)^2(pure physics about energy level of heavy nucleus). Such surprising relation between pure mathematics and physics was founded by mathematician Hugh L. Montgomery and physicist

Freeman Dyson in Princeton. Imaginary number i is pure mathematical number, however $[(i)^2 = -1\ ]$ has an important physical property.

That is

$$[(i)^2 = -1\ ] \rightarrow [(\vec{\imath} \times \vec{\imath}) = -1] \qquad 17\text{-}4\text{-}18$$

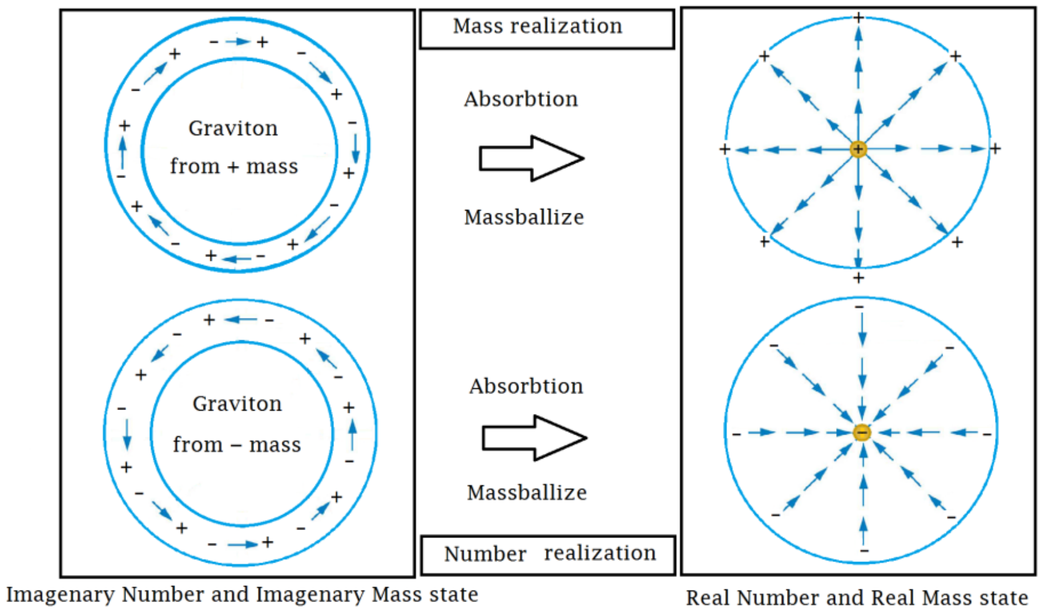


Figure 17-4-8

This means when rotation of negative monopole force line element can appear any negative charge especially negative mass in quantum wave mechanic.

$$i\hbar\frac{d}{\partial t}\psi = H\psi$$

$$\psi(x,t) = \cos(kx - \omega t) + i\ sin(kx - \omega t)$$

$$\psi^{*}\psi = [\cos(kx - \omega t)]^2 - (i)^2\ [\sin\ (kx - \omega t)]^2 \qquad 17\text{-}4\text{-}19$$

Conclusions:

(1) The physical quantity $iych$ made up of the regular physical quantity ych and the imaginary number i cannot be a nonphysical quantity and a

related wrong sign as old physics asserts, despite that mathematically i is called imaginary number.

(2) Mathematically i is in fact a kind of real number.

(3) Therefore, by CFLE theory i can be called an “intermediate” number or more generally a “latent” number.

This revelation was the most important motivation for my writing this book. In conclusion, therefore, we can now safely dispose of Einstein’s two relativity theories!

17.5 Relations Between Maxwell’s Electrodynamics and General Relativity of CFLE Theory

In §4.4, the coulomb force $F = \frac{q^2}{4\mu\varepsilon_0 r^2} = qE$ was changed to $F = qE + QVB$, because the relativity factor $k = \frac{1}{\sqrt{1-\frac{\alpha V^2}{C^2}}}$ is influenced by force line elements as figure 4-4-6.

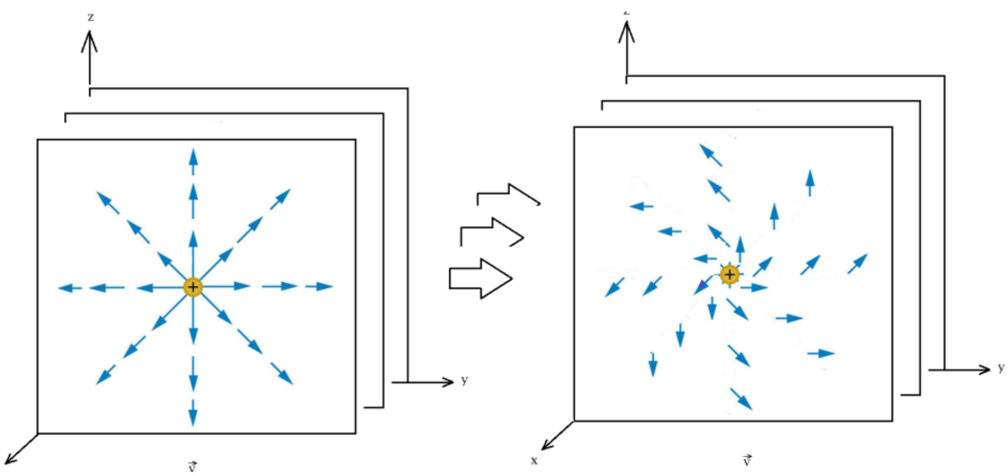


Figure 4-4-6

When a particle accelerates, the force line arrangements (so-called self-interacting) changed further, as expressed by the formula

$$F = F + \int \frac{dF}{dt} dt, \quad F = QE + QVB, \quad QV = P \qquad 17\text{-}5\text{-}1$$

$$F = F + \int \frac{d}{dt}(QE + QVB) dt, \quad QV = P$$

$$= F + \int (Q\frac{dE}{dt} + E\frac{dQ}{dt} + B\frac{dP}{dt} + P\frac{dB}{dt})dt \qquad \text{17- 5-2}$$

But, as discussed in §17.3 figure 17-3-3, this change of force line arrangements is not the last phase. At the last phase occurs magnetic reversal by inertia as figure 17-5-1.

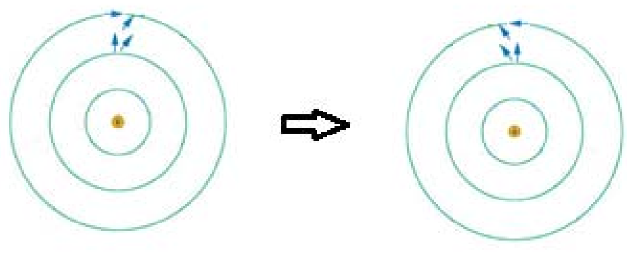


Figure 17-5-1

Therefore, further change of the force line arrangements gives

$$F = F + \int \frac{d}{dt}\{F + (Q\frac{dE}{dt} + E\ \frac{dQ}{dt} + B\frac{dP}{dt} + P\frac{dB}{dt})\}\, dt$$

$$= F + \int \frac{dF}{dt}dt + \int [\ (\frac{dQ}{dt}\frac{dE}{dt} + Q\frac{dE}{dt}) + (\frac{dE}{dt}\frac{dQ}{dt} + \ E\frac{d^2Q}{dt^2})$$

$$+(\frac{dB}{dt}\frac{dP}{B} + B\frac{d^2P}{dt^2}) + (\frac{dP}{dt}\frac{dB}{dt} + P\frac{d^2P}{dt^2})]dt \qquad \text{17-5-3}$$

where $P = QV$, $\frac{dQ}{dt} = I$, $\frac{d^2Q}{dt^2} = I^{\cdot}$ 17-5-4

$$\frac{dp}{dt} = \frac{d}{dt}(QV) = Q\frac{dv}{dt} + V\frac{dQ}{dt} = QA + VI$$

$$\frac{dP}{dt}\frac{dB}{dt} = (Qa + VI)\frac{dB}{dt} = Qa\frac{dB}{dt} + VI\frac{dB}{dt}$$

$$\frac{d^2}{d}\frac{P}{t^2} = \frac{d}{dt}\frac{dP}{dt} = \frac{d}{dt}(Qa\frac{dB}{dt} + VI\frac{dB}{dt}) \qquad \text{17-5-5}$$

Hence, this is written as

$$\frac{d^2}{d}\frac{P}{t^2} = (Qa\frac{d^2}{d}\frac{B}{t^2}) + (Q\frac{dv}{dt}\frac{da}{dt}) + (a\frac{dB}{dt}I) + (VI\frac{d^2B}{dt^2}) + (I\frac{dB}{dt}\frac{dV}{dt}) + V(\frac{dB}{dt}\frac{dI}{dt})$$

17-5-6

From this can be obtained

$$B\frac{d^2p}{dt^2} = (BQa\frac{d^2B}{dt^2}) + (BQa^{\cdot}\frac{dB}{dt}) + (BaI\frac{dB}{dt})$$

$$+ (BVI\frac{d^2B}{dt^2}) + (BIa\frac{dB}{dt}) + (BVI^{\cdot}\frac{dB}{dt}) \qquad 17\text{-}5\text{-}7$$

So, the results of a change of force line arrangement is

$$F = F + \int\frac{dF}{dt}dt + \int[\,(I\frac{dE}{dt} + Q\frac{d^2E}{dt^2}) + (I\frac{dE}{dt} + EI^{\cdot\cdot})$$

$$+ (Qa\frac{dB}{dt} + VI\frac{dB}{dt} + QV\frac{d^2B}{dt^2}) + (Qa\frac{dB}{dt} + VI\frac{dB}{dt} + QV\frac{d^2B}{dt^2})$$

$$+ (BQa\frac{d^2B}{dt^2} + BQa^{\cdot}\frac{dB}{dt} + BaI\frac{dB}{dt} + BVI\frac{d^2B}{dt^2} + BIa\frac{dB}{dt} + BVI^{\cdot}\frac{dB}{dt})]dt$$

$$17\text{-}5\text{-}8$$

In this formula, the factors $\frac{d^2E}{dt^2}$, $\frac{d^2B}{dt^2}$ are the factors of the Maxwell equation, $\nabla^2\mathbf{E} = \varepsilon_0\mu_0\frac{d^2E}{dt^2}$, $\nabla^2\mathbf{B} = \varepsilon_0\mu_0\frac{d^2B}{dt^2}$, which means that the change of force line arrangements results in electromagnetic wave radiation. This means that configuration of reversed electromagnetic field is contradicted present moving situation of particle. Therefore, reversed magnetic field must be out from this moving particle.

This establishes the relation between Maxwell electrodynamics and general relativity of CFLE theory.

Here, the remarkable point is that Maxwell's equation agrees with CFLE theory. That is, "when a particle accelerates, its force lines and force line elements curve for radiation and for maintaining gauge symmetry," and thus the concept of curved space should not be circulated. The special theory of relativity was based on the theory of the electromagnetic field formulated in the last century by the British physicist James Clerk Maxwell (1831–1879), but despite many attempts, Einstein and those who have followed his theories have failed to establish any connection with Maxwell's electrodynamics. Because Einstein and his theories followers believe that force is the ability of empty space to bend, and despite that the electromagnetic field is a physically real entity, classical physicists insist on changing to mathematical space and attempting to bend this pure mathematical space. Therefore, to date, classical physicists have not been able to find the relation between general relativity and electrodynamics, and between gravitational force and electrical force. But in CFLE theory, gravitational force is expressed with the gravitational field. That is,

$$F = F + \int \frac{dF}{dt} dt$$

$$\frac{dF}{dt} = \frac{d}{dt}(mv) = m\frac{dv}{dt} + v\frac{dm}{dt}$$

$$= ma + vi \qquad 17\text{-}5\text{-}9$$

where $a = \frac{dv}{dt}$, $i = \frac{dm}{dt}$

Therefore, it can be written

$$F = F + \int \frac{dF}{dt} dt\,, \quad F = m\mathbb{E} + mv\mathbb{B}, \quad mv = \mathbb{P} \qquad 17\text{-}5\text{-}10$$

where $\mathbb{E}$ is the gravitational field, and $\mathbb{B}$ is the mass magnetic field.

$$F = m\mathbb{E} + mv\mathbb{B}$$

$$F = F + \int \frac{d}{dt}(m\mathbb{E} + p\mathbb{B})dt$$

$$= F + \int (m\frac{d\mathbb{E}}{dt} + \mathbb{E}\frac{dm}{dt} + \mathbb{P}\frac{d\mathbb{B}}{dt} + \mathbb{B}\frac{d\mathbb{P}}{dt})dt \qquad 17\text{-}5\text{-}11$$

When the force line arrangement is changed by acceleration, we get

$$F = F + \int \frac{d}{dt}[F + (m\frac{d\mathbb{E}}{dt} + \mathbb{E}\ \frac{dm}{dt} + \mathbb{P}\frac{dB}{dt} + \mathbb{B}\frac{d\mathbb{P}}{dt})dt$$

$$= F + \int \frac{dF}{dt}dt + \int [\left(\frac{dm}{dt}\frac{d\mathbb{E}}{dt} + m\frac{d^2\mathbb{E}}{dt^2}\right) + \left(\frac{d\mathbb{E}}{dt}\frac{dm}{dt} + \mathbb{E}\frac{d^2m}{dt^2}\right)$$

$$+(\frac{d\mathbb{P}}{dt}\frac{d\mathbb{B}}{dt} + \mathbb{P}\frac{d^2\mathbb{B}}{dt^2}) + (\frac{d\mathbb{B}}{dt}\frac{d\mathbb{P}}{dt} + \mathbb{B}\frac{d^2\mathbb{P}}{dt^2})]\mathrm{dt} \qquad 17\text{-}5\text{-}12$$

But, given that

$$\mathbb{P} = mv, \quad \frac{d\mathbb{P}}{dt} = \frac{d}{dt}(mv) = ma + vi, \quad \frac{dm}{dt} = I, \quad \frac{d^2m}{dt^2} = I^{\cdot} \qquad 17\text{-}5\text{-}13$$

Hence, it can be written

$$\frac{d\mathbb{P}}{dt}\frac{d\mathbb{B}}{dt} = (ma + vI)\frac{d\mathbb{B}}{dt} = ma\frac{d\mathbb{B}}{dt} + VI\frac{d\mathbb{B}}{dt}$$

$$\frac{d^2\mathbb{P}}{dt^2} = \frac{d}{dt}\left(\frac{d\mathbb{P}}{dt}\right) = \frac{d}{dt}(\, ma\frac{d\mathbb{B}}{dt} + VI\frac{d\mathbb{B}}{dt}) \qquad 17\text{-}5\text{-}14$$

Therefore, we obtain

$$\frac{d^2\mathbb{P}}{dt^2} = (ma\frac{d^2\mathbb{B}}{dt^2}) + (m\frac{d\mathbb{B}}{dt}\frac{da}{dt}) + (a\frac{d\mathbb{B}}{dt}\frac{dm}{dt}) + (VI\frac{d^2\mathbb{B}}{dt^2}) + (I\frac{d\mathbb{B}}{dt}\frac{dv}{dt}) + (V\frac{d\mathbb{B}}{dt}\frac{dI}{dt})$$

$$\mathbb{B}\frac{d^2\mathbb{P}}{dt^2} = (\mathbb{B}ma\frac{d^2\mathbb{B}}{dt^2}) + (\mathbb{B}m\dot{a}\frac{d\mathbb{B}}{dt}) + (\mathbb{B}aI\frac{d\mathbb{B}}{dt})$$

$$+ (\mathbb{B}VI\frac{d^2\mathbb{B}}{dt^2}) + (\mathbb{B}Ia\frac{d\mathbb{B}}{dt}) + (\mathbb{B}V\dot{I}\frac{d\mathbb{B}}{dt}) \qquad 17\text{-}5\text{-}15$$

Finally, the whole formula is

$$F = F + \int\frac{dF}{dt}\mathrm{dt} + \int[\,(I\frac{d\mathbb{E}}{dt} + m\frac{d^2\mathbb{E}}{dt^2}) + (I\frac{d\mathbb{E}}{dt} + \mathbb{E}\ddot{I})$$

$$+ (Ma\frac{d\mathbb{B}}{dt} + VI\frac{d\mathbb{B}}{dt} + MV\frac{d^2\mathbb{B}}{dt^2}) + (Ma\frac{d\mathbb{B}}{dt} + VI\frac{d\mathbb{B}}{dt} + MV\frac{d^2\mathbb{B}}{dt^2})$$

$$+ (\mathbb{B}ma\frac{d^2\mathbb{B}}{dt^2} + \mathbb{B}m\dot{a}\frac{d\mathbb{B}}{dt} + \mathbb{B}aI\frac{d\mathbb{B}}{dt} + \mathbb{B}VI\frac{d^2\mathbb{B}}{dt^2} + \mathbb{B}Ia\frac{d\mathbb{B}}{dt} + \mathbb{B}V\dot{I}\frac{d\mathbb{B}}{dt})]dt$$

$$17\text{-}5\text{-}16$$

In this formula, $\frac{d^2\mathbb{E}}{dt^2}$ and $\frac{d^2\mathbb{B}}{dt^2}$ are the gravitational waves discussed in §5.5.4 as a bundle of gravitational force lines. Because the correspondence property of every force line element is the same, the formula for electromagnetic force and gravitomagnetic force are the same. Only CFLE theory can have such a result. Therefore, we can find here the relation between gravity and inertia, and electricity and magnetism as electric inertia.

17.6 Correction of the Inconsistency of the Dirac Delta Function by CFLE Theory

For the vector function **V** = $(\frac{1}{r^2})\mathbf{r}^{\wedge}$, the **V** at every location is directed radially outward.

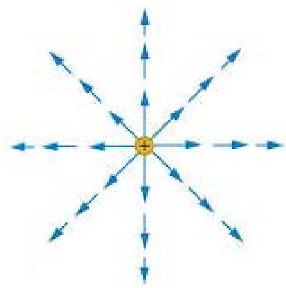


Figure 17-6-1

In theory, this function should have a large positive divergence, but when the divergence is actually calculated, it goes unexpectedly to 0: [6]

$$\nabla \cdot \mathbf{V} = \frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2 \frac{1}{r^2}\right) = \frac{1}{r^2}\frac{\partial}{\partial r}(1) = 0 \qquad 17\text{-}6\text{-}1$$

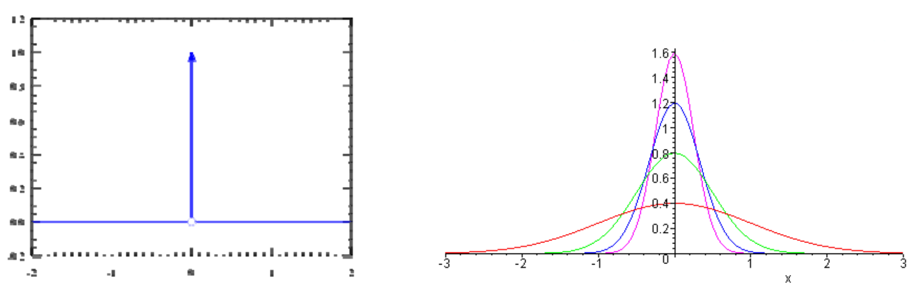


Figure 17-6-2

Taking as an example the case of a sphere of radius R, centered at the origin, when the divergence theorem is integrated to this function, the surface integral is

$$\oint \mathbf{V} \cdot d\mathbf{a} = \int (\frac{1}{r^2}\mathbf{r}^{\Lambda}) \cdot (R^2 \sin\theta \, d\theta \, d\phi \mathbf{r}^{\Lambda}) = (\int_0^{\pi} \sin\theta \, d\theta)(\int_0^{2\pi} d\phi) = 4\pi$$

17-6-2

However, because the volume integral $\int \nabla \cdot \mathbf{V} d\tau = 0$ (and, of course, the real charged particle has divergence of its force line), a fictitious function called the Dirac delta function $\partial(x)$ was created to solve such inconsistency.

6. Equations 17-6-1 through 17-6-4 adapted from the equations in Griffiths, David J. 1989. *Introduction to Electrodynamics*, pp. 44–46, 3rd Edition.

The graph of this one-dimensional function is essentially a very narrow bell curve, having an area of infinite height.

Thus,

$$\delta(x) = 0:\ x \neq 0; \quad \delta(x) = \infty : x = 0 \qquad 17\text{-}6\text{-}3$$

$$\int_{-\infty}^{+\infty} \delta(x) dx = 1 \qquad 17\text{-}6\text{-}4$$

Mathematically speaking, because $\partial(x)$ is not finite at $x = 0$, it is not a function *per se*, but rather a distribution (or a generalized function).

However, this idea is not true, because it imposes upon us to accept the impossible infinity of the area under the function's curve. In reality, the curve's "area" is not a result of infinity. But, because a real particle has a real divergence of its electric force lines and such situation should always be described, the following was introduced instead:

$$\nabla(\frac{\mathbf{r}^{\Lambda}}{r^2}) = 4\pi\delta^3(r)$$

As a condition of definition, this can be generally written as

$$\nabla(\frac{\boldsymbol{\mathcal{R}}^{\Lambda}}{\mathcal{R}^2})\ 4\pi\delta^3(\mathcal{R}) \qquad 17\text{-}6\text{-}5$$

where 4 π is a result of the surface integral $\int \mathbf{V} \cdot d\mathbf{a}$. But such manipulation method can only be a temporary solution, not an essential solution. Here, CFLE theory provides the way to get out of this dead end. Because the electromagnetic field is formed from force lines and force line elements that have to follow the uncertainty principle, the vector function should be expressed with the uncertainty principle. Namely, $\mathbf{V} = (\frac{1}{r^2})\mathbf{r}^{\Lambda}$ is not true according to the correspondence principle and should instead be written as

$$\mathbf{V} = \frac{1}{(r + r_{\Delta o})^2}\mathbf{r}^{\Lambda} \qquad 17\text{-}6\text{-}6$$

Now, when this vector is expressed in the spherical frame,

$$\nabla\mathbf{V} = \frac{1}{(r \pm r_{\Delta o})^2}\frac{\partial}{\partial r}[(r \mp r_{\Delta o})^2 \frac{1}{(r \pm r_{\Delta o})^2}]$$

$$= \frac{1}{(r \pm r_{\Delta o})^2} \frac{\partial}{\partial r} [\frac{(r \mp r_{\Delta o})^2}{(r \pm r_{\Delta o})^2}]$$

$$= \frac{1}{R_{\Delta o}^2} \frac{\partial}{\partial r} (R'_{\Delta o})$$

$$= \frac{1}{R_{\Delta o}^2} Z \neq 0 \qquad 17\text{-}6\text{-}7$$

This result is not 0. In the Dirac delta function, the uncertainty of the particle size $r_{\Delta o}$ from Δr was ignored. That is,

$$\frac{\partial}{\partial \mathrm{r}} (\frac{1}{r^2} r^2) = \frac{\partial}{\partial r} (1) \Rightarrow r^2 = r^2 \Rightarrow r^2 - r^2 = 0 \qquad 17\text{-}6\text{-}8$$

But such physical calculation is impossible according to $\Delta mv\Delta x \geq \hbar$. Therefore, we need to express this by taking uncertainty into account. That is,

$$\frac{\partial}{\partial r} [\frac{(r \mp r_{\Delta o})^2}{(r \pm r_{\Delta o})^2}] = \frac{\partial}{\partial r} (1 \pm Z) \Rightarrow (1 \pm Z)^2 \neq (1 \mp Z)^2$$

$$\Rightarrow (1 \pm Z)^2 - (1 \mp Z)^2 = \pm 4Z \qquad 17\text{-}6\text{-}9$$

In this way, this function can be a regular mathematical function and can express the real physical divergence of vector **V**.