The Principles of Ultra Relativity

by

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"In the full conception, all manifestations of all forms are like beautiful flowers in a vast garden where many colors and many kinds bloom harmoniously together. Each blossom feels itself through the manifestation of another. The low looks up to the tall. The tall looks down the low. The various colors are a delight to all. The manner of growth fills their interest and intensifies a desire for fulfillment. In observing the beauty unfold that lies dormant within, whether in a day or a century, design gradually becomes manifest – in color, in a fragrance sweet to all others. Each glorifies itself by service rendered unto others ; and in turn, receives from all others. All in that great field of beauty are the givers and receivers, vessels through which flows a melody from the Highest. Thus some serve at the foot of the throne, while others serve above the throne and all around it. Each blends with every other, expressing only joy because privileged to serve. " (The Great Master in that country)

Preface

A Phoenix which has been called a creature with eternal lives is told. in old Egyptean tales, to firstly die upon a piled perfumes, carried by himself, in the end of every interval of his life time of five hundred years and to revive just from that ash. A Holy Phoenix shall be seen to revive from hot ashes of Einsteinean theory of relativity and to fly over sky. This is very the principles of ultra relativity along with that background spirit of <cosmic philosophy>.
This title will be found to contain general mathematics, physics and engineerings in order to make our planet a paradise. The theory would be a legitimate sequential of Einsteinean theory of special relativity and general, and, furthermore, that of anti-matter of P.A.M. Dirac's, and contain much an ultra dynamics upon hyper surfaces. It, of course, blongs to frontiers in natural sciences, and also favours classical mechanics (especially does a mechanics on gyroes and vector analysis), which will make you feel a nostalgia for better old days. ⑧ Quantum Gravitational Generator ⑨ Inverse-G Engine and ⑩ Time Reversing Machine have been presented as three representative experimentals of <inverse atomic technology> in the latter part of this title, which will be nothing but a new realm of experimental physics. Inverse Gravitation could dramatically be verified with a great work of John Roy Robert Searl's. It might also be useful as an educational model as like eight fundamentals of Japanese manual lettering (SHODOH).
On the other hand, it can, however, be a fearful weapon. The author emphatically hopes that it may peacefully be used by his Noble Brothers and Sisters.

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§1 Total Angular Momentum Wave Equation

(1−1) Lorentz invariant angular momentun wave Equation

Angular momentum forms six vector (Ref 11) in Minkowskean space-time such that

$$M^{23} = x^2 p^3 - x^3 p^2 - \frac{i\hbar}{2}\gamma^2 \gamma^3,$$
$$M^{31} = x^3 p^1 - x^1 p^3 - \frac{i\hbar}{2}\gamma^3 \gamma^1,$$
$$M^{12} = x^1 p^2 - x^2 p^1 - \frac{i\hbar}{2}\gamma^1 \gamma^2,$$
$$M^{41} = x^4 p^1 - x^1 p^4 - \frac{i\hbar}{2}\gamma^4 \gamma^1,$$
$$M^{42} = x^4 p^2 - x^2 p^4 - \frac{i\hbar}{2}\gamma^4 \gamma^2,$$
$$M^{43} = x^4 p^3 - x^3 p^4 - \frac{i\hbar}{2}\gamma^4 \gamma^3,$$

where $\quad \mathsf{x} = (x^1, x^2, x^3, x^4 = ict)$

and $\quad \mathsf{p} = (p^1, p^2, p^3, p^4 = ip_o)$

stand for Minkowskean coordinate of a mass and that four vector (Ref 12), respectively. M^{jk} are skew symmetric such that

$$M^{jk} = -M^{kj}$$

with respect to super scripts j and k. The latter terms mean intrinsic angular momentum (six spin) (Ref 13). We shall further specify total angular momentum deusity upon the pth hyper surface with m^{jkp} and energy momentum tensor with T^{jp}, of, $\quad \partial_k\, m^{jkp}(x) = 4\pi\, T^{jk}(x), \quad (1-1)$

because we easily verify the relations of

$$4\pi\, \partial_j\, T^{jp} = \partial_j\, \partial_k\, m^{jkp}$$
$$= \frac{1}{2!}\,(\partial_j\, \partial_k\, m^{jkp} + \partial_k\, \partial_j\, m^{kjp})$$
$$= \frac{1}{2}\,(\partial_j\, \partial_k\, m^{jkp} - \partial_j\, \partial_k\, m^{jkp}) \equiv 0,$$

(1 − 1) Lorentz inriariant angular momentum wave Equation

which have been nothing but conseavation of energy momentum tensor (Ref 16). We have made use of

$$m^{jkp} = -m^{kjp} \text{ (skew symmetric)}.$$

The same number of super scripts and lower stands for contraction (sum from 1 to 4), Secondly we shall take the dual of (1 − 1) (Ref 17) such that

$$\partial_k \, {}^{*}m^{jkp}(x) = 0, \qquad (1-2)$$

where the dual means, for instance

$$^{*}T^{jk} = \frac{\varepsilon^{jkmn}}{2} \; T_{mn}$$

ε^{jkmn} are perfectly skew symmetric pseudo tensor of the fourth rank (ipsilon of Eddington's). The right hand side of the dual of (1 − 1) identically vanishes such as

$$\varepsilon^{jkmn} \; T_{mn} = \frac{1}{2} \; (\varepsilon^{jkmn} \; T_{mn} + \varepsilon^{jknm} T_{nm})$$

$$= \frac{1}{2} \; (\varepsilon^{jkmn} T_{mn} - \varepsilon^{jkmn} \; T_{mn})$$

$$\equiv 0,$$

since

$$T^{mn} \; (T_{mn}) = T^{nm} \; (T_{nm})$$

while only the left hand side remains, leading us to (1−2). Confining our analysis only to p = 0, namely to the zeroth hyper surface (ordinary physical space, Ref 14 and 15), and putting the tensor to be

$$\left.\begin{array}{l} Ж = (m^{230}, \; m^{310}, \; m^{120}) \\ iЯ = (m^{410}, \; m^{420}, \; m^{430}) \\ (T^{01}, \; T^{02}, \; T^{03}, \; iT^{04}) = (p, \; iq) \end{array}\right\}$$

we finally find

$$rot\,Ж = 4\pi p + \frac{1}{c} \; \frac{\partial Я}{\partial t},$$

$$div\,Ж = 0,$$

(1-1) **Lorentz inriariant angular momentum wave Equation**

$$rot\ Я = -\frac{1}{c}\frac{\partial Ж}{\partial t},$$

$$div\ Я = 4\pi q, \qquad (1-3)$$

where Ж and iЯ stand for total axial angular momentum density (on the zeroth hyper surface = ordinary physical space) and total polar (Ref 18), respectively.
We namely derive a pair of wave Eqn.

$$-\square Ж = 4\pi\, rot\ \mathrm{p},$$

$$\square Я = \frac{4\pi}{c}\frac{\partial \mathrm{p}}{\partial t} + 4\pi\, grad\ \mathrm{q}, \qquad (1-4)$$

which shows that behaviour of total anpular momentum propagates at signal velocity. (1-4) are also spin wave Equation in relativistie form (Ref 19).

(1-2) Spin Wave and Gravitation

One of the physical prospects of spin or total six angular momentum has been interaction with electromagnetic field. Axial spin has been quantum operator for magnetization, while polar will be found to be that for electric polarizability as described later. On the other hand a particle immersed in ether of spin field must enjoy Coriolis force and centrifugal force in accordance with that vertex.
It has been essentially identical with gravitational force, while polar spin of that confronting entity must enjoy some gravitational interactions. Let a sheet of paper be present. You will recognize it to be a plane if you see it over.

while you will feel that it would be a line if you do it laterally. Gravitational interactions of six spin and that electromagnetic are nothing but two different prospects of the single object. We shall suppose that

$$q = \rho c / \sqrt{1-\beta^2}, \qquad (1-5)$$

in (1−4) for the medium of resting center of mass that enjoys internal motion. Under static field of six spin

$$\varDelta Я = \frac{4\pi c\, grad\ \rho\ (\vec{R})}{\sqrt{1-\beta^2}}, \qquad (1-6)$$

where $\rho(\vec{R})$ stands for mass density. Comparing (1−6) with Equation of gravitation of Poisson's of

$$\varDelta \rho = 4\pi K \rho, \qquad (1-7)$$

we found polar angular momentum density Я and gravitational field G to be associated by the relation of

$$\frac{G}{\sqrt{1-\beta^2}} = -\frac{K}{C} Я. \qquad (1-8)$$

A glance at (1−8) leads us to the conclusion that gravitation has been caused by internal translation of ambient ether, because axial argular momentum has been generating operator of infinitesimal (spatial) rotation, while polar that of infinitesimal tianslation (Ref 29). From weightless field in an artificial satellite, every body may think that gravitation will be caused by a vortex. It has, however, been found to rather a little be different although that estimation was not much remote from the truth.

(1−3) Lorentz Transformation of Gravitational Field

Internal four momentum and total six angular momentum have been a cause of gavitation and also that relult, the latter having defined the former and the former the latter, each other. The former obeys a Lorentz transformation of

$$p'^1 = \frac{p^1 + i\beta p^4}{\sqrt{1-\beta^2}}, \qquad p'^2 = p^2, \quad p'^3 = p^3,$$

$$p'^4 = \frac{p^4 - i\beta p^1}{\sqrt{1-\beta^2}}, \qquad (1-9)$$

which implies that the latter must enjoy that transformation. The second set of (1−3) and that third one we may take four-potential of $\varphi = (\varphi^1, \varphi^2, \varphi^3, \varphi^4 = i\varphi^0)$ of six spin of Ж and iЯ by

$$(Ж, -iЯ) = \mathcal{R}ot\ \varphi = \partial_j \varphi^k - \partial_k \varphi^j, \qquad (1-10)$$

so that the second set of (1−3) and that third one may identically be satisfied (Ref 30), where Rot denotes rotation with respect to space-time (which has six components and, is, therefore, an extension of rot).

Not only $\varphi = (\varphi^1, \varphi^2, \varphi^3, \varphi^4)$

but also $\partial = (\partial^1, \partial^2, \partial^3, \partial^4)$

are four vectors. They obey Lorentz transformations of

$$\varphi'^1 = \frac{\varphi^1 + i\beta\varphi^4}{\sqrt{1-\beta^2}}, \qquad \varphi'^2 = \varphi, \quad \varphi'^3 = \varphi^3,$$

$$\varphi'^4 = \frac{\varphi^4 - i\beta\varphi^1}{\sqrt{1-\beta^2}}. \qquad (1-11)$$

and

$$\partial'_1 = \frac{\partial_1 + i\beta\partial_4}{\sqrt{1-\beta^2}}, \qquad \partial'_2 = \partial_2, \quad \partial'_3 = \partial_3,$$

$$\partial'_4 = \frac{\partial_4 - i\beta\partial_1}{\sqrt{1-\beta^2}}, \qquad (1-12)$$

owing to which total six angular momentum enjoys a Lorentz transformation of $Ж'_1 = Ж_1$

$$Ж'_2 = \frac{Ж_2 + \beta Я_3}{\sqrt{1-\beta^2}}, \qquad Ж'_3 = \frac{Ж_3 - \beta Я_3}{\sqrt{1-\beta^2}},$$

$$\text{Я}_1' = \text{Я}_1 .$$

$$\text{Я}_2' = \frac{\text{Я}_2 - \beta \text{Ж}_3}{\sqrt{1-\beta^2}} ,$$

$$\text{Я}_3' = \frac{\text{Я}_3 + \beta \text{Ж}_2}{\sqrt{1-\beta^2}} , \qquad (1-13)$$

with reference to (1−10). In recourse to the relation between polar angular momentum and gravitation of (1−8) we finally obtain a Lorentz transformation of gravitational field of

$$\text{Ж}_1' = \text{Ж}_1 . \qquad \text{Ж}_2' = \frac{\text{Ж}_2 - \frac{c\beta}{k} G_3}{\sqrt{1-\beta^2}} ,$$

$$\text{Ж}_3' = \frac{\text{Ж}_3 - \frac{c\beta}{k} G_3}{\sqrt{1-\beta^2}} , \qquad G_1' = G_1 ,$$

$$G_2' = \frac{G_2 + \frac{k\beta}{c} \text{Ж}_3}{\sqrt{1-\beta^2}} , \qquad G_3' = \frac{G_3 - \frac{k\beta}{c} \text{Ж}_2}{\sqrt{1-\beta^2}} .$$

(1−4) Spin Induction Law

Static vector field of axial angular momentum and polar has been irrotational such that $rot\ \text{Ж} = 0$, (1−15)
in recourse to (1−3). We may take potential of spin (axial angular momentum) of , $\text{Ж} = grad\ \varphi$. (1−16)
We further suppose that potential at $Q(x)$ is proportional to the solid angle Ω governing closed curve C which contains momentum flux, $P(x)$ such as $\varphi(x') = \Omega P(x)$, (1−17)
We also use a famous expression of classical mechanics

$$\text{grad}\,\Omega = rot\ \alpha , \qquad (1-18)$$

where $\alpha = \oint_C \frac{ds}{r}$. (1−20)
Spatial vector $\vec{r} = (x'^1 - x^1,\ x'^2 - x^2,\ x'^3 - x^3)$ starts from a

point on the curve and terminated at $Q(x)$. We finally ootain a rather familiar relation of

$$Ж = \oint_C \frac{P ds \times \vec{r}}{r^3}, \qquad (1-19)$$

with referece to the first set of (1−3) of

$$rot\ Ж = 4\pi p. \qquad (1-20)$$

(1−19) is nothing but spin induction law, in which internal momentum is thought to be a cause of spin. The one has been defined by auother in (1−3). Pds and ds denote infinitesimal element of internal momentum and element of curve, respectively.

(1−5) The Crucial Test

New Eqn. of gravitation proposed must satisfy the so-called crucial tests. We shall examine our theory of gravitation to furnish satisfactory explanation to the motion of perihelion of a planet as one of the crucial tests.
The moving planet observes a gravitational field of

$$G' = \gamma\ (G + \frac{k\vec{\beta}}{c} \times Ж). \qquad (1-21)$$

in recourse to (1−14), where γ stands for Lorentz factor of

$$\gamma = \frac{1}{\sqrt{1-\beta^2}},$$

with $$\beta = \frac{v}{c}$$

and v for the velocity of a planet. Gravitation will be found to act upon the planet such that

$$F = m\gamma\ (G + \frac{k\vec{\beta}}{c} \times Ж). \qquad (1-22)$$

in which m means rest mass of a planet. The Eqn. of motion of a planet may be found to have the form

$$m \frac{d^2 \mathbf{r}}{d\tau^2} = \frac{\mathbf{F}}{\sqrt{1-\beta^2}},$$

$$\frac{dq}{d\tau} = \frac{\mathbf{p}\cdot\mathbf{G}}{c\sqrt{1-\beta^2}}, \qquad (1-22)$$

where

$$\mathbf{r} = (x^1, x^2, x^3)$$

$$\mathbf{p} = m\frac{d\mathbf{r}}{d\tau}, \qquad q = mc\frac{dt}{d\tau}$$

and $cq = W$ stands for total energy of a planet. It is supposed to enjoy an axially symmetric gravitational field of

$$G_R = -\frac{\mu}{R^2}$$

$$G_\varphi = 0, \qquad (1-24)$$

where R and φ denote two dimensional polar co-ordinate of $X^1 = R\cos\varphi$,

and $X^2 = R\sin\varphi$.

We namely derive

$$q = mc\gamma\left(1 + \frac{\mu}{c^2 R}\right), \qquad (1-25)$$

owing to the latter Eqn. of (1−23), which is nothing but Brillouin's result and that of Lucas'es (Ref 64 and 65).

Boundary conditions have been taken to be

$$\lim_{R\to\infty} q = mc\gamma. \qquad (1-26)$$

They stated that Einsteinean relation of

$$W = \frac{mc^2}{\sqrt{1-\beta^2}},$$

must be corrected with gravitational potential. We have to replace Lorentz factor by $\gamma' = \gamma\left(1 + \dfrac{\mu}{c^2 R}\right)$. (1−27)

The radial part of the Eqn. of motion in terms of the corrected Lorentz factor reads

(1-5) The Crucial Test

$$\frac{d^2R}{c^2d\tau^2} - \frac{h^2}{R^3} = (1+\frac{\mu}{c^2R})^2\frac{\mu}{c^2R^2}$$

$$= -(1+\frac{2\mu}{c^2R}+\frac{\mu^2}{c^4R^2})\frac{\mu}{c^2R^2}, \quad (1-28)$$

where we suppose that $\frac{k\beta}{c} \ll 1$

and $\beta \ll 1$,

and |Ж| is assumed to be small relatively to gravitational field of a celestial body. The latter term of (1-22) has thus been neglected. h stands for aerial velocity of

$$R^2\frac{d\varphi}{cd\tau} = h, \quad (1-29)$$

which was led to in recourse to $G_\varphi = 0$.

(See the ordinary problem of Kepler's). The Eqn. of (1-28) can be solved by the familiar method of planetary motion, and we find the angle Ψ covered by one cycle

$$\Psi = \frac{4}{A\sqrt{\gamma-\alpha}}\int_0^{2\pi}\frac{d\varphi}{\sqrt{1-k^2\sin^2\varphi}}, \quad (1-30)$$

with $k^2 = \frac{\beta-\alpha}{\gamma-\alpha}$,

α, β and γ being the roots of cubic Eqn. which appears in the right hand side of the integral such that

$$\alpha+\beta+\gamma = \frac{3c^6h^2}{2\mu^3}(1-\frac{\mu^2}{c^4h^2}),$$

and $A^2 = \frac{3\mu^3}{3c^6h^2}$.

The parameters α and β are determined by

$$\alpha = \frac{1}{a(1+e)},$$

and $\beta = \frac{1}{a(1-e)}$,

where a and e mean major radius of the orbit and eccentricity, respectively (γ does not stand for Lorentz factor this time).

Expanding (1 −30) and neglecting infinitesimal terms, we finally find

$$= 2\pi + \frac{24\pi^3}{c^2(1-e^2)}\left(\frac{a}{T}\right)^2$$

in which T means the period expressed in seconds.

The latter term shows secular rotation of the elliptic orbit in the same sense as the revolution (Fig A).

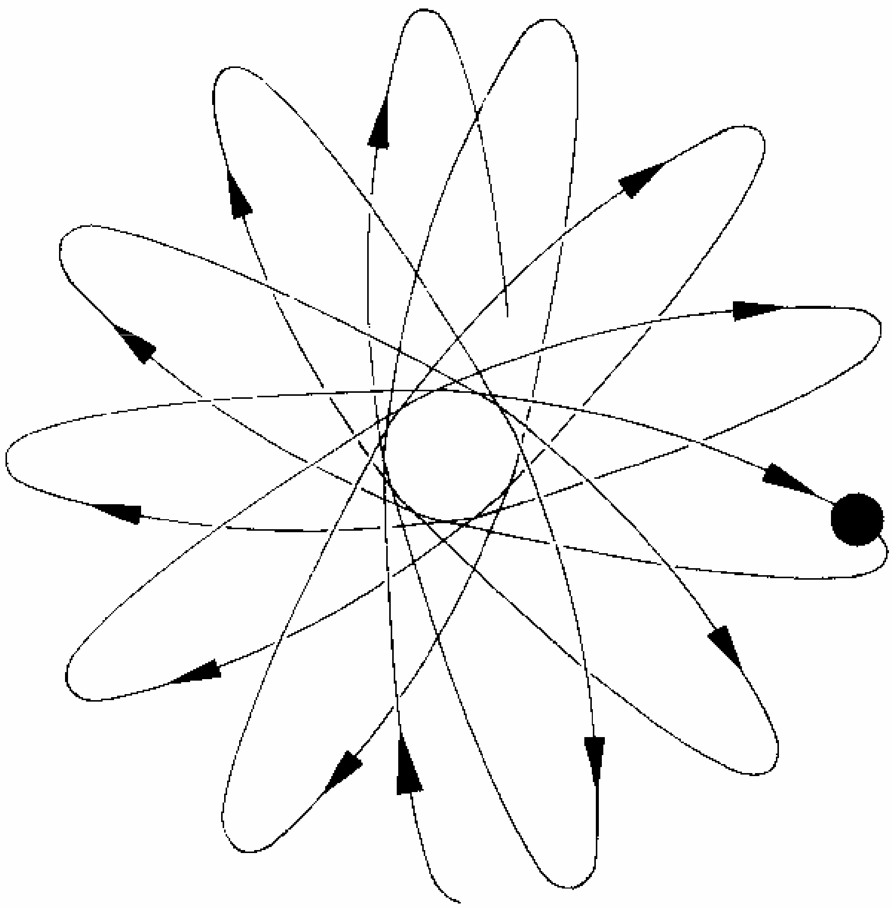


Fig. A

It is just identical with Einstein's result, and will furnish a satisfactory verification of our Eqn. of gravitation.

§ 2 Relativistic Spherecal Harmonics

(2−1) Angular Momentum Operator as Six Vector

Whe shall solve Klein-Gordon Eqn. of

$$(\Box - \kappa^2)\,\Psi(\mathrm{X}) = 0. \qquad (2-1)$$

with four dimensional polar co-ordinate of,

$$x^1 = x = r \sin\theta \sin\varphi \cos\Psi,$$
$$x^2 = y = r \sin\theta \sin\varphi \sin\Psi,$$
$$x^3 = z = r \sin\theta \cos\varphi,$$
$$x^4 = u = r \cos\theta, \qquad (2-2)$$

where $0 \leqq r < \infty$, $0 \leqq \theta \leqq \pi$, $0 \leqq \varphi \leqq \pi$

and $0 \leqq \Psi \leqq 2\pi$.

We shall further let D́ Alambertian of $\Box$ anallytically continue into Euclidean space-time (unitary trick) such that

$$\Box \to -\Delta_4 = -\frac{1}{r^3}\frac{\partial}{\partial r}\left(r^3\frac{\partial}{\partial r}\right) + \frac{K^2}{r^2}$$

with $$K^2 = -\left[\frac{1}{\sin^2\theta}\frac{\partial}{\partial\theta}\left(\sin^2\theta\frac{\partial}{\partial\theta}\right) - \frac{L^2}{\sin^2\theta}\right],$$

and $$L^2 = -\left[\frac{1}{\sin\varphi}\frac{\partial}{\partial\varphi}\left(\sin\varphi\frac{\partial}{\partial\varphi}\right) + \frac{1}{\sin^2\varphi}\frac{\partial^2}{\partial\Psi^2}\right]. \qquad (2-3)$$

K^2 stands for the openator of square of six angular momentum (Ж, iЯ) of,

$$Ж = \begin{pmatrix} x^2p^3 - x^3p^2 = i\hbar\,(x^2\partial_3 - x^3\partial_2) \\ x^3p^1 - x^1p^3 = i\hbar\,(x^3\partial_1 - x^1\partial_3) \\ x^1p^2 - x^2p^1 = i\hbar\,(x^1\partial_2 - x^2\partial_1) \end{pmatrix}$$

$$iЯ = \begin{pmatrix} x^4p^1 - x^1p^4 = i\hbar\,(x^4\partial_1 - x^1\partial_4) \\ x^4p^2 - x^2p^4 = i\hbar\,(x^4\partial_2 - x^2\partial_4) \\ x^4p^3 - x^3p^4 = i\hbar\,(x^4\partial_3 - x^3\partial_4) \end{pmatrix}$$

namely of,

$$K^2 = Ж^2 - Я^2 = Ж^2 + (iЯ)^2,$$

(2−1) **Angular Momentum Operator as Six Vector**

L^2 being ordinary angular momentum operator, the eigen functions and the eigen values of which are furnished with

$$L^2 Y_L^m(\varphi, \Psi) = L(L+1) Y_L^m(\varphi, \Psi),$$

$$Y_L^m(\varphi, \Psi) = (-1)^{\frac{|m|+m}{2}} \sqrt{\frac{2L+1}{2} \cdot \frac{L-|m|}{L+|m|}}$$

$$\sin^{|m|}\varphi \frac{d^{|m|}}{d(\cos\varphi)^{|m|}} \frac{1}{2^L} \sum_{j=0}^{j=[\frac{L}{2}]} (-1)^j$$

$$\frac{(2L-2j)!}{j!(L-j)!(L-2j)!} (\cos\varphi)^{L-2j} \cdot \frac{\exp(im\Psi)}{\sqrt{2\pi}}. \qquad (2-4)$$

$Ж^2$ commutes with $Я^2$ by

$$[Ж^2, \quad Я^2] = 0. \qquad (2-4b)$$

Я are also observable since so are Ж (Ref 47).

We have made use of commutation relations of four momentum operator and corresponding co-ordinate of space-time of,

$$[p^j, x^k] = -i\hbar\delta^{jk}, [p^j, x^k] = [x^j, x^k] = 0$$

$$(j, k = 1 \sim 4).$$

δ^{jk} stands for Kronecker's delta (Ref 48). We also obtain

$$[K^2, Ж^2] = [K^2, Я^2] = 0. \qquad (2-4c)$$

from (3−4b). K is also oleservable. L means orbital quantum number (Ref 2) and is a non-negative integer, which satisfies a relation of,

$$L + 1 \leqq n, \qquad (2-5)$$

n being principal quantum number. m denotes magnetic quantum number, which satisfies

$$|m| \leqq L$$

(integers). Δ_4 stands for four dimensional Laplacian.
The following differential Eqn. of,

radially:

$$\left[\frac{d^2}{dr^2} + \frac{3}{r}\frac{d}{dr} + \left(k^2 - \frac{n^2-1}{r^2}\right)\right] R_n(r) = 0, \qquad (2-6)$$

(2−1) Angular Momentum Operator as Six Vector

the first angular part :

$$\left[(1-Z^2)\frac{d^2}{dZ^2} - 3Z\frac{d}{dZ} - \frac{L(L+1)}{1-Z^2} - (n^2-1) \right] Ⓗ_n^L(\theta) = 0, \qquad (2-7)$$

with $Z = \cos\theta$.

(3−7) can be obtained by differentiating Gegenbauer differential Eqn. (Ref 3) of,

$$\left[(1-Z^2)\frac{d^2}{dZ^2} - 3Z\frac{d}{dZ} + N(N+2) \right] C_N^1(\cos\theta) = 0,$$

by L times. We finally derive

$$Ⓗ_n^L(\theta) = \sin^L\theta \left[\frac{d}{d(\cos\theta)}\right]^L C_{n-1}^1(\cos\theta). \qquad (2-8)$$

We have $L+1 \leqq n$,

so that (2−8) may physically be meaningful.

(2−2) Relativistic Spherical Harmonics

In recourse to the relation among principal quantum numbers and orbital the eigen value in (2−6) is noshing but principal of

$$n = L+1,\ L+2,\ \cdots\cdots .$$

The orthonormal associations are

$$\int_0^{\pi} Ⓗ_n^L(\cos\theta)\ Ⓗ_{n'}^L(\cos\theta)\sin^2\theta\, d\theta$$

$$= \frac{\pi}{2}\cdot\frac{(n+L)!}{n\{(n-L-1)!\}}\ \delta nn', \qquad (2-9)$$

where $\delta nn'$ stands for Kronecker's symbol (Ref 4), and $\sin^2\theta\, d\theta$ means the first angular segment of space-time volume element of

$$d\tau = r^3 \sin^2\theta \sin\varphi \, dr\, d\theta\, d\varphi\, d\Psi .$$

Radially we derive elementary solutions which are regular at r = 0 (also finite when r→∞),

$$R_n(r) = \frac{\sqrt{\kappa}}{r} J_n(\kappa r). \qquad (2-10)$$

Their normalization relations are furnished by

$$\int_0^\infty [R_n(r)]^2 r^3 dr = \delta(0), \qquad (2-11)$$

where $r^3 dr$ denotes radial segment of space-time volume element of

$$d\tau = r^3 \sin^2\theta \sin\varphi \, dr\, d\theta\, d\varphi\, d\Psi ,$$

and $\delta(Z)$ stands for Diracean delta function, and does not for Kronecker's one .

(2−3) Eigen Values of Polar Angular Momentum

The eigen value λ of polar angular momentum of $\mathfrak{R}^2$ is determined by,

$$\mathfrak{R}^2 \Pi(\theta, \varphi, \Psi) = [\sec^2\theta \frac{\partial}{\partial\theta}(\cos^2\theta \frac{\partial}{\partial\theta})$$
$$-\tan^2\theta L^2]\Pi(\theta, \varphi, \Psi) = \lambda \Pi(\theta, \varphi, \Psi).$$

$$(2-12)$$

Putting Π to be

$$\Pi(\theta, \varphi, \Psi) = H(\theta)\, Y_L^m(\varphi, \Psi),$$

we obtain separated differential Eqn. of ,

$$[\sec^2\theta \frac{\partial}{\partial\theta}(\cos^2\theta \frac{\partial}{\partial\theta}) - L(L+1)\tan^2\theta - \lambda]\, H(\theta) = 0,$$

$$L^2 Y_L^m(\varphi, \Psi) = L(L+1)\, Y_L^m(\varphi, \Psi). \qquad (2-13)$$

along with

$$x = r\cos\theta \sin\varphi \cos\Psi , \qquad z = r\cos\theta \cos\varphi ,$$
$$y = r\cos\theta \sin\varphi \sin\Psi , \qquad x^4 = u = r\sin\theta .$$

(2-3) Eigen Values of Polar Angular Momentum

and with $0 \leqq r < \infty$, $0 \leqq \theta \leqq \pi$.

$0 \leqq \varphi \leqq \pi$ and $0 \leqq \Psi \leqq 2\pi$.

The differential Eqn. of,

$$[\sec^2\theta \frac{\partial}{\partial\theta}(\cos^2\theta\frac{\partial}{\partial\theta}) + L(L+1)\tan^2\theta - \lambda$$

$$\times Ⓗ(\theta) = 0, \qquad (2-14)$$

determines that eigen value of λ. We namely obtain

$$[(1-t^2)\frac{d^2}{dt^2} - 3t\frac{d}{dt} - \frac{L(L+1)}{1-t^2} + \lambda + L(L+1)]$$

$$\times Ⓗ(t) = 0,$$

$$(t = \sin\theta) \qquad (2-15)$$

which is nothing but associated Gegenbauer differential Eqn with

$$\lambda + L(L+1) = n^2 - 1$$

$$= N(N+2), \qquad (2-16)$$

and along with

$$H(t) = \cos^L\theta [\frac{d}{d(\sin\theta)}]^L C^1_{n-1}(\sin\theta), \qquad (2-17)$$

where $L + 1 \leqq n$, $(2-18)$

and $C^1_n(\sin\theta)$ stands for Gegenbauer polynoms (Ref 3) refferred to in (2-8). Thus, amplitude of polar angular momentum is determined by

$$|Я| = \sqrt{n^2 - 1 - L(L+1)}\ \hbar, \qquad (2-19)$$

in which n means principal quantum number in recourse to the former analysis.

Orthonormal eigen functions in Minkowskean space-time are,

$$Ⓗ^L_N(\theta) = [i(ch\,\theta)^L / M_L][\frac{d}{d(sh\,\theta)}]^{L+1}$$

$$\times \cos(N+1)(\theta + \frac{i\pi}{2}), \qquad (2-20)$$

(Ref 24) where

$$M_L^2 = N^2(N^2+1) \cdots\cdots (N^2+L^2)$$

(2−3) Eigen Values of Polar Angular Momentum

Orthogonal associations are expressed by

$$\int_0^\infty Ⓗ_N^L(\theta)\ Ⓗ_{N'}^L(\theta)\ c\hbar^2\ \theta\, d\theta = \frac{\pi}{2}\ \delta(N-N')$$

$$(0 \leqq N < \infty) \qquad (2-21)$$

in which $\delta(N-N')$ stands for Diracean delta function, and according to which principal quantum number can analytically be continued onto complex plane (Ref 25).

It is analogical to Regge poles of complex orbital quantum numbers (Ref 26).

§3 Quantum Operator for Electric Polarizability

(3−1) Lorentz Invariant Hamiltonian

Polar angular momentum contains Hamiltonian as the eighth variable. We have to develope relativistic Hamiltonian formulation of eight canonical variables so that we may descr-ibe that behaviour. This Hamiltonian formulation has been examimed by several researchers (Ref 31, 32), recently by H. Enatsu (Ref 33). The Eqn. of motion under relativistic formulation of a particle immersed in electromagnetic ether

$$mc\frac{d}{dt}\left(\frac{dr}{ds}\right) = e\frac{dr}{ds}\times H + eE, \qquad (3-1)$$

can be derived by variating the action of,

$$\delta I_1 = \delta \int L_0\, ds, \qquad (3-2)$$

under relativistic constraint of

$$ds^2 = -dx^2,$$

where $\qquad r = (x^1, x^2, x^3),$

and Lagrangian density is furnished by.

$$L_0 = -mc + 2m\alpha\frac{dx}{ds}\cdot A, \qquad (3-3)$$

m, $\alpha = \dfrac{e}{2me}$ and A stand for rest mass, a half of coupling constant of electromagnetic interaction and (four) vector potential of external electromagnetic field, respectively. Adding indeterminate part of Lagrangian density of

$$\lambda\left(\frac{dx}{ds}\right)^2,$$

to L_0, and variating

$$I = \int \left[L_0 + \lambda\left(\frac{dx}{ds}\right)^2 \right] ds, \qquad (3-4)$$

outside tho geodetic, the Eqn. of motion of,

$$2\lambda \frac{d^2 r}{dS^2} = e\frac{dr}{dS} \times H + eE\frac{dx^0}{dS}$$

$$2\lambda \frac{d^2 x^0}{dS^2} = 2m\alpha\frac{dr}{dS} \cdot E, \qquad (3-5)$$

is obtained. λ means indeterminate constant of Lagrange's. We emphatically write dS outside the geodetic. We again come onto the geodetic taking as

$$2\lambda = mc,$$

so that (3−5) may coincide with (3−1). We namely derive eight canonical variables of $\times$ and

$$p^j = \frac{\partial L}{\partial\left(\frac{dx^j}{ds}\right)} = mc\frac{dx^j}{ds} + 2m\alpha A^j, \qquad (3-6)$$

in recourse to which Lorentz invariant Hamiltonian of

$$H = (P - 2m\alpha A)^2 / 2mc + mc, \qquad (3-7)$$

can be obtained. Eight canonical relations are

$$\frac{d\times}{ds} = \frac{\partial H}{\partial P},$$

$$\frac{dP}{ds} = -\frac{\partial H}{\partial \times}, \qquad (3-8)$$

the eighth of which leads us to

$$\frac{dH^0}{ds} = \frac{\partial H}{\partial t}. \qquad (3-9)$$

Ordinary Hamiltonian $H^0 = \frac{cp^4}{i}$,

is related to that Hamiltonian by (3−9). We finally derive an expression of

$$\frac{dH^2}{ds} = \frac{ds}{dt} \cdot \frac{dH}{ds},$$

$$\Longrightarrow \gamma H^0 = cH,$$

especially in a resting system of internal motion (Ref 34), where γ denotes Lorentz factor. This implies a physical meaning of Lorentz scalar of H. That conservation law of

$$\frac{dH}{ds} = 0, \qquad (3-11)$$

corresponds with that of ordinary Hamiltonian of,

$$\frac{dH^0}{dt} = 0. \qquad (3-12)$$

Interaction part with external field takes the form of,

$$\gamma H^0 = cH$$
$$= -\alpha(Ж \cdot \mathrm{H} - Я \cdot \mathrm{E}), \qquad (3-13)$$

where Ж and iЯ stand for axial angular momentum and polar, respectively. Conventional magnetic moment i has been furnished by

$$4\pi \mathrm{i} = -\frac{\partial H^0}{\partial H}. \qquad (3-14)$$

Can't electric moment be done by

$$4\pi i \mathrm{P} = -\frac{\partial H^0}{\partial(i\mathrm{E})} = +\frac{i\alpha Я}{\gamma}, \qquad (3-15)$$

and can't we call polar angular momentum guantum operator for electric polarizability ? Magnetic field and electric are axial vector field and polar in Minkowskean space-time. Axial angular momentum Ж and polar iЯ also correspond with this and that, respectively. We namely obtain an expression of

$$4\pi(\mathrm{i}, \mathrm{P}) = g\alpha \begin{pmatrix} 0, & Ж_3, & -Ж_2, & -iЯ_1 \\ -Ж_3, & 0, & Ж_1, & -iЯ_2 \\ Ж_2, & -Ж_1, & 0, & -iЯ_3 \\ iЯ_1, & iЯ_2, & iЯ_3, & 0 \end{pmatrix} \qquad (3-16)$$

where g means nuclear g-factor.

(3−2) Lorentz Transformation of Magnetization and Electrie Polarization

Lorentz transformation of axial angular momentum and polar has been determined by (1 — 13). In recourse to (3 — 14) and (3 — 15) we derive that of magnetization and electric polarization of,

$$I_1' = I_1 , \qquad P_1' = P_1$$

$$I_2' = \frac{I_2 + \beta p_3}{\sqrt{1-\beta^2}} , \qquad P_2' = \frac{P_2 - \beta I_3}{\sqrt{1-\beta^2}} ,$$

$$I_3' = \frac{I_3 - \beta p_2}{\sqrt{1-\beta^2}} , \qquad P_3' = \frac{P_3 + \beta I_2}{\sqrt{1-\beta^2}} , \qquad (3 - 17)$$

which just corresponds with the result of W. G. V. Rosser's (Ref 35) and subsequently verifies (3 — 14) and (3 — 15).

(3 — 3) Lorentz Invariant Heisenbergean Equation

In recourse to eight canonical relations of (3 — 8) as many canonical Eqn. of,

$$\frac{dx}{ds} = \frac{i}{\hbar} [H, x] ,$$

$$\frac{dP}{ds} = \frac{i}{\hbar} [H, P] , \qquad (3 - 18)$$

can be obtained with reference to Poisson's brackets .

Secondly we derive Lorentz invariant Heisenbergean Eqn. of,

$$\frac{df}{ds} = \frac{i}{\hbar} [H , f] , \qquad (3 - 19)$$

where f stands for physical quantity composed of sums and products of eight canonical variables. This Epn . is a Lorentz invariant (contravariant) generalization of usual Heisenbergean Eqn. of motion of,

$$\frac{df}{dt} = \frac{i}{\hbar} [H^0 , f] . \qquad (3 - 20)$$

If we put f to be

$$f = H , \quad \text{in} \quad (3 - 19)$$

we again verify (3 — 11) .

§ 4 SEIKE・Kramers Equation

(4−1) Gyration of Four Dimensional Top

In the former section we obtained Lorentz invariant Eqn. of motion of Heisenberg's. If we apply this Eqn. to several physical quantities, we will have some Eqn. which must naturally be Lorentz invariant. Firstly we derive

$$\frac{d Ж}{d\tau} = \alpha\,(Ж \times H - Я \times E),$$

$$\frac{d Я}{d\tau} = \alpha\,(Ж \times E + Я \times H), \qquad (4-3)$$

in recourse to commutation relations of six angular momentum of $\quad Ж \times Ж = i\hbar Ж, \quad Я \times Я = i\hbar Ж.$

$$[Ж_j,\ Я_k] - i\hbar Я_m,\ [Я_j,\ Ж_k] = i\hbar Я_m, \qquad (4-2)$$

when we take Lorentz scalar and that physical quantity to respectively be interaction of six angular momentum with external electromagnetic field of

$$H = -\frac{\alpha}{c}(Ж \cdot H - Я \cdot E), \qquad (4-1)$$

and that six angular momentum. j, k and m are taken to be cyclic and (4−2') holds under commutation relations among relativistic canonical variables of

$$[p^j,\ x^k] = i\hbar\,\delta^{jk}, \quad [p^j,\ p^k]$$

$$= [x^j,\ x^k] = 0, \qquad \delta^{44} = -1, \qquad (4-4)$$

(δ^{jk} are Kronecker's symbols). Canonical variables are supposed to commute with electromagnetic field. If we take

$$Я = E = 0,$$

in (5−3), we easily find

$$\frac{d Ж}{d\tau} = a\, Ж \times H, \qquad (4-5)$$

which is nothing but ordinary gyro magnetic Eqn. (Ref 36), but in which correction of motion to clock of the system.

(4−3) is Lorentz invariant gyro electromagnetic Eqn. (Ref 18). (4−3) is also rearranged in the form of

$$\frac{d\mathrm{l}}{d\tau} = \alpha (\mathrm{l} \times \mathrm{H} + \mathrm{P} \times \mathrm{E}),$$

$$+ \frac{d\mathrm{P}}{d\tau} = \alpha (\mathrm{l} \times \mathrm{E} + \mathrm{P} \times \mathrm{H}), \qquad (4-7)$$

in recourse to (3−14) and (3−15), where l and P stand for magnetic moment and electric of the system, respectively (Ref 37). We may observe gyrational torque to electric moment with external electric field, which has been introduced by K. OKANO (Ref 38). This electric moment also contains oscillation of anti-particles, namely negative component of Zitterbewegungen. because eigen value of polar angular momentum (α−mal operators) corresponds with those of positive evergy and negative. This is analogical with the fact that axial angular momentum specifies rotation and counter one on the zeroth hyper surface (ordinary physical space).
(4−3) seems to classically state gyrations of four dimensional top. (5−3) was firstly introduced by H. A. Kramers in the former age, several insufficient points would, however, be found in the succeeding analysis (Ref 38). They will naturally be corrected if you fabricate inverse (anti−) atomic motor presented later. This would, as it were, be like eight fundamentals to inverse (anti−) atomic technology, which will be experimental physics in twenty first century.

(4−2) Solutions to Circularly Polarized Electromagnetic Field

What is the behaviour of four dimensional top if it is immersed in circularly polarized electromagnetic field of

$$\boldsymbol{H} = (\boldsymbol{H}_1 \cos \Omega \tau , \ \boldsymbol{H}_1 \sin \Omega \tau , \ \boldsymbol{H}_0) ,$$

(4−2) Solutions to Circularly Polarized Electromagnetic Field

$$\boldsymbol{E} = (-\boldsymbol{E}_1 \sin \Omega \tau ,\ \boldsymbol{E}_1 \cos \Omega \tau ,\ 0)\ ? \qquad (4-8)$$

That of polar angular momentum Я is described by

$$\frac{Я}{Я_0} = \begin{pmatrix} A\cos\alpha, & A\sin\alpha, & -B \\ -\sin\alpha, & \cos\alpha, & 0 \\ B\cos\alpha, & B\sin\alpha, & A \end{pmatrix} \eta \begin{pmatrix} -A\cos\omega\tau \\ -A\sin\omega\tau \\ B \end{pmatrix}$$

$$\begin{pmatrix} \cos\Omega\tau, & \sin\Omega\tau, & 0 \\ -\sin\Omega\tau, & \cos\Omega\tau, & 0 \\ 0, & 0, & 1 \end{pmatrix} = \eta, \qquad (4-9)$$

where boundarry conditions are assumed to be

$$\frac{Я(0)}{Я_0} = \begin{pmatrix} A\cos\alpha, & A\sin\alpha, & -B \\ -\sin\alpha, & \cos\alpha, & 0 \\ B\cos\alpha, & B\sin\alpha, & A \end{pmatrix} \begin{pmatrix} -A \\ 0 \\ B \end{pmatrix}. \qquad (4-10)$$

We have started from a particled state, with

$$\alpha = Arctan \frac{\boldsymbol{E}_1}{\boldsymbol{H}_1},$$

$$\boldsymbol{B}/\boldsymbol{A} = \alpha\sqrt{H_1^2 + \boldsymbol{E}_1^2}\ /\ (\alpha \boldsymbol{H}_0 + \Omega),$$

and $\quad \boldsymbol{A}^2 + \boldsymbol{B}^2 = 1$.

As stated in the former section, the eigen value of the last component of polar angular momentum specifics positively energied state or negatively (Ref 39). The system enjoys negatively energied state under the condition of,

$$\bar{P}(\tau) = \frac{1}{2\pi\omega} \int_0^{2\pi} Я_3(\tau)\, d(\omega\tau)$$

$$= \alpha\sqrt{H_1^2 + E_1^2}\,(\alpha H_0 + \Omega)/\omega^2 < 0\,. \qquad (4-11)$$

with $\quad \omega^2 = \alpha^2(H_1^2 + E_1^2) + (\alpha H_0 + \Omega)^2$

For the material entities of Ferroxplane or Barium Strontium Titanate $\quad \alpha < 0$,

We finally obtain $\quad 0 < \alpha H_0 + \Omega \qquad (4-12)$

We move to negative energy state starting from particled with (4-12). We shall later state statistical regulation (in the section of inverse atomic motor).

(4−3) Gyro Electromagnetic Equation under Maxwellean Braking Action (Ceased)

§ 5 Equation of Motion to State Four Momentum

(5−1) Electromagnetic Behaviour of State Four Momentum

If we observe state four momentum of (p, iq) as a physica quantity f with Lorentz invariant Heisenbergean Eqn. of(3−19 an Eqn. of motion of

$$\frac{dP}{d\tau} = \alpha (P \times H + qE),$$

$$\frac{dq}{d\tau} = \alpha P \cdot E, \qquad (5-1)$$

is obtained under electromagnetic field. For single charged particle

$$\alpha = \frac{e}{mc}, \quad P = m\frac{dr}{d\tau}, \quad \frac{e}{c}\frac{dx}{d\tau} = \frac{i}{c},$$

(current)

(5−1) reduces to ordinary Eqn. of motion with Lorentz force of,

$$\frac{dp}{d\tau} = \frac{i}{c} \times H + \frac{e}{c}E,$$

$$\frac{dW}{d\tau} = \frac{i}{c} \cdot E, \qquad (C.G.S)\ (5-2)$$

where W stands for energy of that particle. We here point out that it is nothing but (c times) momentum along the normal (t axis) on the zeroth hyper surface (ordinary physical space). We shall later state that momentum along the normal on the other hyper surface is generalized energy. (5−1) will be a generalization of Eqn. of motion with an ordinary charged particle into a neutral but with electromagnetic interaction (for instance, of a neutron or atoms in general).

(5−2) Solutions under Gravitational Deceleration

The above system enjoys a solution of,

(5−2) Solutions under Gravitational Decceleration

$$p^1(\tau) = -mc\frac{d\,b}{a^2+d^2}\,[\, exp(-a\tau) + \frac{a}{d}\sin d\tau - \cos d\tau \,],$$

$$p^2(\tau) = -mc\frac{b}{a^2+d^2}\,[\, a\cos d\tau + d\sin d\tau - a\,exp(-a\tau)\,],$$

$$p^3(\tau) = -mc\frac{a}{a^2+d^2}\,[\, 2d\sin d\tau + \frac{a^2-d^2}{a} \times sh\,a\tau \,],$$

$$Q(\tau) = -\frac{mc}{a^2+d^2}\,[\,(a^2+b^2+d^2)\,ch\,a\tau - b^2\cos d\tau\,], \qquad (5-3)$$

where we observe the momentum from upon the system rotating at the angular frequency of Ω around Z axis on the zero-th hyper surface (ordinary physical space) such that

$$\begin{pmatrix} p^1 \\ p^2 \\ p^3 \end{pmatrix} = \begin{pmatrix} \cos\Omega\tau, & \sin\Omega\tau, & 0 \\ -\sin\Omega\tau, & \cos\Omega\tau, & 0 \\ 0, & 0, & 1 \end{pmatrix} \begin{pmatrix} P^1 \\ P^2 \\ P^3 \end{pmatrix},$$

$$q = Q,$$

and boundary conditions are taken to be

$$p^1(0) = p^2(0) = p^3(0) = 0,$$

$$Q(0) = -w^0 = -mc \;(<0).$$

We have namely started from resting state of negative energy The notations have been defined by

$$a = g/c, \qquad b = aH_1 = aE_1,$$

and $\qquad d = aH_0 + \Omega.$

We have also applied electromagnetic field of (4−8) and gravitational field of.

$$G = (0,\ 0,\ -g). \qquad (5-4)$$

We can realize an initial condition of negative energy with the fequency condition of (4−12). We find energy of external gravitational field to flow into the system by.

$$\frac{dw}{dt} = \frac{mc\dfrac{dw}{d\tau}}{mc\dfrac{dt}{d\tau}} = \frac{mc^2\dfrac{dQ(\tau)}{d\tau}}{Q(\tau)}$$

$$= \frac{mc^2[\,a(a^2+b^2+d^2)\,sh\,a\tau + d\,b^2\sin d\tau\,]}{[\,(a^2+b^2+d^2)\,ch\,a\tau - b^2\cos d\tau\,]}$$

$$= mc^2 \frac{[\, a(a^2+b^2+d^2)\ \mathrm{th}\, a\tau + d b^2 \sin d\tau\ \mathrm{sech}\, a\tau \,]}{(a^2+b^2+d^2) - b^2 \cos d\tau\ \mathrm{sech}\, a\tau}$$

$$\longrightarrow mgc\ (\tau \to \infty), \qquad (5-5),$$

after longer driving. Stress energy of gravitation (Ref 40) of $W = -g^2/8\pi k$,
($\approx 5.4 \times 10^{11}$ ergs/cm^3 on the surface of the earth) is consumed.

(5−3) Behaviours of the Second Order and Third Derivative of Time

If we apply

$$f = \frac{dp}{d\tau}$$

to Lorentz invariant Heisenbergean Eqn. of (3−19). and make use of relativistic commutation relations of (4−4), we obtain electromagnetic behaviour of second order of four momentum of the system concerned

$$\frac{d^2 p}{d\tau^2} = \alpha^2\, [\, (P \times H) \times H + q\, (E \times H) + (p \cdot E)\, E \,],$$

$$\frac{d^2 q}{d\tau^2} = \alpha^2\, [\, (P \times H) \cdot E + q\, E^2 \,], \qquad (5-6)$$

the second set of which becomes

$$mc \frac{d^3 t}{d\tau^3} = \alpha^2 [\, (P \times H) \cdot E + q\, E^2 \,],$$

replacing q with $mc\dfrac{dt}{d\tau}$.

This implies behaviours of the third derivative of time, where τ should be thought to be invariant time (the fifth variable) of Enatsu's (Ref 41). (mc^2 times) velocity of time with respect to the geodetic is nothing but energy on the zeroth hyper surface (ordinary physical), but will directly be behaviours of time (See time reversing machine).

§ 6 Several Relativistic Problems

(6 − 1) Four Dimensional Kepler's Problem

Relativistic Eqn. of motion of

$$m \frac{d^2 x}{d\tau^2} = f \,, \qquad (6-1)$$

with $\quad x = (x^1, \; x^2, \; x^3, \; x^4)$

$\qquad\quad = (x, \; y, \; Z, \; u),$

and $\quad f = (f^1, \; f^2, \; f^3, \; f^4)$

leads us to

$$\frac{d^2 r}{d\tau^2} - r\left[\left(\frac{d\theta}{d\tau}\right)^2 + \left(\frac{d\varphi}{d\tau}\right)^2 \sin^2\theta + \left(\frac{d\Psi}{d\tau}\right)^2 \sin^2\theta \right.$$

$$\left. \times \sin^2\varphi\right] = -\frac{kM}{r^2} \,,$$

$$\frac{d}{d\tau}\left(r^2 \frac{d\theta}{d\tau}\right) - r\left[r\left(\frac{d\varphi}{d\tau}\right)^2 \sin\theta \cos\theta + r \right.$$

$$\left. \times \left(\frac{d\Psi}{d\tau}\right)^2 \sin\theta \cos\theta \sin^2\varphi\right] ,$$

$$\frac{d}{d\tau}\left(r^2 \sin^2\theta \frac{d\varphi}{d\tau}\right) - r^2 \sin^2\theta \sin\varphi \cos\varphi \left(\frac{d\Psi}{d\tau}\right)^2 = 0 \,,$$

$$\frac{d}{d\tau}\left(r^2 \sin^2\theta \sin\varphi \frac{d\Psi}{d\tau}\right) = 0 \,, \qquad (6-3)$$

if we put $\quad f_r = -\dfrac{kM}{r^2} \,,$

$$f_\theta = f_\varphi = f_\Psi = 0 \,, \qquad (6-2)$$

and make use of space-time polar co-ordinate (r, θ, φ, of (2 − 2). Space-time gravitational potential of $-\frac{\mu}{r}$ ($r^2 = x^2 + y^2 + Z^2 + u^2$) has been introduced by Eanat (Ref 41). (6 − 3) is nothing but fundamental Eqn. of space-time Kepler's problem and a generalization of in three dimensional space (Ref 42). The last set of Eqn. states conservation of axial angular momentum.

(6−2) Lorentz Transformation of Impedance

A telegraphic Eqn. (Ref 43) reads

$$(\boldsymbol{L} \frac{\partial^2}{c^2 \partial t^2} + c_0 \boldsymbol{R} \frac{\partial}{c \partial t} - \frac{1}{c_0} \frac{\partial^2}{\partial x^2}) \boldsymbol{I} = 0 , \qquad (6 - 4)$$

Where L, c_0 and R are impedance par unit length of transmission line. (A) Maxwellean Eqn. is invariant in electromagnetic medium in terms of electric permeability and magnetic. (B) Total angular momentum wave Eqn. of (1−1) and (1−2) are invariant in terms of six spin, while it is natural that a telegraphic Eqn. should be invariant under Lorentz transformation when we observe the medium to be composed of impedance. The telegraphic Eqn. may easily be found to have the form

$$\{ \gamma (\boldsymbol{L}' - \frac{\beta^2}{C_0'}) \frac{\partial^2}{c^2 \partial t^2} + \boldsymbol{R}' \frac{\partial}{c \partial t} - \gamma (\frac{1}{c_0'} - \beta^2 \boldsymbol{L}') \frac{\partial^2}{\partial x^2}$$

$$- \beta [\boldsymbol{R}' + 2 \gamma (\boldsymbol{L}' \frac{1}{C_0'}) \frac{\partial}{c \partial t}] \frac{\partial}{\partial x} \} \boldsymbol{I} = 0 , \qquad (6 - 5)$$

since four derivative enjoys Lorentz transformation of(1 −12). We must have the relation of

$$\boldsymbol{L}' = \frac{\gamma}{1 + \beta^2} (\boldsymbol{L} + \frac{\beta^2}{C_0}) ,$$

$$\frac{1}{C_0'} = \frac{\gamma}{1 + \beta^2} (\frac{1}{C_0} + \beta^2 \boldsymbol{L}) ,$$

$$\boldsymbol{R}' = \boldsymbol{R} , \qquad (6 - 6)$$

so that (6−5) may coincide with (6 −4). (6−6) is nothing but Lorentz transformation of impedance. γ stands for Lorentz factor of $\gamma = \frac{1}{\sqrt{1 - \beta^2}}$.

(6 − 3) Super Singnal Lorentz Transformation

(6 − 3 − 1) Ultra Dynamics upon the First Hyper Surface.

Infinitesimal space element in three dimensional space is expressed with $dx\,dy\,dz$,

and is closed by six infinitesimal plane elements of ($dydz$, that confronting surface), ($dzdx$, that confronting) and ($dxdy$, that confronting), while Minkowskean infinitesimal space-time element is specified by

$$dx\,dy\,dz\,du \;(u = x^4 = ict),$$

and is closed by eight infinitesimal hyper surface elements of ($dydzdu$, that confronting hyper surface), ($dzdu \times dx$, that comfronting), ($dudxdy$, that confronting) and ($dxdydz$, that confronting) as shown in Fig. 1:

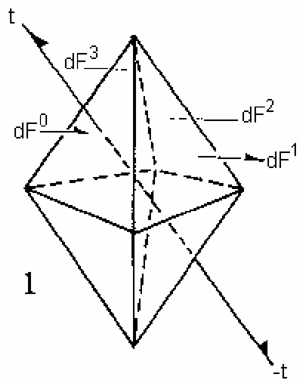


Fig. 1

We have called a section of Minkowskean space-time <hyper surface> (Ref 14, 15) in comparison with infinitesimal space-time element although it is essentically a solid.

The hyper surface composed with

$$dF^0 = dx\,dy\,dz\,,$$

is called the zeroth hyper, to which time axis is orthogonal. This is Ordinary Physical Space, on which most of physical observations are performed. Lorentz transformation on the zeroth hyper surface (Ordinary Physical Space) was furnished with

$$x' = (x - Vt) / \sqrt{1 - \beta^2}\,,$$
$$y' = y\,, \qquad z' = z\,,$$

(6−3−1) Ultra Dynamics upon the First Hyper Surface

$$t' = (t - \frac{V}{c^2} x) / \sqrt{1-\beta^2} \ , \qquad (6-7)$$

with $\beta = \frac{V}{C}$.

We have widely known that a mass can not exceed the signal velocity on that hyper plane(Ordinary Physic?l Space) where that <proper time> (Ref 20) is determined by

$$d\tau = \sqrt{1-\beta^2} \ dt . \qquad (6-8)$$

Generally speaking, physical phenomena on the other hyper surface must be present. For instance, we can think of <the first hyper surface>, onto which (dy dz du) x axis is orthogonal, and where the role of x is replaced by that on the zeroth (Ordinary Physical Space), (Ref 14, 15). On that plane the history of a person is observed along t axis which corresponds with x axis on the zeroth hyper surface (Ordinary P Physical Space) as shown in Fig. 2.

Fig. 2

(See the corresponding leaf.)

Proper time of a mass may easily be found to have the form

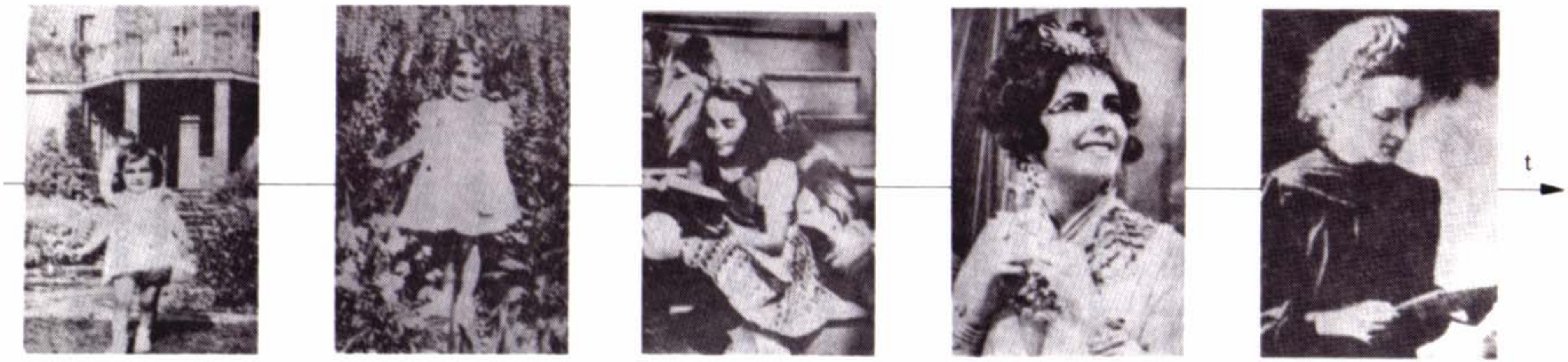
$$d\tau' = \sqrt{1 - c^2 \left(\frac{dt}{dx} \right)^2} \cdot \frac{dx}{c} \ , \qquad (6-9)$$

$$= \sqrt{1 - \left(\frac{C}{V} \right)^2} \cdot \frac{dx}{c} \ , \qquad (6-10)$$

if we replace dt by dx in (6−8). We have emphasized that V is anything but inverse of velocity by explicitely writing as $\frac{dt}{dx}$.

(6−3−2) Lorentz Transformation on the First Hyper Surface (Super signal Lorentz Transformation)

Thus, (6−10) is physically meaningfal only to $C < V$, and Lorentz factor becomes $\gamma' = \frac{1}{\sqrt{1-\left(\frac{C}{V}\right)^2}}$,



(Fig. 2)

1

(History of entities is observed along time axis on the 1st hyper surface corresponding with x axis on the zeroth hyper surface (ordinary physical

(6 − 3 − 2) Lorentz Transformation on the First Hyper Surface (Super Signal Lorentz Transformation)

We namely derive Lorentz transformation on that plane by replacing the role of t by that of x, such that

$$t' = (t - \frac{x}{V}) / \sqrt{1 - (\frac{c}{V})^2} = (t - \frac{dt}{dx} \cdot x) / \sqrt{1 - (\frac{c\,dt}{dx})^2}$$

$$z' = z, \qquad y' = y,$$

$$x' = (x - \frac{c^2 t}{V}) / \sqrt{1 - (\frac{c}{V})^2} = (x - c^2 t \cdot \frac{dt}{dx}) / \sqrt{1 - (\frac{c\,dt}{dx})^2} \qquad (6-11)$$

which is physically meaningful only when a mass is super signal. We also verify that $x'^2 + y'^2 + z'^2 + c^2 t'^2 = x^2 + y^2 + z^2 - c^2 t^2 =$ constant. We have emphatically remarked the same fact as in (6−9) by expressing $V = \frac{dx}{dt}$, explicitely. <The first hyper surface> is nothing but the plane on which super signal phenomena can be described. The component T^{1k} of energy momentum tensor has been the quantity which belongs to that plane.

(6−3−3) Hyper Energy

Energy is nothing but (c times) momentum along time on the zeroth hyper surface (Ordinary Physical Space), such that

$$W = mc^3 \frac{dt}{ds} = \pm mc^3 \cdot \frac{dt}{c\sqrt{1-\beta^2}dt}$$

$$= \pm \frac{mc^2}{\sqrt{1-\beta^2}},$$

which has, in other terms, been (c times) momentum along normal onto that plane. We can therefore, define energy on the first hyper surface of

$$W = c\,p^x = mc\frac{dx}{d\tau} = mc^2 / \sqrt{1 - (\frac{c}{v})^2}, \qquad (6-12)$$

as (c times) momentum along that normal of x axis.
This can be developed by Laurent expansion (Ref 22) as

$$= mc^2 [\, 1 + \frac{1}{2} (\frac{c}{v})^2 + \cdots\cdots \,], \qquad (6-13)$$

inside light cone (Ref 21).
Direct application of definition of energy on the zeroth hyper surface (Ordinary Physical Space) to the first can not furnish a beautiful formula.

§ 7 Multi-harmonic Equation

(7−1) Potentials to Stress Tensor

Equilibrium of internal force in three dimensional isotropic elastic medium reads (Ref 6)

$$\partial_k f^{jk} = 0, \qquad (7-1)$$

(contracted over k)

where f^{jk} strands for three dimensional stress tensor with

$$f^{jk} = f^{kj}$$

(j and k = 1 ~ 3).

They are associated with ordinary expression with

$$\sigma_x = f^{11}, \quad \sigma_y = f^{22}, \quad \sigma_z = f^{33},$$

$$\tau_{yz} = f^{23}, \quad \tau_{zx} = f^{31}, \quad \tau_{xy} = f^{12}. \qquad (7-2)$$

We may take stress potential of φ^1, φ^2, and φ^3 (Ref 7) such that

$$f^{jj} = -(\partial_k^2 \varphi^m + \partial_m^2 \varphi^k)$$

(j, k and m = 1, 2 and 3, cyclic),

$$f^{jk} = \partial_j \partial_k \varphi^m \quad (j \neq k \neq m), \qquad (7-3)$$

so that (7−1) may identically be satisfied, or

$$\sigma_x = -\left(\frac{\partial^2 \varphi^3}{\partial y^2} + \frac{\partial^2 \varphi^2}{\partial z^2}\right),$$

$$\sigma_y = -\left(\frac{\partial^2 \varphi^1}{\partial z^2} + \frac{\partial^2 \varphi^3}{\partial x^2}\right),$$

$$\sigma_z = -\left(\frac{\partial^2 \varphi^2}{\partial x^2} + \frac{\partial^2 \varphi^1}{\partial y^2}\right),$$

$$\tau_{yz} = \frac{\partial^2 \varphi^1}{\partial y \partial z},$$

$$\tau_{zx} = \frac{\partial^2 \varphi^2}{\partial z \partial x},$$

$$\tau_{xy} = \frac{\partial^2 \varphi^3}{\partial x \partial y}. \qquad (7-4)$$

(7−1) Potentials to Stress Tensor

On the other hand, stress potential is associated with displacement potential by the relation of

$$\varphi^m(\vec{r}) = G[\Psi^j(\vec{r}) + \Psi^k(\vec{r})] + X(x^m), \qquad (7-7)$$

in recourse to fundamental Eqn. of elasticity of

$$f^{jk} = G(\partial_j e^k + \partial_k e^j), \quad (j \neq k) \qquad (7-6)$$

if we take displacement potential Ψ of

$$\Psi = (\Psi^1, \Psi^2, \Psi^3)$$

with $\quad e = (\partial_1 \Psi^1 \quad \partial_2 \Psi^2 \quad \partial_3 \Psi^3). \qquad (7-5)$

$$e = (e^1, e^2, e^3) \quad \text{and} \quad 2G = mE/(m+1)$$

mean displacement and modulus of shearing elasticity, respectively. m and E are Poisson's number and modulus of longitudinal elasticity, respectively, with

$$r = (x^1, x^2, x^3).$$

The function $X(x^m)$ only depends upon x^m. We shall suppose that $\quad \Psi^j \to 0,$

when $\quad r \to \pm\infty. \qquad$ Then, $\quad X(x^m) \equiv 0.$

We accordingly obtain

$$2G\Psi^j = \varphi^k + \varphi^m - \varphi^j,$$

namely

$$2G\Psi^1 = \varphi^2 + \varphi^3 - \varphi^1,$$
$$2G\Psi^2 = \varphi^3 + \varphi^1 - \varphi^2,$$
$$2G\Psi^3 = \varphi^1 + \varphi^2 - \varphi^3. \qquad (7-8)$$

(7−2) Tri-harmonic Stress Function

Putting (7−8) into fundamental Eqn. of elasticity of

$$\varepsilon^j = \partial_j e^j = \frac{1}{E}\left[\sigma^j - \frac{\sigma^k + \sigma^m}{m}\right],$$

(not contracted over k)

we obtain a secular Eqn. of

$$\begin{pmatrix} \partial_1^2 + \Delta/m, & -(\partial_3^2+\partial_1^2), & -(\partial_1^2+\partial_2^2) \\ -(\partial_2^2+\partial_3^2), & \partial_2^2+\Delta/m, & -(\partial_1^2+\partial_2^2) \\ -(\partial_2^2+\partial_3^2), & -(\partial_3^2+\partial_1^2), & \partial_3^2+\Delta/m \end{pmatrix} \begin{pmatrix} \varphi^1 \\ \varphi^2 \\ \varphi^3 \end{pmatrix} = 0 .$$

We namely derive

$$\frac{(m+1)(1-m^2)}{m^3} \Delta^3 \varphi^j = 0, \qquad (7-10)$$

$$(j = 1, \ 2 \ \text{and} \ 3),$$

which leads us to

$$\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}\right)^3 \varphi^j = 0, \qquad (7-11)$$

except in the case where $m = 1$.

(7−11) can be rearranged in the form of ,

$$\left(\frac{\partial^6}{\partial x^6} + \frac{\partial^6}{\partial y^6} + \frac{\partial^6}{\partial z^6} + 3\frac{\partial^6}{\partial x^4 \partial y^2} + 3\frac{\partial^6}{\partial x^2 \partial z^4}\right.$$

$$+ 3\frac{\partial^6}{\partial x^2 \partial y^4} + 6\frac{\partial^6}{\partial x^2 \partial y^2 \partial z^2} + 3\frac{\partial^6}{\partial x^2 \partial z^4}$$

$$\left. + 3\frac{\partial^6}{\partial y^4 2 z^2} + 3\frac{\partial^6}{\partial y^2 \partial z^4}\right) \varphi^j = 0 , \qquad (7-12)$$

Which is nothing but three dimensional extension of Airy's bi-harmonics (partial differential Eqn. of the fourth order) (Ref 8) and can, therefore, be called Tri-harmonic Eqn. (that of the sixth order). There are six unknowns of f^{jk} and as many Eqn. of (7−1) and (7−11). Stress components can uniquely be determined by chosing three independent solutions of (7−11). Plane harmonics has the single potential. Three canponents of potential are, however, necessary in the theory of three dimensional elasticity, according to which partial differential Eqn. of the sixth order appears.

(7 — 3) Elasticity of Electromagnetic Ether

Multi-harmonics of the sixth order is found to appear in the former section to six components of stress and shearing stress. There are, however, sixteen components of tensor of internal force in Minkowskean space-time. In this case, fundamental Eqn. also enjoys higher order since components of stress potential increase. Preceding the examination of that Eqn. we must reveal elasticity along (axis of) time.
Let two magnetic charges with opposite sign and bound with magnetic lines of force be present in electromagnetic space governed by Maxwellean Eqn. That lines of force would shrink longitudinally and elongate laterally. Let two electric charges with the identical sign and bound with electric lines of force further be present. They are repelled each other, and that lines of force would elongate longitudinally and shrink laterally. This is the so-called elasticity of background ether of electromagnetic field. There, however, arises a very puzzling question

(Q) : What is the difference between elasticity with respect to magnetic field and that to electric ? Three dimensional elasticity will be sufficient with the former only. The answer would be furnished by

(A) : Magnetic elasticity has been only spatial, electric elasticity, however, implies that of ether along time, because magnetic fields are spatial components of electromagnetic tensor, while electric those concerned with time.
We may, therefore, introduce modulus of longitudinal elasticity per unit volume of hyper seerface by

$$\partial_j e^j = \varepsilon^j = \frac{1}{E} \left(f^{jj} - \frac{f^{kk} + f^{mm} + f^{nn}}{m} \right)$$

(not contracted over j) , (7 — 1 3)

where f^{jk} stands for k-th component of stress upon < the j-th hyper surface >. ε^j are strains in x^j sense. The latter terms mean lateral contribution of f^{kk}, f^{mm} and f^{nn}.

$$e = (e^1 , e^2 , e^3 , e^4)$$

denote space-time displacement. We also derive fundamental Eqn. on space-time elasticity of

$$f^{jk} = G\,(\partial_j e^k + \partial_k e^j)\,, \qquad (7-15) \qquad (j \neq k,\ \text{three Eqn.})$$

if we perform observations with co-ordinate fixed upon electric lines of force, where G of,

$$2G = \frac{mE}{m+1}\,, \qquad (7-16)$$

stands for modulus of shearing elasticity upon hyper surfaces. Thirdly we introduce displacement potential of

$$\Psi = (\Psi^1,\ \Psi^2,\ \Psi^3,\ \Psi^4)\,, \quad \text{by} \quad e = (\partial_1 \Psi^1,\ \partial_2 \Psi^2,\ \partial_3 \Psi^3,\ \partial_4 \Psi^4). \qquad (7-17)$$

On the other hand, we define stress potential φ^{jk} (six components) by

$$f^{jj} = -\,(\partial_k^2 \varphi^{mn} + \partial_m^2 \varphi^{nk} + \partial_n^2 \varphi^{mk})\,,$$

$$f^{jk} = \partial_j \partial_k \varphi^{mn} \quad (j \neq k \neq m \neq n) \qquad (7-19)$$

so that equilibrium of stress of,

$$\partial_k f^{jk} = 0\,, \qquad (7-18)$$

when no volumetric (four dimensional) force is present. Elliminating Ψ with (7−13), (7−17) and (7−19), we obtain a secular Eqn. of

$$\begin{pmatrix} (b+c)(d+a), & b(\square-a)-mcd, & c(\square-a)-mbd, & -m(b+c)^2, & c(\square-d)-mab, & b(\square-d)-mca \\ a(\square-b)-mcd, & (d+b)(c+a), & c(\square-b)-mda, & c(\square-a)-mab, & -m(c+a)^2, & a(\square-d)-mbc \\ a(\square-c)-mbd, & b(\square-c)-mda, & (a+b)(c+d), & b(\square-d)-mca, & a(\square-d)-mbc, & -m(a+b)^2 \\ -m(d+a)^2, & d(\square-c)-mab, & a(\square-b)-mca, & (d+a)(b+c), & a(\square-b)-mcd, & a(\square-c)-mdb \\ d(\square-c)-mab, & -m(d+b)^2, & d(\square-a)-mbc, & b(\square-a)-mdc, & (c+a)(b+d), & b(\square-c)-mda \\ d(\square-b)-mca, & d(\square-a)-mbc, & -m(c+d)^2, & c(\square-a)-mbd, & c(\square-b)-mda, & (a+b)(c+d) \end{pmatrix} \begin{pmatrix} \varphi^{23} \\ \varphi^{31} \\ \varphi^{12} \\ \varphi^{41} \\ \varphi^{42} \\ \varphi^{43} \end{pmatrix} = 0\,,$$

with $a+b+c+d = \square$, and

$$a = \partial_1^2, \quad b = \partial_2^2, \quad c = \partial_3^2 \quad \text{and} \quad d = \partial_4^2\,.$$

We further derive $(\det\beta)\ \varphi^{jk}=0,$ (7−21)

rearranging it so that it may be symmetrical, where

$$\beta=\begin{pmatrix} -m(a+b)^2, & a(\square-d)-mbc, & b(\square-d)-mca, & (a+b)(c+d), & b(\square-c)-mda, & a(\square-c)-mbd, \\ a(\square-d)-mbc, & -m(c+a)^2, & c(\square-d)-mab, & c(\square-b)-mda, & (d+b)(c+a), & a(\square-b)-mcd, \\ b(\square-d)-mca, & c(\square-d)-mab, & -m(b+c)^2, & c(\square-a)-mbd, & b(\square-a)-mcd, & (b+c)(d+a), \\ (a+b)(c+d), & c(\square-b)-mda, & c(\square-a)-mbd, & -m(c+d)^2, & d(\square-a)-mbc, & d(\square-b)-mca, \\ b(\square-c)-mda, & (c+a)(d+b), & b(\square-a)-mdc, & d(\square-a)-mbc, & -m(d+b)^2, & d(\square-c)-mab, \\ a(\square-c)-mdb, & a(\square-b)-mcd, & (d+a)(b+c), & d(\square-b)-mca, & d(\square-c)-mab, & -m(d+a)^2 \end{pmatrix},$$

with $\beta^{jk}=\beta^{kj}$

(Ref. 27). det β finally loads us to a beautiful relation of

$$8\,(m+1)^5\,(m-2)\,(\partial_1\partial_2\partial_3\partial_4)^4\,\square^4\varphi^{jk}=0, \qquad (7-22)$$

after some complicated arithmeties presented in appendix.

It naturally holds that $0<m$, and we obtain

$$\square^4\ (\partial_1\partial_2\partial_3\partial_4)^4\ \varphi^{jk}=0, \qquad (7-23) \qquad \text{for} \quad m\neq 2.$$

The factor of differentiations of $(\partial_1\partial_2\partial_3\partial_4)^4$ can be taken off if we suppose that stress vanishes at (four dimensionally) infinity. We finally arrive at

$$\square^4\ \varphi^{jk}(x)=0, \qquad (7-24)$$

in which static field is described by $\Delta^4\ \varphi^{jk}\ (x,\ y,\ z)=0.$ (7−25)

This is called Tetra-harmonic Eqn. (Ref. 27) and a further extension of tri-harmonic Eqn. of

$$\Delta^3\ \varphi^j\ (x,\ y,\ z)=0. \qquad (7-11)$$

(7−4) Explicit Representation of Components of Energy Tensor

We first start from Airy's bi-harmonic Eqn. of,

$$\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}\right)^2 \varphi(x, y)=0, \tag{A}$$

which is secondly extended into tri-harmonic Eqn. of,

$$\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}+\frac{\partial^2}{\partial z^2}\right)^3 \varphi^j(x, y, z)=0. \tag{B}$$

(B) has further been generalized into tetra-harmonic of,

$$\left(\frac{\partial^2}{\partial x^2}+\frac{\partial^2}{\partial y^2}+\frac{\partial^2}{\partial z^2}-\frac{1}{c^2}\frac{\partial^2}{\partial t^2}\right)^4 \varphi^{jk}(x)=0, \tag{C}$$

which are interesting proccesses.

(7−4) Explicit Representation of Components of Energy Tensor

A particular solution to (7−25) in static Maxwellean field of stress is given by $\varphi^{jk}(x, y, z)=AR^5$, (7−27)
with $R^2=x^2+y^2+z^2$, by solving

$$\left[\frac{1}{R^2}\frac{\partial}{\partial R}\left(R^2\frac{\partial}{\partial R}\right)\right]^4 \varphi^{jk}(x, y, z)=0, \tag{7−26}$$

in recourse to

$$\Delta=\frac{1}{R^2}\frac{\partial}{\partial R}\left(R^2\frac{\partial}{\partial R}\right)-\frac{L^2}{R^2}.$$

where L^2 stands for axial angular momentum operator of

$$L^2=-\frac{1}{\sin\varphi}\frac{\partial}{\partial\varphi}\left(\sin\varphi\frac{\partial}{\partial\varphi}\right)-\frac{1}{\sin^2\varphi}\frac{\partial^2}{\partial\Psi^2},$$

with

$$x=R\sin\varphi\cos\Psi,$$
$$y=R\sin\varphi\sin\Psi,$$
$$z=R\cos\varphi.$$

A is normalization constant. Elementary solutions are generally determined by

$$\varphi^{jk}_{mnpq}=A\left(\frac{\partial}{\partial x}\right)^m\left(\frac{\partial}{\partial y}\right)^n\left(\frac{\partial}{\partial z}\right)^p\left(\frac{\partial}{\partial u}\right)^q R^5 \tag{7−28}$$

(7−4) **Explicit Representation of Components of Energy Tensor**

We shall take φ^{mn} to be $\qquad \varphi^{mn}=A\,(\partial_m^6+\partial_m^6)\,R^5.$

Then, explicit representations of energy momentum tensor are furnished by

$$T^{jk}=f^{jk}=A\partial_j\partial_k\,(\partial_m^6+\partial_n^6)\,R^5\,,$$
$$T^{jj}=f^{jj}=-A[\,\partial_k^2\,(\partial_m^6+\partial_n^6)+\partial_m^2\,(\partial_n^6+\partial_k^6)+\partial_n^2\,(\partial_m^6+\partial_k^6)]R^5 \qquad (7-29)$$

which leads us to those of stress (energy) tensor of,

$$T^{11}=-45A\,\{4/R^3-(17x^2+6y^2+17z^2)/R^5+[17x^4+25y^2$$
$$\times(z^2+x^2)+20z^2x^2+17z^4]/R^7+7[2(2x^2+10y^2$$
$$+5z^2)z^2x^2-y^2(z^4+x^4)-2z^2x^2\times(z^2+x^2)]/R^9$$
$$+63z^2x^2[2z^2x^2+y^2(z^2+x^2)]/R^{11}\}\,,$$

$$T^{22}=-45A\,\{4/R^3-(17y^2+6z^2+17x^2)/R^5+[17y^4+25z^2$$
$$\times(x^2+y^2)+20x^2y^2+17x^4]/R^7+7[2(2y^2+10z^2$$
$$+5x^2)x^2y^2-z^2(x^4+y^4)-2x^2y^2\times(x^2+y^2)]/R^9$$
$$+63x^2y^2[2x^2y^2+z^2(x^2+y^2)]/R^{11}\}\,,$$

$$T^{33}=f^{33}=-45A\,\{4/R^3-(17z^2+6x^2+17y^2)/R^5+[17z^4$$
$$+25x^2(y^2+z^2)+20y^2z^2+17y^4]/R^7+7[2(2z^2+10x^2$$
$$+5y^2)y^2z^2-x^2(y^4+z^4)-2y^2z^2\times(y^2+z^2)]/R^9$$
$$+63y^2z^2[2y^2z^2+x^2(y^2+z^2)]/R^{11}\}\,,$$

$$T^{44}=f^{44}=-45A\,\{-28/R^3+2[17(x^4+y^4+z^4)+35(y^2z^2$$
$$+z^2z^2+x^2y^2)]/R^7+7[(y^2z^4+z^2x^4+x^2y^4)+78x^2y^2z^2$$
$$+7(y^4z^2+z^4x^2+x^4y^2)]/R^9+126(y^4z^4+z^4x^4+x^4y^4)$$
$$/R^{11}\}\,,$$

$$T^{23}\,(=T^{32})=f^{23}\,(=f^{32})=-\frac{45Ayz}{R^7}\times[5(y^2+z^2)-2x^2]$$
$$-(63x^4/R^4)(y^2+z^2)]\,,$$

(7 − 4) Explicit Representation of Components of Energy Tensor

$$T^{31}(=T^{13})=f^{31}(=f^{13})=-(45\,AzX/R^7)\times\{12\,R^2-5\,[\,3\,(z^2+x^2)-8\,y^2\,]-(14\,y^2/R^2)\times[\,5\,(z^2+x^2)-2\,y^2\,]-(63\,y^4/R^4)(z^2+x^2)\}\,,$$

$$T^{12}(=T^{21})=f^{12}(=f^{21})=-(45\,Axy/R^7)\times\{12\,R^2-5\,[\,3\,(x^2+y^2)-8\,z^2\,]-(14\,z^2/R^2)[\,5\,(x^2+y^2)-2\,z^2\,]-(63\,z^4/R^4)(x^2+y^2))]\}\,,$$

and the remainings of

$$T^{41}(=T^{14})=f^{41}(=f^{14})=T^{42}(=T^{24})=f^{42}(=f^{24})=T^{43}(=T^{34}=f^{43}(=f^{34})=0\quad \text{(Ref. 28)}.$$

Each of the components of Maxwellean stress is identical with that of the corresponding energy momentum tensor.

§8 Loss of Weight

(8−1) Energy Density of G-field

Stress energy of gravitation of,

$$W = -\frac{g^2}{8\pi k}, \qquad (8-1)$$

is contained in unit volume of the zeroth hyper surface (Ordinary Physical Space) in Riemannean space (Ref. 44) near a planet (Ref. 40).

It particularly reduces to

$$\approx -5.4 \times 10^{11}\ \mathrm{ergs/cm^3} \qquad (8-2)$$

upon the surface of the Earth since

$$g = 980\ \mathrm{cm/sec^2}$$

which is about identical with stress one $(-\frac{E^2}{8\pi k})$ of electric field of

$$E = 8.8 \times 10^8\ \mathrm{V/cm},$$

and is about **ten thousand times ordinary stress energy of magnetization.**

This is present not only at the palace but also at the old Black Joe's cabin, and can become energy source which is **more general than that with Nuclear Fusion.**

(8−2) Moebius Wound

We shall firstly translate Moebius Band into electric device. The following drawing shows Mobius wound. We shall secondly make a trourus of Moebius wound, which forms Klein Bottle (the following photo).

Photo 38

The next photo shows Moebius Band (educational model, respectively).

(8 2) Moebius Wound
(8 — 3) Loss of G

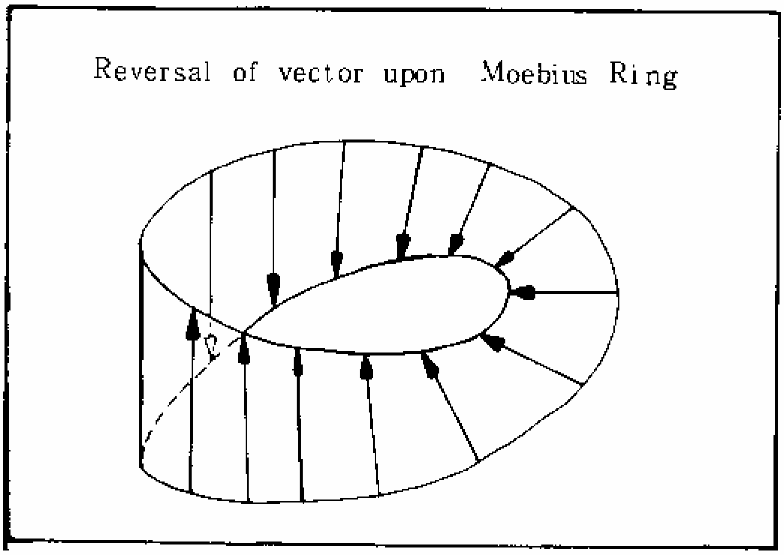


Fig. 92

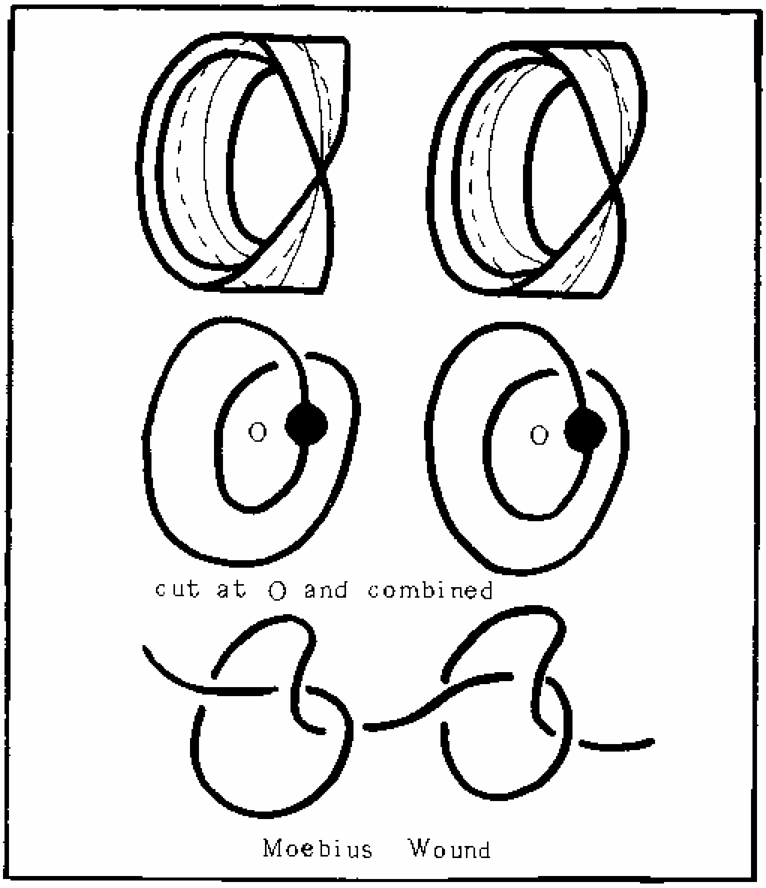
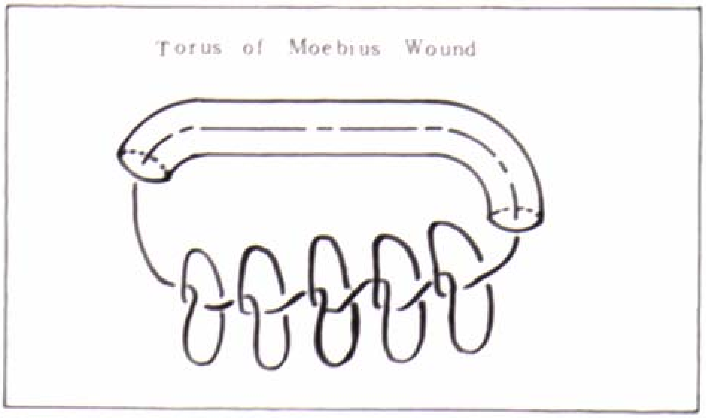
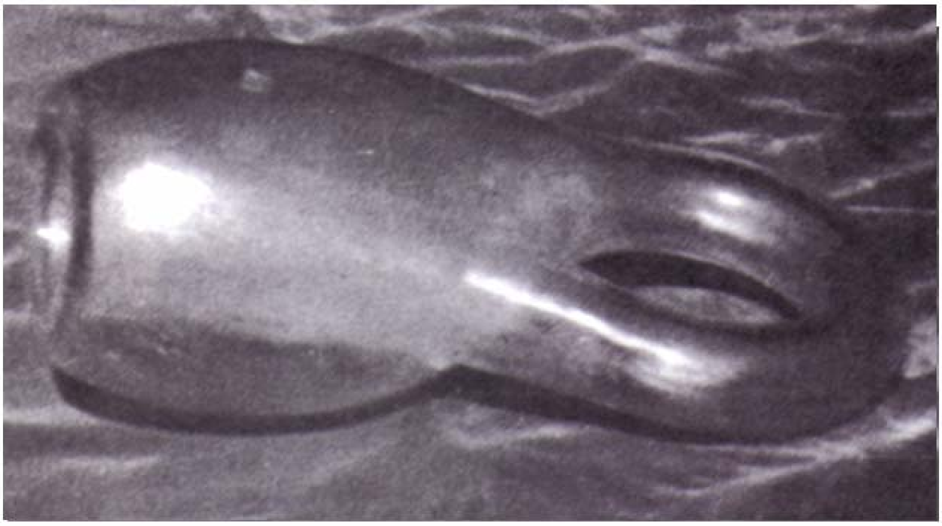


Fig. 93



(Fig. 94)



(Photo 39)

(8-3) Loss of G

We shall feed electric current to Moebius Coil as in the following Fig. Then, Klein Bottle (torus coil) loses weight as on the following table. Experimental specifications are as

Ampere (DC)	Grams
2	− 0. 0 5 9
3	0. 1 2 3
4	− 0. 1 6 9
5	− 0. 2 1 3
6	− 0. 2 9 1

follows／torus coil／17 turns of Moebius wound／／own weight of the coil／about 30 gr／／power supply／regulated (NPS 151D／Dendy)／／Balaner／Ex 200N (200gr Max and resolu-tion of 0.001 gr) (digital).

If we feed about 620 amperes by superconduction, loss of g exceeds the own weight, leviting.

(8−4) Return of History

As tachyon is super signal, it catches past signal. Then, time reverses. The system returns a history (falling path by g), being repelled by g and attaining loss of g.

(Photo 40)

That is to say, we find that tachyon upon the first hyper seerface goes out onto the zeroth (physical space).

For example, the following photo shows − 0. 657 gr of loss. The greater the current, the more the loss.

It attains − 2. 18 gr as the next photo shows when we feed

60A DC to a Moebius coil of 3 turns.

(Photo 41)

Falling mass attains／

$$s = -\frac{g}{2}(2)^2 = -1.960 \ cm$$

at／

$$t = 2 \text{ second},$$

while does

$$s = -1.960 + \frac{g}{2} \times 1^2 = -1,470 \ cm \quad \text{at} \quad t = 3$$

after timereversal of／

$$t = 2 \text{ second}.$$

Fachyon of 2c attains

$$\ell = 20c$$

at／

$$t = 10 \text{ second}$$

while signal does

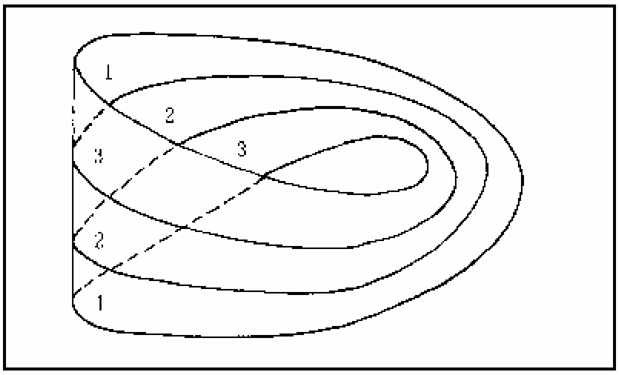
$$\ell = 10c.$$

That tachyon catches a signal of／

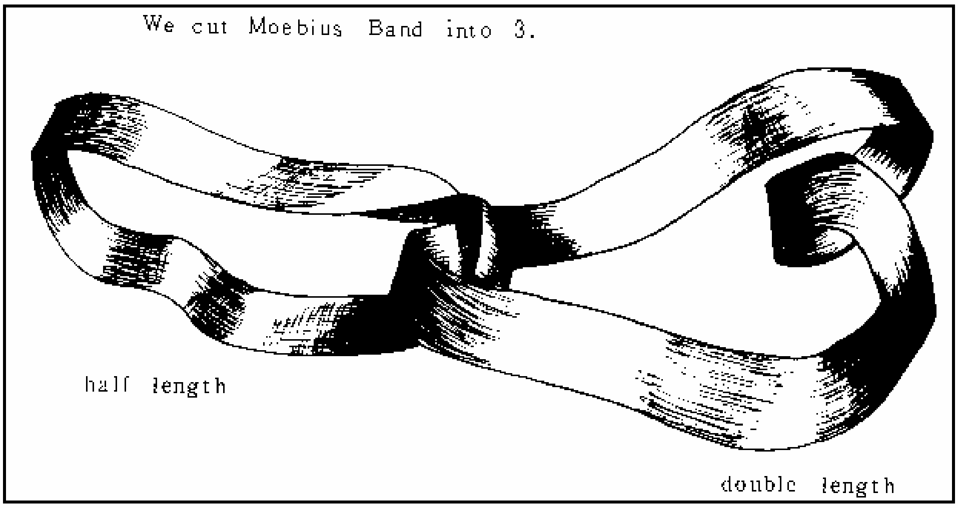
$$t = -10 \text{ second},$$

resulting in time reversal of this system.

Mass is repelled by g, resulting in loss of weight.



(Fig. 95)



(Fig. 96)

Cutting Moebius Strip into 3, we label 1, 2 and 3. The 1 continues onto the 3, the 2 onto itself and the 3 onto the 1. As shown in the following figure, we have 2 strips.

The one is half another. Wave with the velocity of c is on the longer strip, that with the velocity of 2c cannot but be on the short. This reason is why tachyon flows in Moebius Strip (or Moebius wound coil).

(8-5) Growth of State Momentum under G-Deceleration

Four momentum of the atoms of **Barium Strontium Titanate or Ferroxplana** (or Ferrite) grows under circularly polarized electromagnetic field of (4−8) in recourse to (5−4) such that

$$\frac{dp^3}{dt} = \frac{mc\,\dfrac{dp^3}{d\tau}}{mc\,\dfrac{dt}{d\tau}} = \frac{mc\,\dfrac{dp^3}{d\tau}}{Q(\tau)}$$

$$= \frac{mca\,[\,2d^2\cos d\tau + (a^2 - d^2)\,\mathrm{ch}a\tau\,]}{(a^2 + b^2 + d^2)\,\mathrm{ch}a\tau - b^2\cos d\tau}$$

$$= \frac{mca\,[\,(a^2 - d^2) + 2d^2\cos d\tau\,\mathrm{sech}\,a\tau\,]}{(a^2 + b^2 + d^2) - b^2\cos d\tau\,\mathrm{sech}\,a\tau}$$

$$\rightarrow \frac{a^2 - d^2}{a^2 + b^2 + d^2} \times mg \quad (\,\tau \rightarrow \infty\,)\,, \qquad (8\text{–}26)$$

which is invariant under positive value of Q(o). We take Q(o) to be positive since negative Q(o) furnishes negative growth of total energy and, therefore, provokes pair annihilation with ambient atmosphere and it becomes dangerous. The frequency condition is preseribed by

$$\alpha H_0 + \Omega < 0\,, \qquad (8\text{–}27)$$

in which α, H_0 and Ω are coupling constant, vertical magnetic field (static) and rotation frequency of electric field (of Nuclear Electric Resonance), respectively. They are stated of in the fifth chapter. Resultant state four momentum of Barium Strontium Titanate and Ferroxplana (or Ferrite) can be described by (5−1), in which the growth of the third component of resultant state four momentum is determined by

$$\frac{dP^3}{dt} \rightarrow \frac{a^2 - d^2}{a^2 + b^2 + d^2} \cdot \mu g \qquad (\,\tau \rightarrow \infty\,) \qquad (8\text{–}28)$$

μ stands for reduced mass of ferroxplana (or ferrite) m_1 and Barium Strontium Titanate m_2 such that

$$\mu = \frac{m_1 m_2}{m_1 + m_2} \ . \qquad (8\text{–}29)$$

They occupy different positions upon the zeroth hyper surface (physical space) and form reduced mass, on which we stated in appendix (A–4). Growth of momentum reduces to that of current such that

$$\alpha \frac{dP^3}{dt} = \frac{e}{mc} \frac{d}{dt}\left(m \frac{dZ}{d\tau}\right)$$

$$= \frac{d}{dt}\left(\frac{e}{c} \frac{dZ}{d\tau}\right) = \frac{1}{c} \times \frac{dI^3}{dt} \quad , \qquad (8\text{–}30)$$

to the single charged particle, where I^3 means the third component of current. Thus, we reasonably regard growth of generalized current to be,

$$c\,\alpha \frac{dP^3}{dt} = \frac{di^3}{dt} \qquad (8\text{–}31)$$

to generalized flux of state density with coupling constant α of electromagnetic interaction. We namely derive

$$\frac{di^3}{dt} = \frac{\mu\alpha g}{g'} \times \frac{a^2 - d^2}{a^2 + b^2 + d^2} \quad (\tau \to \infty) \ , \qquad (8\text{–}32)$$

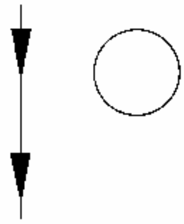
in recourse to (8–28), which is nothing but growth of quantum current with G–deceleration. On the other hand, induction law of Faraday's is given by;

$$\Psi = -\frac{L}{c^2} \times \frac{di^3}{dt} \quad \text{(Ref. 46)} \ .$$

Electric potential across the inductor coupled with mutual inductance L to vertical infinite line (the line along regulated current of P^3) becomes

$$\Psi = -\frac{\alpha L \mu g}{g' c^2} \cdot \frac{a^2 - d^2}{a^2 + b^2 + d^2} \quad . \tag{8-33}$$

Fig. 5



(Faraday's induction is done upon a circle coupled with mutual inductance L to vertical quantum current)

$$\frac{a^2 - d^2}{a^2 + b^2 + c^2} \approx -1$$

holds since

$$a = \frac{g}{c} \ll 1$$

is so small, and we can technologically and easily realize

$$|b| \ll |d| \quad .$$

We finally obtain

$$\Psi = -\frac{\alpha L \mu g}{g' c} \quad (|b| \ll |d|) \tag{8-34}$$

owing to (8-33).

(8-6) Thermodynamical and Statistical Probability

Orientation of four momentum of an atom in space-time can be split into those of axial angular momentum and polar on the zeroth hyper surface (physical space). Then, orientation of a pair of angular momenta(axial one and polar) Ж and Я owns four degrees of freedom in general, but they are orthogonal such that

$$Ж \cdot Я = Я \cdot Ж = 0 \quad . \tag{8-35}$$

Three parameters are, therefore, necessary.

We verified orthogonality with reference to the commutation relations of (4-4).

Let α, β and Ψ be Eulerian angles (in Fig.3) when magnetic field and electric [those of circularly polarized electromagnetic field of (4–8) are orthgonal are x–axis and y, respectively].

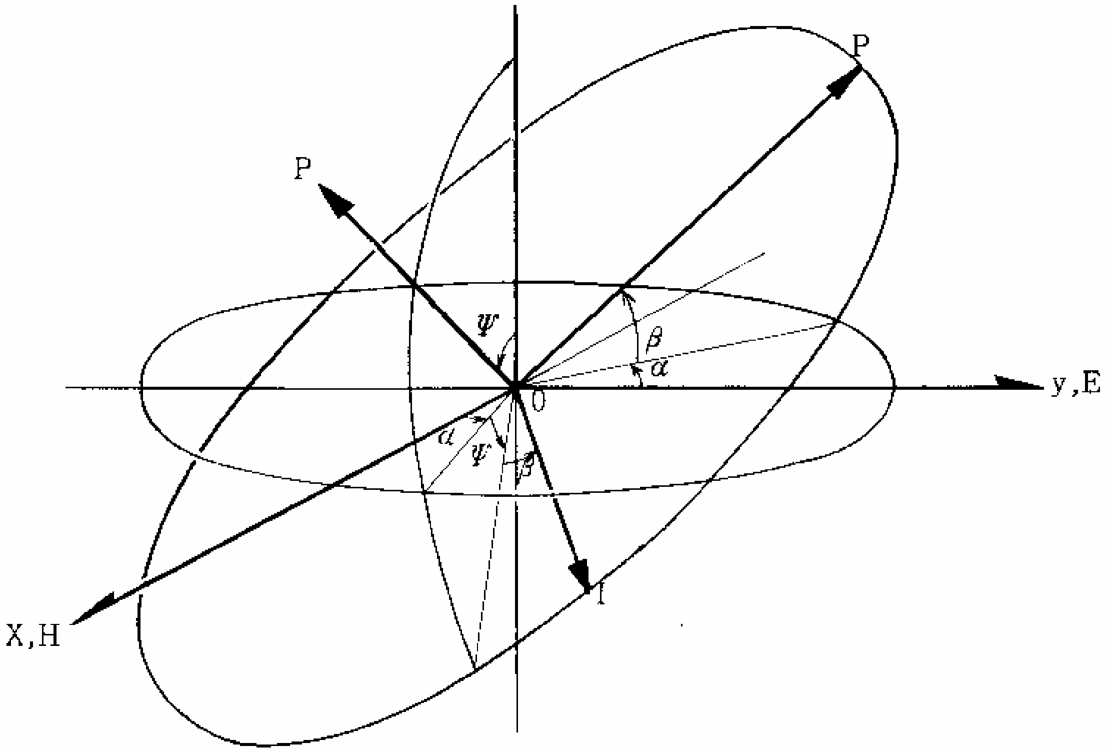


Fig. 3

[Eulerian angles formed by axial angular momentum and polar. See the right leaf.]

Vector producted vector Ж × Я of a pair of angular momenta has been thought to form the angle Ψ with Z axis. Magnetic field and axial angular momentum Ж forms the angle of

$$\cos\theta = \cos\alpha \cos\Psi \cos\beta - \sin\alpha \times \sin\beta \ ,$$

while electric field and polar one do that of,

$$\cos\varphi = -\sin\alpha \cos\Psi \sin\beta + \cos\alpha \cos\beta \ .$$

Our Boltzmannean factor becomes

$$\frac{1}{kT\gamma}\left[(I\,|H|\,\cos\alpha\cos\beta + P\,|E|\,\times\sin\alpha\sin\beta)\cos\Psi - (I\,|H|\,\times\sin\alpha\sin\beta - P|E|\,\cos\alpha\cos\beta)\right] \ ,$$

where $I = \alpha\,|Ж|$, and $P = \alpha\,|Я|$,

Lorentz factor having appeared since Hamiltonian (energy) is given in recourse to (3–13). Performing transformation of,

$$\alpha + \beta = u$$

and $\alpha - \beta = v$, and with reference to integral expressions of modified Bessel function of the lowest order, we find statistical and thermodynamical probability Z of an atom [Also see the appendix (A–7)] of,

$$Z = \frac{\int_0^\pi I_0\left[a(\cos\Psi + 1)\right]\, I_0\left[b(\cos\Psi - 1)\right] \times \sin\Psi\cos\Psi\, d\Psi}{\int_0^\pi I_0\left[a(\cos\Psi + 1)\right]\, I_0\left[b(\cos\Psi - 1)\right] \times \sin\Psi\, d\Psi}$$

in which a and b stand for a pair of Boltzmannean factor of

$$a = \frac{I\,|H|}{kT} \tag{8-37}$$

and

$$b = \frac{P\,|E|}{kT}\,, \tag{8-38}$$

and $I_0(Z)$ in integrand for modified Bessel function of the lowest order, respectively. Amplitudes of axial angular momentum and polar are determined by

$$|Ж| = \sqrt{L(L+1)}\,\hbar\,,$$
$$|Я| = \sqrt{n^2 - 1 - L(L+1)}\,\hbar \tag{2-19}$$

in recourse to ordinary spherical harmonics and ultra spherical harmonics of (2-17), respectively.

(8-7) Locking Magnetic Field

Statistical and thermodynamical probability obtained in the former section is so small to our higest electromagnetic field that we may not manufacture < Möbius Generator (Quantum G-generator). We shall proceed to locking magnetic field in order to cure the difficulty. Circulation of spin density line of force is generated such that

$$Ж_s = \frac{P_3 Z}{r^2} \tag{8-41}$$

Fig. 4

(circulation of spin density line of force)

around momentum flux in recourse to spin induction law of (1-19) by the third component of vector state momentum [See the appendix of (A-3)], where $Ж_s$ stands for circumferential component along a circle of radius r [in Fig.4].

Boltzmannean factor becomes

$$\exp\beta = \exp\frac{\alpha Ж_s h\sqrt{1-\beta^2}}{kT} \tag{8-42}$$

(8–7) Locking Magnetic Field

when real of torus magnetic field ih is applied along this circulation, in which $Ж_S$ means the value to unity degree of freedom. Lorentz factor appears since the relation of (3–10) is present between energy and Lorentz scalar H.

Orientation of the third component of vector state momentum can be evaluated by

$$P'^3(\tau) = P^3(\tau)\, L(\beta) \,, \qquad (8\text{–}43)$$

where $L(\beta)$ is the so-called Langevin function. We namely define in order that $P'^3(\tau)$ may take a maximal value $P^3(\tau)$ in the limit for h to be infinity. We have applied statistics of paramagnetism (Ref.48) to the theory since $Ж_S$ is present outside momentum pillar although Barium Strontium Titanate and Ferrite are ferroelectrics and ferromagnetic subtance, respectively. We have a philosophy that spin density is determined by momentum density while the latter by former, respectively, namely by

$$\mathrm{rot}\, Ж = 4\pi p \,. \qquad (8\text{–}45)$$

What we arrange spin by magnetic field, we do momentum. This effect can experimentally be verified.

Induced electric potential is determined by

$$\Psi = -\frac{\alpha L \mu g}{g'c} L(\beta) \,, \qquad (8\text{–}46)$$

when we take statistical thermodynamics into consideration in recourse to (8–43) and with reference to

$$\frac{dP'^3}{dt} = \frac{dP^3}{dt} L(\beta) \,.$$

Langevin function attains $L(\beta) \approx 0.99$ to

$$\beta = 100 \,,$$

and does unity to $\beta \to \infty$. We must have

$$\beta \approx 100$$

for sufficient induction obtained. On the other hand, it follows that

$$\beta = \frac{\alpha P^3(\tau)\, z \sqrt{1-\beta^2}\, h}{kT}$$

in recourse to (8–41) and (8–42). We further derive

(8-7) Locking Magnetic Field

$$\beta = \frac{\alpha mca \left[2d \sin d\tau + \frac{a^2 - d^2}{a} \times \operatorname{sha}\tau \right] Zh}{kTr^2 \left[(a^2 + b^2 + d^2) \operatorname{cha}\tau - b^2 \cos d\tau \right]}$$

$$= \frac{c\alpha mZh \left[2d \sin d\tau \operatorname{secha}\tau + \frac{a^2 - d^2}{a} \operatorname{tha}\tau \right]}{kTr^2 \left[a^2 + b^2 + d^2 - b^2 \cos d\tau \operatorname{secha}\tau \right]}$$

$$\to \frac{c\alpha mZh}{kTr^2} \cdot \frac{a^2 - d^2}{a^2 + b^2 + d^2} \left(\tau \to \infty \right) \tag{8-47}$$

$[\operatorname{secha}\tau \to 0 , (\tau \to \infty)]$, when we take

$$\frac{1}{\sqrt{1 - \beta^2}} = \frac{dt}{d\tau} = \frac{Q(\tau)}{mc}$$

into consideration, (8-47) finally reduces to

$$\approx \frac{-cm\alpha Zh}{kTr^2}, \tag{8-48}$$

since $a \ll 1$, and $|b| \ll |d|$ as stated in (8-34), while

$$Z = \frac{ab}{3!} \tag{8-49}$$

to a and b of (8-37) and (8-38) and to the value of

$$\alpha\, |Ж| \approx \alpha\, |Я| \approx M_B \qquad (a \ll 1 \ , \ b \ll 1)$$

M_B = Bohrmagneton.

M_B appears because amplitudes of Ж and Я of an atom is determined by (2-19), and coupling constant of electromagnetic interaction α by

$$e/mc \approx -1.8 \times 10^7/\text{gauss}\cdot\text{sec} .$$

We finally evaluate (8-48) with

$$\approx \frac{-\alpha mcabh}{6kTr^2} \tag{8-50}$$

which reduces to

$$100 \approx \frac{1.8 \times 10^7 \times 10^{-24} \times 3 \times 10^{10} abh}{k \times 300 \times (2.5)^2} \tag{8-51}$$

to the value of m (mass of an atom)

$\approx 10^{-24}$ gr ,

T = 300°K (room temperature) and when we use a locking coil of 2r = 5cm and bind circulation of spin with this magnetic field of the coil.

E_1 and H_1 can not be so high as **static (imaginary) magnetic field** since they stand for the amplitudes of electromagnetic field with high frequency, and can we have reasonable value of $E_1 = 3 \times 10^4$ V / cm and $H_1 = 10^2$ gauss, respectively ? (8−52)
We have taken $E_1 = H_1$
(nill magnetic field) (C.G.S) into consideration. **Orthogonal rotary magnetic field** is induced owing to induction law of Faraday's to rotary electric field whe we realize it with three spherical condensers (as stated later). We namely need a locking magnetic field of, $ih \approx 10^6 i$ gauss, (8−53)
with reference to (8−51). (8−53) must be applied to **spin density line** (in Fig.4). This magnetic field is realized by a **toroidal Möbius coil**. The **imaginary** current of,

$j \approx 5.0 \times 10^6$ i Ampere (8−54)

can sufficiently furnish (8−53) although it may vary according to the size of coil. This current would be the key to **Möbius generator**.

(8−8) Output Electric Potential

Möbius generator operates when we put output coil as in Fig.9.

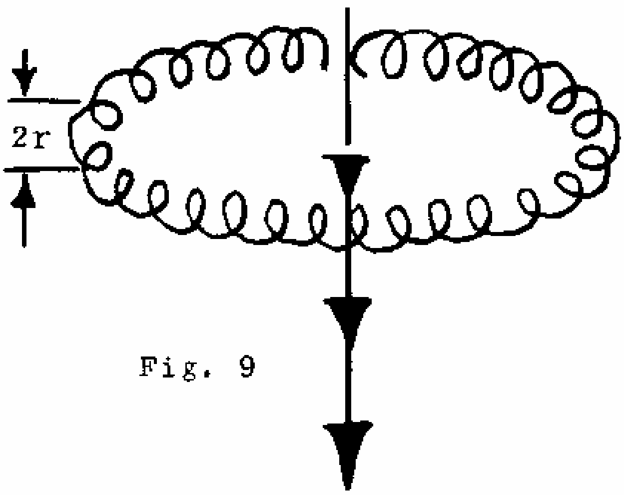


Fig. 9

(8–8) Output Electric Potential
(Output coil around momentum pillar. See the right.)
That electric potential becomes

$$\Psi = 6.0 \times 10^2 L(\beta) \text{ esu}$$

for μ in (8–46) to be $\mu = 100$ gr, and $L = 10^{-8}$ H

$$= 10 \text{ cm} \quad (CGS)$$

at the surface of the earth ($g = 980$ cm/sec^2 $\approx 10^3$ cm/sec^2), which reduces to

$$\approx 1.8 \times 10^5 \text{ V} \qquad (D.C.) \qquad (8\text{–}55)$$

to a locking magnetic field of (8–53), namely to

$$L(\beta) \approx 99 \% .$$

Mutual inductance between vertical infinite line and toroidal coil is determined by

$$L = 4\pi n \left(R - \sqrt{R^2 - r^2}\right) \qquad (CGS),$$

as discussed in appendix (A–8), in which n, R and r mean the value in turns and radii of toroidal coil shown in Fig.9.
Our value of

$$L = 10^{-8} \text{ H} \approx 10 \text{ cm}$$

corresponds with those of

$$n = 10 \text{ turns},$$

$R = 4$ cm, and $r = 1$ cm, respectively, which has no core, but can't be greater, since stationary current of generator is so large.

(8–9) Output Power

We shall next proceed to output power of that generator. Flowing rate of energy from outer Riemannean space–time under geogravitational deceleration is stated by

$$\frac{dw}{dt} \to \mu g c \quad (\tau \to \infty) \qquad (8\text{–}56)$$

when we use μ in (8–29) to (5–5).
(8–28) is modulated also with $L(\beta)$ such that

$$\frac{dw}{dt} \longrightarrow \mu g c L(\beta) , \qquad (8\text{–}57)$$

when we look at the fundamental Eqn. of (5–1) and with reference to

$$P'^3(\tau) = P^3(\tau) L(\beta) . \qquad (8\text{–}58)$$

Statistical and thermodynamical probability has been taken into consideration. It finally reduces to

$$\approx 100 \times 10^3 \times 3.0 \times 10^{10} L(\beta) \quad ergs/sec.$$
$$\approx 3.0 \times 10^8 L(\beta) \quad W$$
$$\approx 3.0 \times 10^5 L(\beta) \quad kW$$
$$\approx 3.0 \times 10^5 \quad kw, \qquad (8\text{–}59)$$

to the value of $\mu = 100gr$ in (8–57), and with $L(\beta) = 99\%$,

where $g \approx 10^3 \ cm/sec^2$, (8–60)

is used at the surface of the earth, which becomes about a sixth at the lunar surface.

$$m_1 = m_2 = 200gr$$

of Barium Strontium Titanate and Feroxplana (or Ferrite) have been used with reference to (8–29). This value would be reasonable with a locking coil of,

$$2r = 5 \ cm,$$
$$R = 4 \ cm$$

and $r = 1 \ cm$,

and output coil of the same order of size.

(8–10) Condenser Coil

We can feedback electric potential in order that we may obtain rotary electric field, when we set three coils as in Fig.10 with the same order of mutual inductance (with vertical infinite line) as output coil. That output electric potential becomes $\Psi \approx 1.8 \times 10^5 \ V$ (D.C.) with the same inductance of coil as output one.

(Three Coils as Feedback One and three spherical condenser.)

Mutual electric induction of condensers is determined by

$$Q_1 = -(Q_2 + Q_3)$$
$$\therefore Q_1 + Q_2 + Q_3 = 0,$$

when we feedback this electric potential with the circuit in Fig.11, to three spherical condensers in Barium Strontium Titanate, where Q_1, Q_2 and Q_3 stand for charges of the indi-

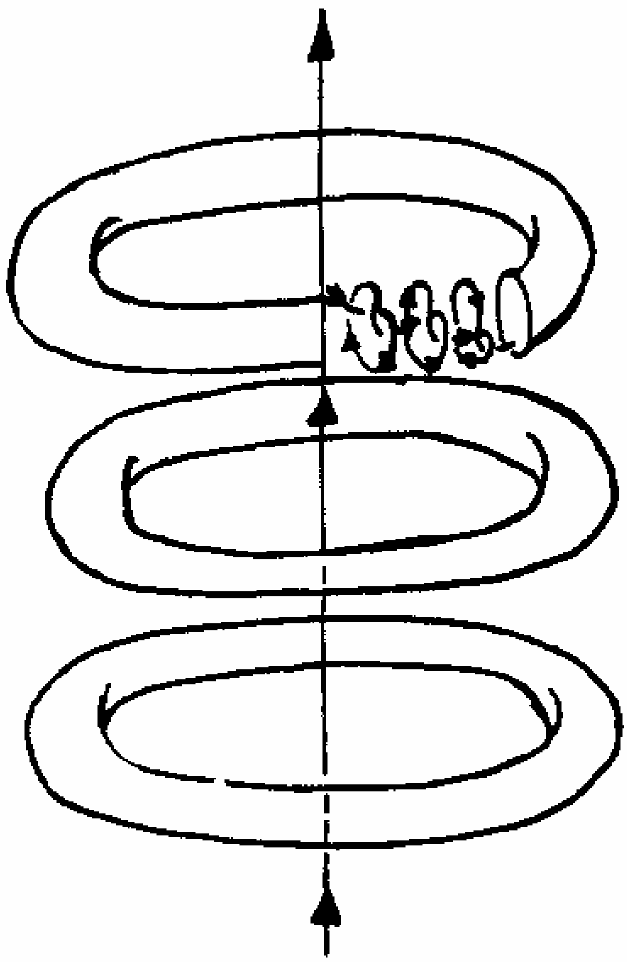


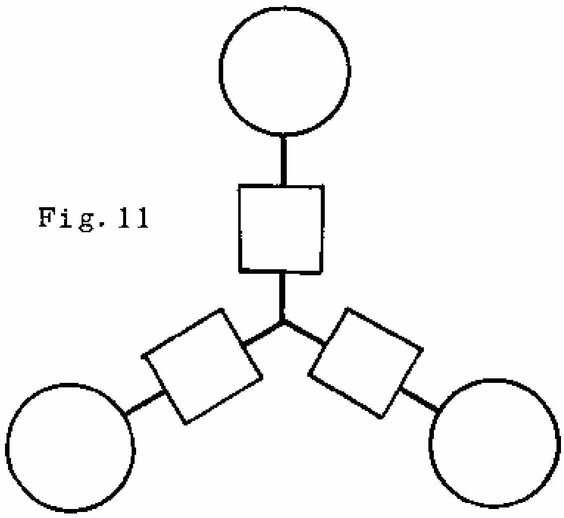
Fig.10

vidual condensers. It also follows

$$C_0\,\Psi_1 + C_0\,\Psi_2 + C_0\,\Psi_3 = 0\ ,$$
$$\therefore\ C_0\,(\Psi_1 + \Psi_2 + \Psi_3) = 0\ ,$$
$$\therefore\ \Psi_1 + \Psi_2 + \Psi_3 = 0\ , \qquad (8-61)$$

if we denote the capacitance of the same condensers with C_0, and their electric potential with Ψ_1, Ψ_2 and Ψ_3, respectively. (8−61) is nothing but the condition of three phases current. It can, therefore, supply rotary electric field.

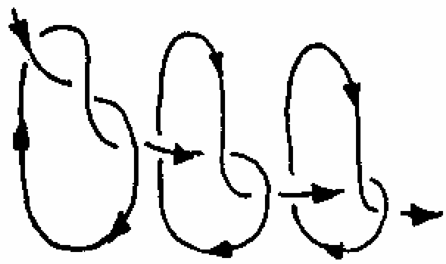
Fig. 11



(Circuit diagram three condensers among coils and three spherical condensers.)

We shall call these coils star-conjunction condenser coil. They are formed with Kleinean Roll which is shown in Fig.48.

Fig. 48



(Kleinean Condenser Coils.)

(8-11) Feedback Locking Coil

We shall so finally proceed to locking coil that we may bind circulation of spin.

We can derive an imaginary requested locking current of (8-58) in recourse to (8-54) and (8-58) when we put Kleinean coils indicated in Fig.47 and Picture22 around growing momentum pillar in Fig.12.

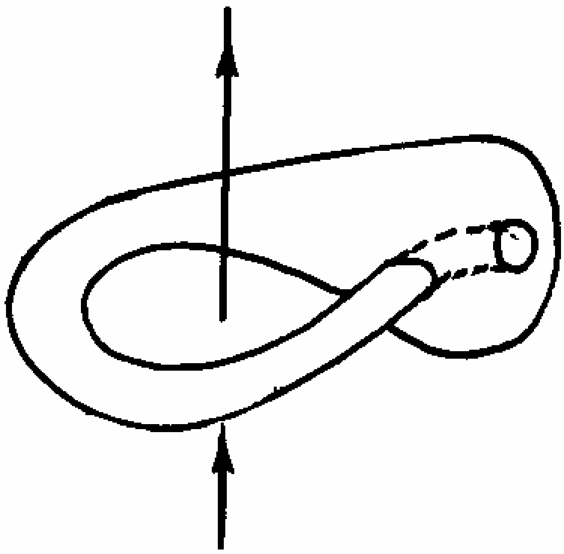


Fig. 12

(Kleinean tube around momentum pillar. See the right.)
Upper limit of the absolute value of imaginary locking current is determined by

$$10^7 \times K^2 R \leq \mu g c L(\beta) \quad . \tag{8-62}$$

Kleinean coil absorbs electromagnetic energy as shown in (8-18), while that electric potential is induced by working of G to quantum current pillar, which is explaind by the right hand side of (8-62). That is to say, negative ohmic

(8-11) Feedback Locking Coil

loss can not exceeds G-deceleration.

$$R = 10^{-4}\ \Omega \qquad (8\text{-}63)$$

can be realized with Möbius coil of pure cupper. We have the Eqn. of inequality of,

$$10^{7} \times K^{2} \times 10^{-4} \leqq 10^{2} \times 10^{3} \times 3 \times 10^{10} \times 0.99 , \qquad (8\text{-}64)$$

when

$$\mu = 100 \text{ gr} ,$$

which leads us to

$$K \leqq 1.73 \times 10^{6} \text{ A} . \qquad (8\text{-}65)$$

(8-64) furnishes stationary locking magnetic field of (8-53), where 10^{7} stands for a factor of,

watt / ergs / sec .

Total view of quantal G-generator is given in Fig.13 with reference to Fig.9, Fig.10 and Fig.12 and also to locking coil for excitation.

(8−11) Feedback Locking Coil

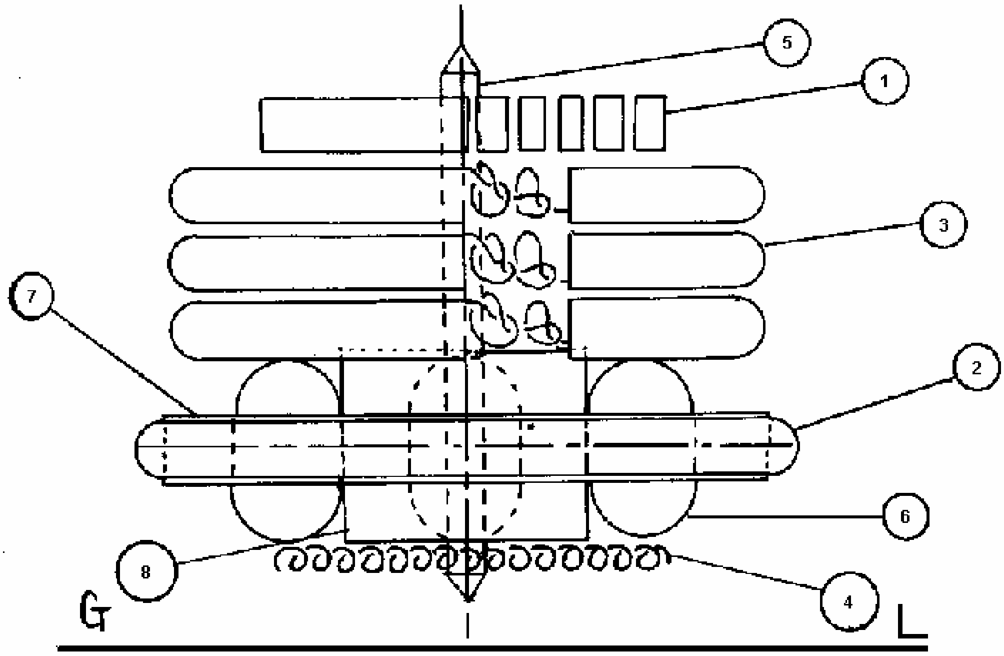
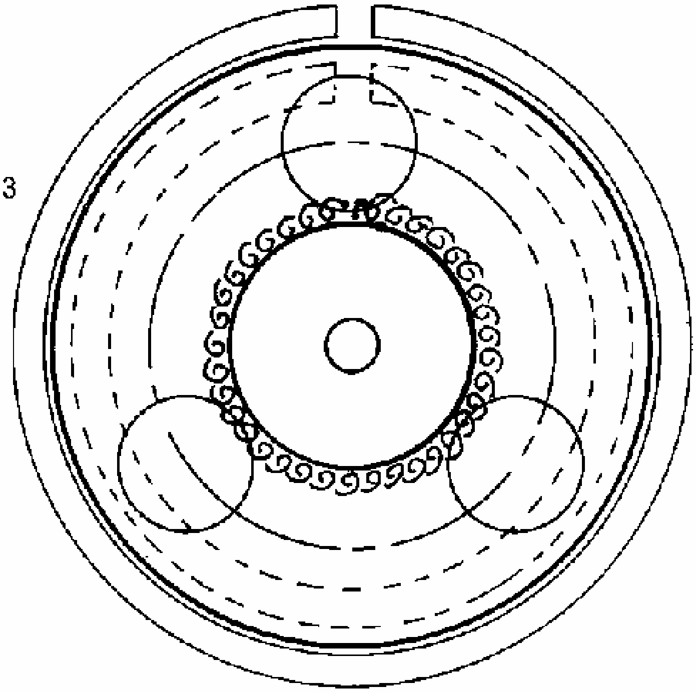


Fig. 13



(Total View of Möbius G-generator)

① means locking coil also in Fig.12,
② standing for excitation,
③ for condenser coil also in Fig.10(triplet),
④ for output coil also in Fig.9,
⑤ for magnetic pillar which supplies vertical static magnetic field,
⑥ for three spherical condensers,
⑦ for Barium Strontium Titanate Block and
⑧ for Ferrite Block, respectively.

⑤ would correspond with magnetizing field of ordinary dynamo.

§ 9 Inverse Atomic Engine

Sketch of inverse atomic engine.
Circularly polarized electromagnetic field produced with three spherical condensers charged by three phases current converts quantal fuel into negative energy state.

(9−1) G−field of Negative Energy

G-field of G and polar angular momentum Я are related by,

$$\frac{G}{\sqrt{1-\beta^2}} = -\frac{k}{c}\text{Я}, \tag{9−1}$$

as stated in the first chapter. If we put (9−1) into (1−4) we obtain

$$\Box\frac{G}{\sqrt{1-\beta^2}} = -\frac{4\pi k}{c^2}\cdot\frac{\partial p}{\partial t} - \frac{4\pi k}{c}\cdot \text{grad}\, q, \tag{9−2}$$

the first term in the right hand side of which is about $1/c$ times the second. Gravitation of negative energy owns the potential with opposite sign of that of positive energy. Gravitation of negative energy is repulsive since that of positive energy attractive. Einsteinean Equation of gravitation (Ref. 70) of, (9—1) G-Field of Negative Energy

$$\Box \gamma^{00} = -\frac{8\pi K}{c^4} T^{00}, \tag{9-3}$$

furnishes the same result which shows γ^{00} of strain of Riemannean space-time to have the different sign to

$$T^{00} \lesseqgtr 0,$$

and g—potential of φ to own the samely different signs (φ being potential of g-field where $G = -\mathrm{grad}\,\varphi$.),

with
$$\gamma^{00} = \frac{2\varphi}{c^2}.$$

We have known four kinds of entities of

(α) occupied state of positive energy
(β) unoccupied state of positive energy
(γ) occupied state of negative energy and finally
(δ) unoccupied state of negative energy,

in which (α) and (δ) belong to positive energy, while (β) and (γ) do to negative energy (Ref. 71). We derive TABLE 1 if we denote attractive gravitation with + and repulsive with −.

TABLE 1

	Occupied	Unoccupied
Positive Energy	+	−
Negative Energy	−	+

It would be clear that gravitation to negative energy is repulsive according to the following Gedanken Experiment: (G) A mass occupies $s = -4.9\,m$ at $t = 1$ sec. and $s = -19.6\,m$ at $t = 2$ sec.

when it freely falls from the origin near the surface of the earth. It will also do $s = -14.7\,m$ at $t = 3$ sec. and the origin at $t = 4$ sec.

of the clock synchronized with that of mass at infinity if time is reversed. The latter process is free rising which is nothing but the motion of negative time since negatively energied entity owns $\frac{dt}{ds} < 0$, owing to the definition of total energy of,

$$W = mc^3 \frac{dt}{ds} \quad \left(= \pm \frac{mc^2}{\sqrt{1-\beta^2}} \right)$$

$$\left(ds = \pm c\sqrt{1-\beta^2}\, dt \right),$$

energy being momentum along time or that velocity (except mc^3). In other words, it is repelled by G-field, where rest mass of,

$$m = \frac{\sqrt{q^2 - p^2}}{c}$$

can never be negative.

$$\frac{W}{c^2} = \pm \frac{m}{\sqrt{1-\beta^2}}$$

can either become positive or negative, but this mass is quite different from the mass that specifies inertia of motion.

(9−2) The Transformation with Nuclear Electric Resonance

The component with negative energy exceeds when we take frequency condition of (4−12) of Nuclear Electric Resonance (NER) under circularly polarized electromagnetic field of (4−8), namely quantal seeds fall into negatively energied state. In virtue of g-deceleration we may apply growth of four momentum of (5−3) to this NER, namely energy of the system of,

$$c\,Q_t(\tau) = W(\tau),$$

enjoys negative growth. The flowing rate of g-stress energy from outer G-space is also expressed with (5−5). That of resultant four momentum is expressed with (8−29), in which reduced mass of μ and statistical and thermodynamical probability are taken into consideration.

Electric field which are the components concerned with time suffix of electromagnetic field plays an essential role in Nuclear Electric Resonance, you would please notice. Polar angular momentum which specifies Zitterbewegung are the components done with time of angular momentum tensor, correspon-

ded with which electric field within electromagnetic tensor plays an important role. Electric instruments which make use of magnetic field are more than what do of electric field. What do of electric field can regulate essentially relativistic parameters such as energy, time or gravitation. For instance, three phases induction motor has **rotating magnetic field**, but none of machines does **rotating electric field**, while inverse-G engine owns it.
We have not yet know what occurs if we replace **rotating magnetic field** with **that electric** in NMR. This answer will be found in NER.

(9−3) Thrust and Output of <Inverse-G Engine>

In accordance with the conclusions in the former section, inverse-G motor is realized when we take the frequency condition of (4−12) and use quantum gravitational generator except ④ output coil. This motor is roughly shown in Fig.7

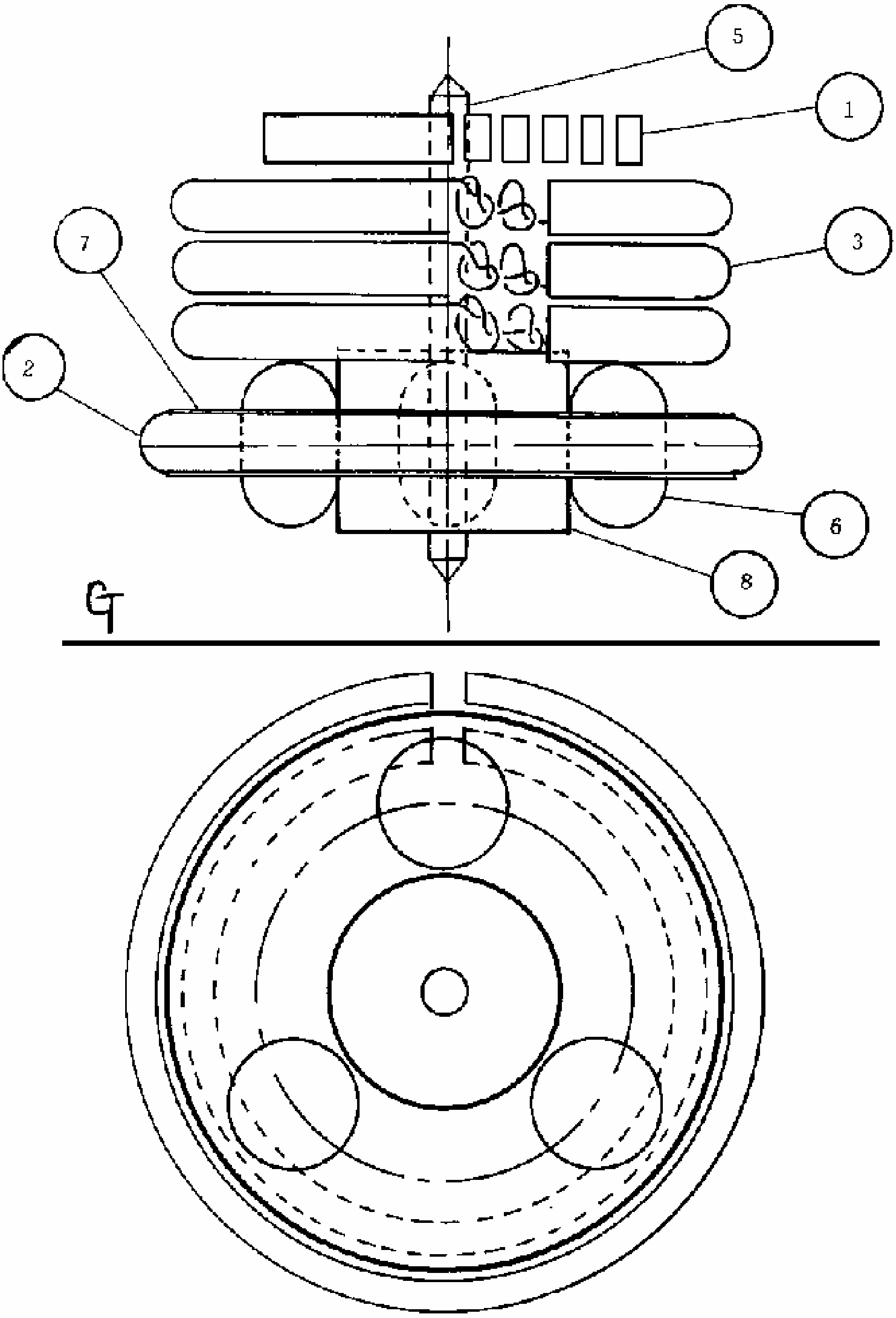
Fig. 7.
(See the next page)

We excite it by putting a giant pulse into ② exciting coil from differentiators as stated in the last part of (8−10). You had better drive it with the frequency condition of (4−12). Four momentum of quantal seeds grows such that
$m \rightleftarrows \mu$ in (5−3), where μ stands for the value of (8−5).
We shall denote the distribution of energy of
$c\,Q(\tau) = W(\tau)$ with

$$W(\tau) = -\frac{\mu c^2 \delta(x)\,\delta(y)\,\delta(z)}{a^2+d^2}\left[(a^2+b^2+d^2)\,\mathrm{cha}\,\tau - b^2 \cos d\tau\right], \qquad (9-4)$$

since it is mainly concentrated upon the origin of **zeroth hyper surface** (Ordinary Physical Space), in which $\delta(x)$

(9—3) Thrust and Output of <Inverse-G Engine>



means **delta function of Dirac's** (Ref. 5), and the origin does center of mass of the quantal seeds. Quantal seeds are composed of **Barium Strontium Titanate** and **Ferroxplana** (or Ferrite). It also follows,

$$\Box\frac{G_x}{\sqrt{1-\beta^2}}=\frac{4\pi k}{c}\cdot\frac{\mu c}{a^2+d^2}\left(\frac{\partial}{\partial x}\delta(x)\right)\delta(y)\,\delta(z)\left((a^2+b^2+d^2)\,\mathrm{cha}\,\tau-b^2\cos d\,\tau\right),$$

$$\Box\frac{G_y}{\sqrt{1-\beta^2}}=\frac{4\pi k}{c}\cdot\frac{\mu c}{a^2+d^2}\delta(x)\left(\frac{\partial}{\partial y}\delta(y)\right)\delta(z)\left((a^2+b^2+d^2)\,\mathrm{cha}\,\tau-b^2\cos d\,\tau\right),$$

$$\Box\frac{G_z}{\sqrt{1-\beta^2}}=\frac{4\pi k}{c}\cdot\frac{\mu c}{a^2+d^2}\delta(x)\,\delta(y)\left(\frac{\partial}{\partial z}\delta(z)\right)\left((a^2+b^2+d^2)\,\mathrm{cha}\,\tau-b^2\cos d\,\tau\right),\qquad(9-5)$$

in recourse to (9－2) and neglecting the first term in that expression in comparison with the latter. We can solve (9-5) such that

$$\frac{G_x}{\sqrt{1-\beta^2}}=-\frac{k\mu\left((a^2+b^2+d^2)\,\mathrm{cha}\,\tau-b^2\cos d\,\tau\right)}{a^2+d^2}\times\int_{-\infty}^{\infty}\delta(x^0)\int_{-\infty}^{\infty}\delta(y^0)\int_{-\infty}^{\infty}\frac{\frac{\partial}{\partial z^0}\delta(z^0)\,dx^0\,dy^0\,dz^0}{\sqrt{(x-x^0)^2+(y-y^0)^2+(z-z^0)^2}},\qquad(9-6)$$

owing to the familiar method of retarded potential in electrodynamics, where τ does not concern integration since it is thought to be **Enatsuean invariant time** (Ref. 41) and, therefore, the fifth variable. In recourse to the formula on **delta function** of,

$$\int\varphi(x)\left(\frac{d}{dx}\right)^n\delta(x)\,dx=(-1)^n\left(\frac{d}{dx}\right)^n\varphi(x),$$

(n is non-negative integer),

we obtain

$$=\frac{-k\mu\left((a^2+b^2+d^2)\,\mathrm{cha}\,\tau-b^2\cos d\tau\right)}{a^2+d^2}\cdot\frac{\partial}{\partial z}\left(\frac{1}{r}\right),$$

$$(r^2=x^2+y^2+z^2).\qquad(9-7)$$

On the other hand,

$$\frac{1}{\sqrt{1-\beta^2}}=\left|\frac{Q'(\tau)}{\mu c}\right|,$$

holds in which

$$Q'(\tau)=\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}Q(\tau)\,dx\,dy\,dz=\frac{\mu c\,[(a^2+b^2+d^2)\,\mathrm{cha}\,\tau-b^2\cos d\tau]}{a^2+d^2}$$

$$\times\int_{-\infty}^{\infty}\delta(x)\,dx\int_{-\infty}^{\infty}\delta(y)\,dy\int_{-\infty}^{\infty}\delta(z)\,dz=\frac{\mu c\,[(a^2+b^2+d^2)\,\mathrm{cha}\,\tau-b^2\cos d\tau]}{a^2+d^2}\tag{9-8}$$

since **Lorentz factor** concerns with center of mass of what determines g-field. We finally obtain

$$G_z=\frac{k\mu z}{r^3},\tag{9-9}$$

the remaining solutions of which are

$$G_x=\frac{k\mu x}{r^3},\qquad G_y=\frac{k\mu y}{r^3}.\tag{9-10}$$

The repulsive gravitation of,

$$\mathbf{G}=\frac{k\mu}{r^3}(x,\ y,\ z),\tag{9-11}$$

is generated around <**inverse atomic motor**>. It is repulsive because we let negative energy grow under the frequency condition of (4−12). The earth M is repelled by

$$M\mathbf{G}=(0,\ 0,\ \frac{k\mu M}{R^2})=(0,\ 0,\ \mu g),\tag{9-12}$$

in −Z-direction in recourse to (9−11), where M and R stand for mass of the earth and that radius, respectively. The one is related to another by,

$$g=\frac{kM}{R^2}.\tag{9-13}$$

We have thought the earth to be sphere and M is concentrated upon that center. We shall think about an important problem for a while. The Z-sense in (9−11) possesses no physical character. **Resonance magnetic field** H_0 is found to orient in that sense if we examine (4−8). Mean component of resultant magnetic field with circular polarization remains in Z-sense while it enjoys a precession around Z-axis. Characteristic sense of (9−11) will be that of magnetic fiel You will please remember that the Z-sense of **magnetic**

quantum number of a hydrogen atom is magnetic direction when we calmly take off the field (Ref. 58) although it can be taken in any direction. <Inverse Atomic Motor> is repelled by the earth at μg with reference to (9−12), which is nothing but a thrust of that motor.
It is unnecessary for to again take g-deceleration into consideration as with chemical rockets since it is repelled by μg instead of $-\mu g$. Payloads must, however, be less than μ since the instruments except quantal seeds possess ordinary gravitation. The acceleration of α is determined by

$$\alpha = \frac{\mu - \nu}{\mu + \nu} g, \tag{9-14}$$

when a payload is ν, and it can escape from at the bottom of potential well of gravitation only when

$$\nu < \mu.$$

On the other hand, the flowing rate of g-stress energy into the motor amounts to

$$\frac{dW}{dt} \approx 3 \times 10^9 \text{ kw} \approx 3 \times 10^9 \text{ HP}, \tag{9-15}$$

when $\mu = 1$ ton,
namely with $m_1 = m_2 = 2$ ton,
since it is determined by (8−29). Most of that energy was fed to locking coil as stated in the eighth chapter.
(9−15) is far greater than the output of Saturn of NASA
Jets and automobiles make use of gasoline as fuel and it is finite. <Inverse atomic motor> is nothing but ether in g-field (g-stress energy) which is infinitely present anywhere in the universe. Picture №3 shows a sketch of that motor. We can see three spherical condensers which furnish Nuclear Electric Resonance.
The frequency condition of negative energy is taken. Pair annhilation with air molecules occurs, with negative energy. Vacuum of boundary layer is produced, which decreases flying resistance and makes her sail at very high speed.

(9−4) Experimental Estimation (Revised) (Ceased)

(9-5) Semiconductor Coil/Landau Oscillator

Semiconductor of P type carries holes. They enjoy negative energy state as they belong to unoccupied state of electron.

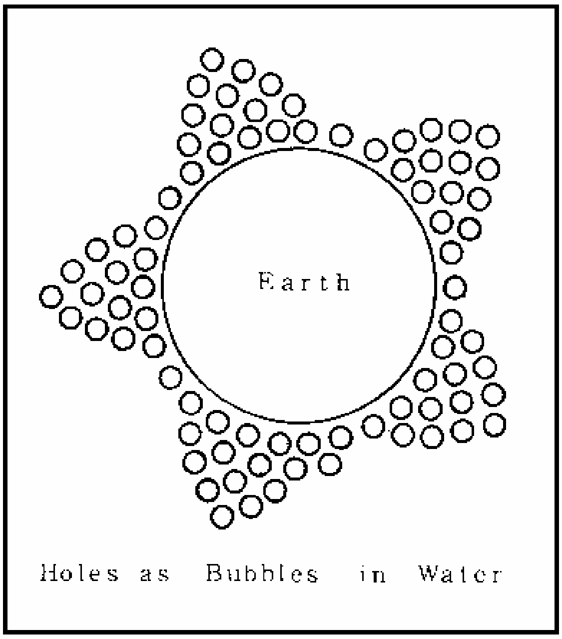


Fig. 66

The left drawing indicates g strain energy as unoccupied state of particles as it is distributed around Earth as negative energy. Coil of P type semiconductor can, therefore, absorb g strain energy. It is difficult to, for example, make coil by round wire of Si as its hardness almost equals to crystal.

We shall, therefore, make a coil by combining many transistors.

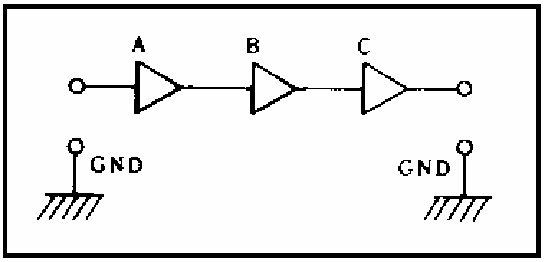


Fig. 67

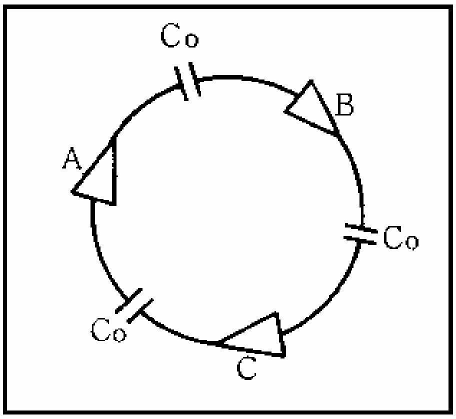


Fig. 68

The right drawing shows that conventional amplifier is composed of, for example, A. B and C stage, and that signal is amplified by A stage, B and C, and then terminates.

At this time, we shall combine C stage with A. Signal can be

Amplified infinite times as it is again done by A stage after the amplification by A, B and C stage. This round amplifier is, therefore, called ＜Endless Amplifier＞, which makes single turn of semiconductor coil.

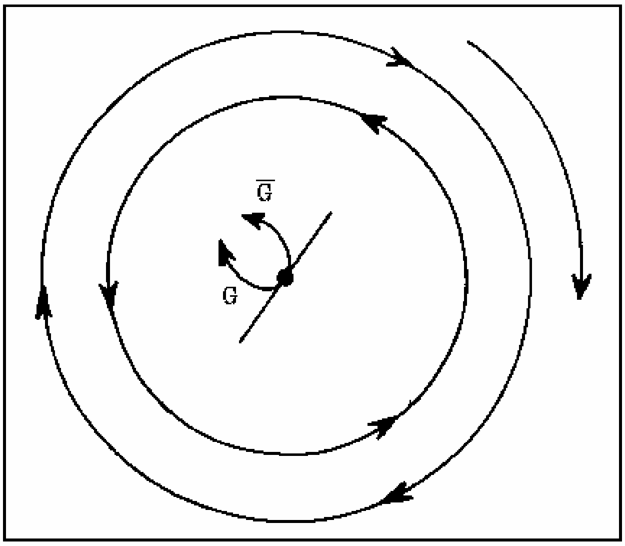


Fig. 82

Holes enjoy clockwise rotation, while electrons run counter clockwise, when mixed current of holes and electrons is present. Right turning g−field of holes is superposed upon left turning g-field of electrons upon center.

Well, graviton owns the following properties／

A) Rest mass m is zero／

$$m = 0 \qquad (9-16)$$

Graviton G, of course, obeys Klein−Gordon Eqn. of／

$$(\square - \kappa^2)\ \Psi\ (x,\ y,\ z,\ t) = 0 \qquad (9-17)$$

that potential φ being expressed by Yukawa's one of／

$$\varphi = \frac{\varphi_0\ exp\ (-\frac{mc}{\hbar} R\ )}{R} \qquad (9-18)$$

where R, for example, stands for the distance from center of earth.

G potential owns the form of／

$$\frac{kM}{R}$$

which implies that

$$m = 0.$$

B) That spin is 2／

$$s = 2\hbar \qquad (9-19)$$

which Einstein found as his energy tensor is symmetric.

C) Anti−particle of graviton is nothing but graviton itself as it is one of bosons and most of them have been so.

D) G of left polarization is anti−particle of that of right one as anti−paiticle of left polarized particle is that of right polarization (Ref. 76).

Superposition of right turning g−field and left one, therefore, gives pair annhilation of G and anti-graviton of $\overline{G}$ of/

$$G+\overline{G}\rightarrow 4\gamma \quad \cdots\cdots \qquad (9-20)$$

which occurs at the center of endless amplifier as carriers of transistor are electrons and holes.

In quantum theory of fields it is often discussed that quantal energy W of oscillating quantum is expressed by/

$$W=\hbar\omega=hf \quad \cdots\cdots \qquad (9-21)$$

where h, ω and f are Planck's constant, angular frequency and frequency, respectively, and

$$2\pi\hbar=h.$$

γ of (9−20) does not stand for Lorentz factor of/

$$\gamma=\frac{1}{\sqrt{1-(\frac{v}{c})^2}},$$

but for photon.

Quantal energy of this electrical system comes down by this pair annhilation as graviton G carries total energy of W′ of electron or hole of/

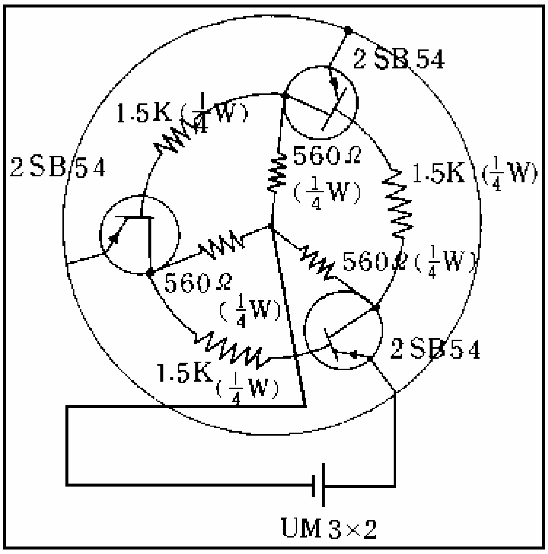


Fig. 83

$$W'=Mc^2+\frac{M}{2}v^2+\frac{3Mc^2}{8}\left(\frac{v}{c}\right)^4+\cdots\cdots \qquad (9-22)$$

(electrons, for example, either absorb or emit gravitons).

The frequency of <Endless Amplifier of Takahashi Type> comes down such that/

Time	Frequency (kHz)	Time	Frequency (kHz)
15:36	20.625	15:41	20.492
〃 37	20.597	(·········)	↓
〃 38	20.556	15:55	20.402
〃 39	20.525	(·········)	↓
〃 40	20.492	16:01	20.362

Experimental specifications being/Source/UM3×2/3.2 Volt DC

⁄⁄ Attenuation ⁄ 1/10 ⁄⁄ Impedance Matching ⁄ 1 MΩ ⁄⁄ Date ⁄ 19 ⁄ September ⁄ 1981. Unit circuit of Takahashi's can be applied to any transistors of 2SA, 2SB or 2SC type.

It is difficult to make multi turns of endless amplifier if the unit circuit is complicated even though it is theoretically possible. The following drawing indicates a simplified circuit with 2 transistors only to each transistor (We cannot use coupling condensors to IC which has this type of coupling circuit). Mr. Yoshitomo TAKAHASHI found this circuit. One may use about 1 KΩ and 500 Ω, and should supply higher potential of about 15 volt DC.

(9−6) Landau Oscillator of Torus Shape

We made 13 phases Landau oscillator (Endless Amplifier) by combining units of that oscillator of Takahashi type as in the right drawing, the collector resistor of which is 560 Ω ($\frac{1}{4}$ W type), that coupling resistor being 1.5 KΩ ($\frac{1}{4}$ W type also). One should notice odd parity.

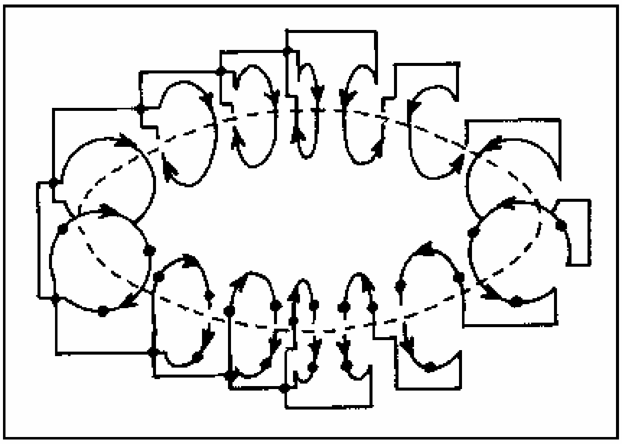


Fig. 84

Even stages give no oscillation.

Owing to pair annihilation of gravitons that frequency comes down with time as upon the following table, which shows the result of 8 hours drive.

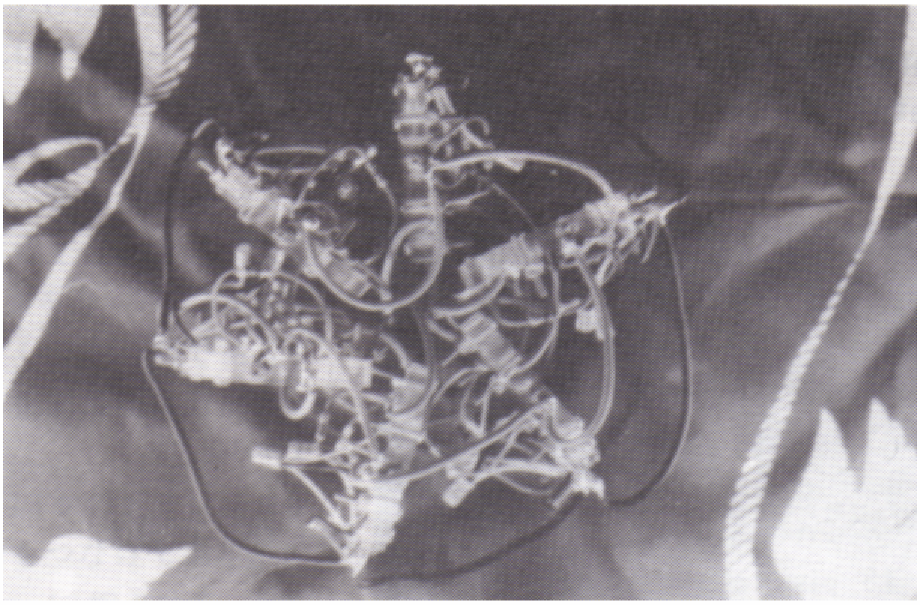


Photo 31

Time	Frequency(kHz)	Time	Frequency(kHz)
7:44	3.530	9:13	3.293
〃 45	3.500	(………)	↓
〃 46	3.475	10:14	3.222
〃 47	3.456	(………)	↓
〃 48	3.443	12:01	3.147
〃 49	3.433	(………)	↓
(………)	↓	14:39	3.092
8:01	3.392	(………)	↓
(………)	↓	16:03	3.076

Experimental specifications are∥Date/28/September/1981∥B Potential/DC 15 volt (stabilized)∥Attenuation/ $1/10$ ∥impedance Matching/1 MΩ∥Frequency Counter/FC 756 (Trio Co. Ltd)

Phase potertial (between neighbouring collectors) is/

10.2 volt AC,

while theoretical value is computed to be/

$$\Psi_2 \cdot \Psi_1 = \mathrm{DC} \times \frac{2}{n} \cdots\cdots \qquad (9\ \ 23)$$

$$= 2.3077 \text{ volt},$$

where

$$\mathrm{DC} = 15 \text{ volt}$$

denotes input potential, and

$$n = 13$$

does number of stages.

One gets voltage ratio percentage η of/

$$\eta = 100\% \times \frac{10.2}{\Psi_2 - \Psi_1} \doteqdot 442\%$$

which exceeds 100% although quantal energy comes down against time. The next photo indicates oscillogram of 17 phases endless amplifier, which is rectangular wave.

13 stages automatically generate 13 phases rectangular current.

The following oscillogram shows the first phase of 21 staged endless amplifier and the second.

One can find phase shift of $4\pi/21$. Stabilized power supply is passable and dry battery is best.

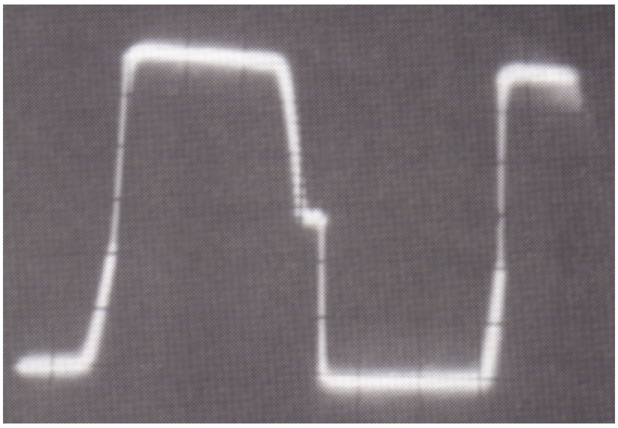


Photo 35

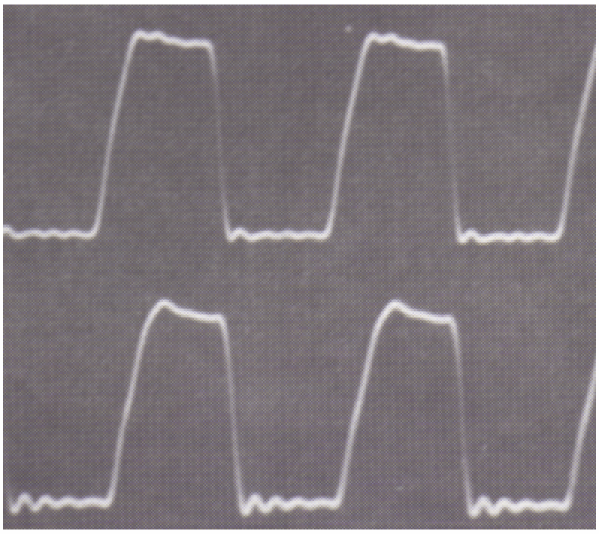


Photo 36

(9-7) IC Coil/G Reactor

We can also make Landau Oscillator with SN7404 (Hex Invertors) as it has 6 invertors when we combine odd number of invertors serially (See the next drawing). 3 ICs of SN7404 form 17 phases Landau Oscillator as/

(9-7) IC Coil/G Reactor

$$6 \times 3 - 1 = 17$$

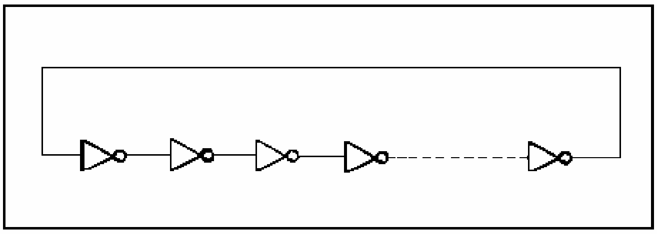


Fig. 85

which is shown upon the right drawing.

The frequency also comes down against time as upon the next table/

Quantal energy almost attains zero when cell is smaller and electron current small against decreasing ratio. Experimental specifications being/

B Potential/UM3×3/4.8 volts DC//Cycle Counter/FC756// Impedance Matching/1MΩ // Attenuation/0.1//Date/10/ October/1982.

Time	Frequency(MHz)
6:44	4.9712
(………)	↓
19:22	4.0785
(night)	
8:00	2.7064
(………)	↓
14:05	943.686
(………)	↓
19:50	113.069
(………)	↓
19:57	130.087
(………)	↓
19:59	0

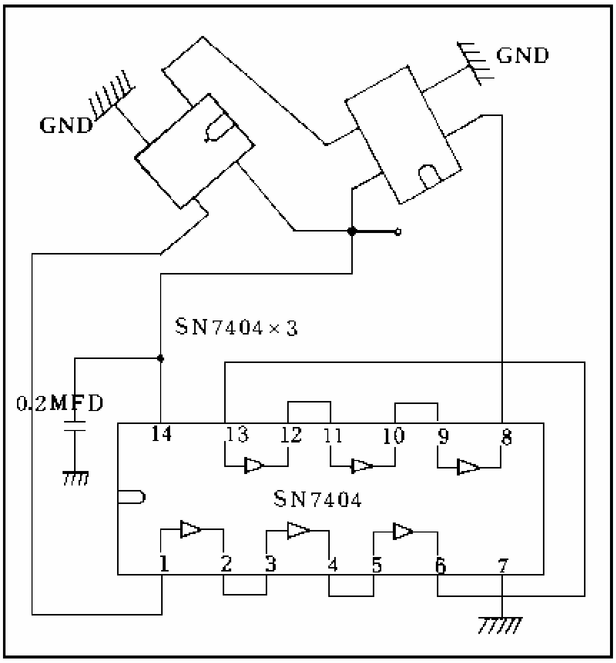


Fig. 86

The former drawing is top view although that of tube or transistor is bottom one. One can easily make IC coil as one may not use resistors, but only combine IN and OUT of invertors.

It is also called <G Reactor> as pair annhilation of gravitons of/

$$G + \overline{G} \rightarrow 4\gamma .$$

Electrons and holes are unlimited although Uranium is limited.

(9−8) Seike's Law of Pair Annhilation of Gravitons

<G Reactor> of 13 phases endless amplifier gives the curve which we can express with the Eqn. of／

$$W - W_1 \quad W_0\, e^{-\alpha t}$$
(9−24)

where W and W_1 are energy and asymptotic value of energy as

$$t \to \infty$$

as upon the following drawing. We can also express this relation with a differential Eqn. of／

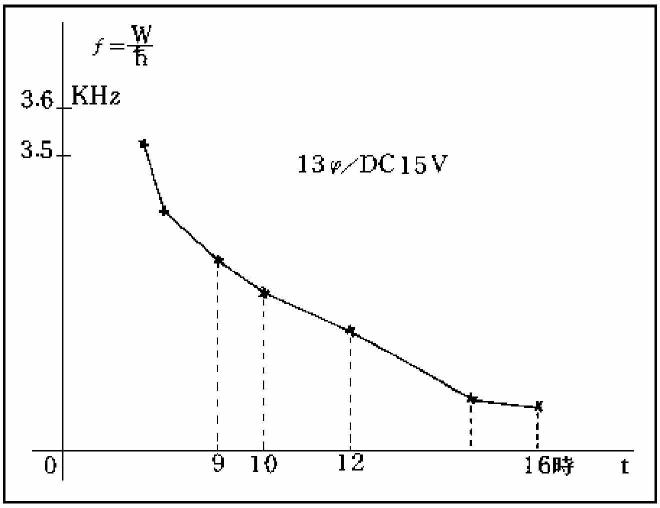


Fig. 87

$$\frac{\frac{dW}{dt}}{W \quad W_1} = -\alpha$$

or／

$$\frac{\frac{df}{dt}}{f - f_1} = -\alpha$$

where f stands for frequency. The former Eqn. resembles that of radio activity of／

$$N \quad N_0\, e^{-dt} \cdots\cdots \qquad (9-25)$$

where N denotes the number of atoms.

We shall call this relation <Seike's Law of Pair Annhilation of Gravitons>.

§ 10 Time Reversing Machine

(10−1) ~ (10−4) (Revised) (Ceased)

(10−5) Infinite Degrees of Freedom of Torus

Landau oscillator of torus shape is possessed of 2 degrees of round freedom as it is composed of circular Landau oscillators. The following drawing indicates that its units can be composed of smaller circular oscillators of Landau's.

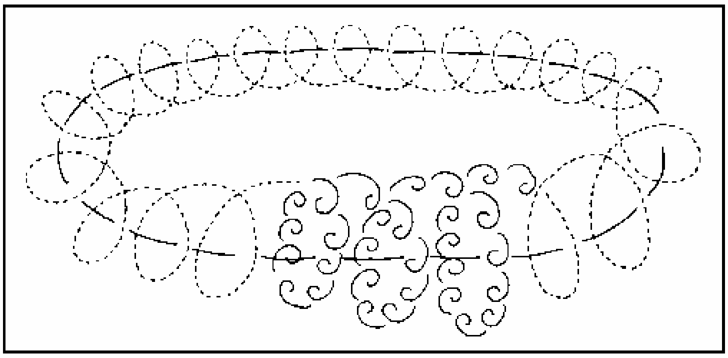


Fig. 77

We can again composed small units of smaller circular oscillators of Landau's.

We can, therefore, obtain even 5 degrees of freedom of torus or 6 degrees of that freedom as the left drawing shows.

We finally obtain theoretical infinite degrees of that freedom. The right photo indicates this relation that there is a person who has a book, on which a person owns a book, on which a man has a book, on which (········) and so on beyond.

By making Landau oscillator of multi degrees of round freedom with this in mind we can get greater incoming rate of negative energy and higher percentage efficiency of OUT potential to driving one.

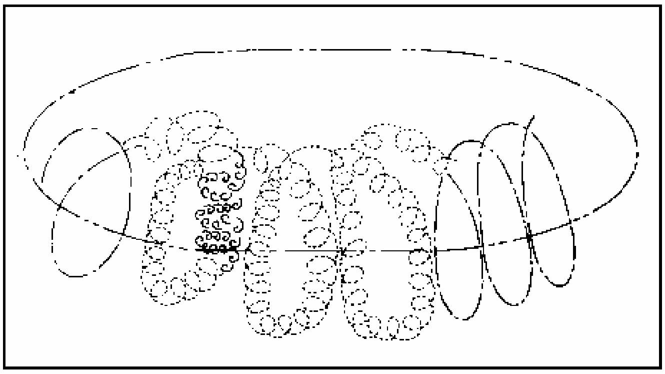


Fig. 78

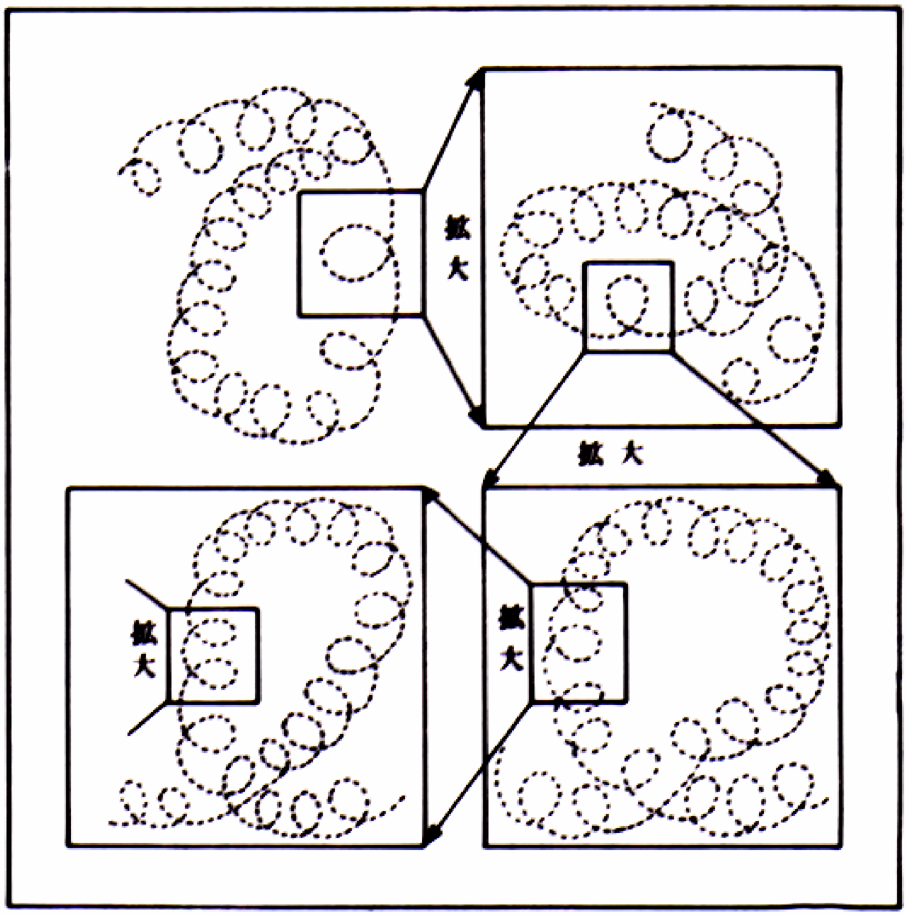


Fig.79

Fig.32

(10−6) Heisenbergean Chain of Uncertainty

With the former photo in mind, we shall examine uncertainty of Heisenberg's relativistically.

It maintains that either momentum p^1 or co-ordinate x is uncertain by the relation of,

$$\hbar \leqq \Delta p^1 \cdot \Delta x \ ,$$

which leads to that in the y-direction of,

$$\hbar \leqq \Delta p^2 \cdot \Delta y \ ,$$

and also to that in the z-direction of,

$$\hbar \leqq \Delta p^3 \cdot \Delta z \ ,$$

where p^2 and p^3 stand for the 2nd component of momentum and the 3rd one, respectively.

Relativistically we naturally obtain that in time-direction of,

$$\hbar \leqq \Delta p^0 \cdot \ (c \Delta t).$$

As we often discussed, p^0 (momentum in time-direction) and energy W are related by,

$$W/c = p^0 \ (i p^0 = p^4) \ ,$$

which leads us to,

$$\hbar \leqq \Delta W \cdot \Delta t \ ,$$

in which $ct = x^0$,

and $x^4 = i x^0$,

are well known.

It maintains that/

≪Time becomes uncertain when one tries to precisely determine energy W, while energy becomes unccrtain when one does to precisely observe time.≫

For example, uncertainty of time of,

t = 15 minute 30 second $\pm \Delta t$

occure when we precisely observe energy W at,

t = 15 minute 30 second.

The left drawing schematically indicates that time of,

t = 15 minute 30 second

is superposed either on,

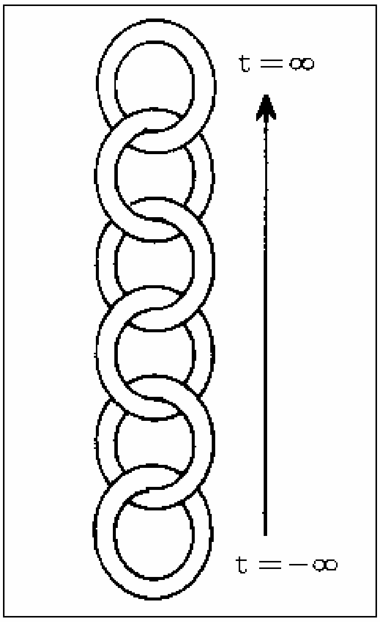


Fig. 80

$$t_{(-1)} = 15 \textit{ minute } 29 \textit{ second}$$

or

$$t_1 = 15 \textit{ minute } 31 \textit{ second},$$

in recourse to which there is an infinite chain of time from,

$$t = -\infty$$

to

$$t = \infty.$$

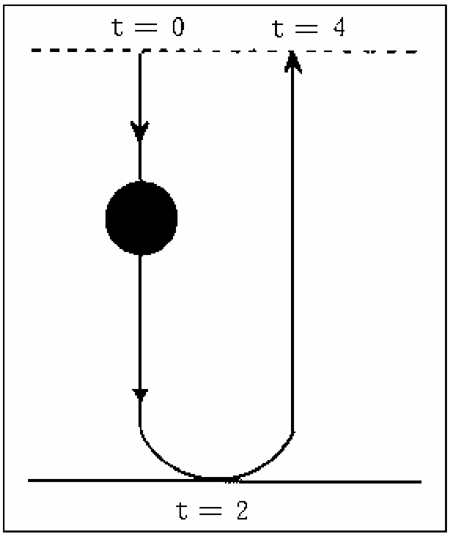


Fig. 81

On the other hand, we shall examine mass with negative energy repelled by G.

Mass attains

$$s = -\frac{g}{2}\, t^2 = -490 \ cm$$

at

$$t = 1 \textit{ second},$$

after it begins to fall in g space at

$$t = 0,$$

and does

$$s = \frac{g}{2}\, t^2 = -\frac{g}{2} \cdot (2)^2 = -1,960 \ cm,$$

at

$$t = 2 \textit{ second},$$

while does

$$s = -1,960 - \frac{g}{2} \cdot 1^2 = -1,470 \ cm,$$

at

$$t = 3 \textit{ second}$$

after time reversal at

$$t = 2 \textit{ second}$$

as it is repelled by G, and it does

$$s = -1,960 + \frac{g}{2} \cdot (2)^2 = 0,$$

at

$$t = 4 \ second,$$

which is nothing but the initial position.

It is reasonable to understand that time begins to reverse at,

$$t = 2 \ second$$

We shall again remember that energy is nothing but c times momentum in time direction such that/

$$W = c\,p^0 = mc^2 \frac{dt}{d\tau} \ (d\tau = \pm\sqrt{1-\beta^2}\,dt).$$

We accordingly obtain/

$$mc^2 \frac{dt}{d\tau} < 0 \quad ,$$

$$\therefore \ \frac{dt}{d\tau} < 0 \ ,$$

to negatively energied body.

That is to say, velocty along time axis is negative with respect to proper time. Time becomes negative with proper time, which is always positive. Namely, time reverses. We can go backwards along the infinite chain of Heisenbergean uncert-ainty, stated before. The former photo of books on the cover of the other book states this physical fact.

The following photo explains one of the properties of crea-ture, in which eggs stand for genes. A hen is determined to

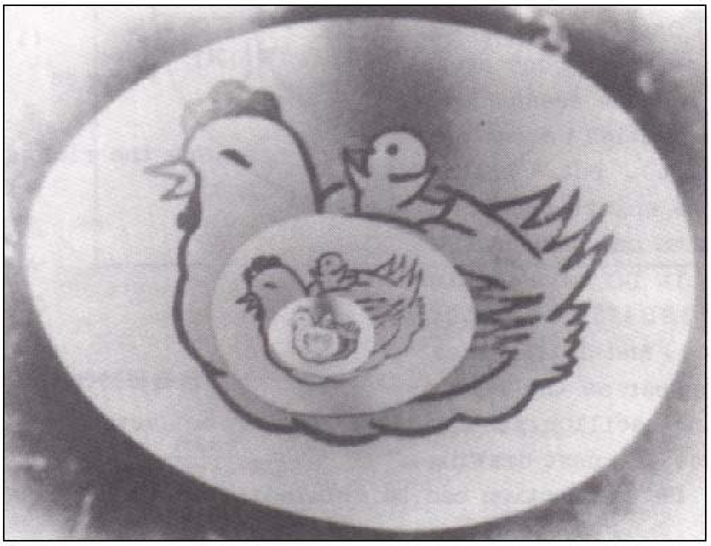


Photo 33

appear in gene. This hen owns genes, in which a hen is determind to do, and this hen owns genes.

(…………)

Negative energy, time reversal and biophysical chain can be related together. If one makes nucleic acid, can he make a creature only with it ? No, thoro should be an infinite chain of background time.

About 8 degrees of freedom of torus of Landau oscillator will generate negative energy field, which will give reversible time field, and by which one can get one of the solutions of puzzles with respect to G, time and life at the same time. Relativistic biophysics will also appear.

(10−7) Time Reflection of Electromagnetic Wave

We shall make <Mixed Transistorized Coil> with PNP transistors and NPNs as upon the following drawing.

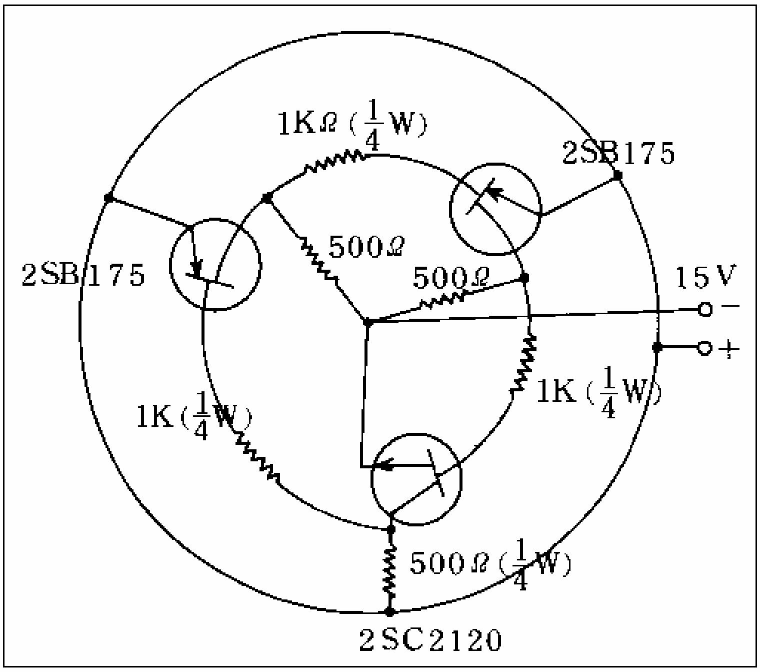


Fig. 88

Oscillation of 3 phases mixed one stops when one feeds higher potential (about 15 volt), but 9 phases one enjoys oscillation when one does even 15 volt DC between lines (2SB175×5+2SC2120×4) and delta pulse appear as the suceeding oscillogram indicates between collectors of 2SC2120 (Also see the next drawing).

Delta function can be obtained when angular frequency of ∕

$$f(t)=\frac{\sin\omega t}{\pi t}$$

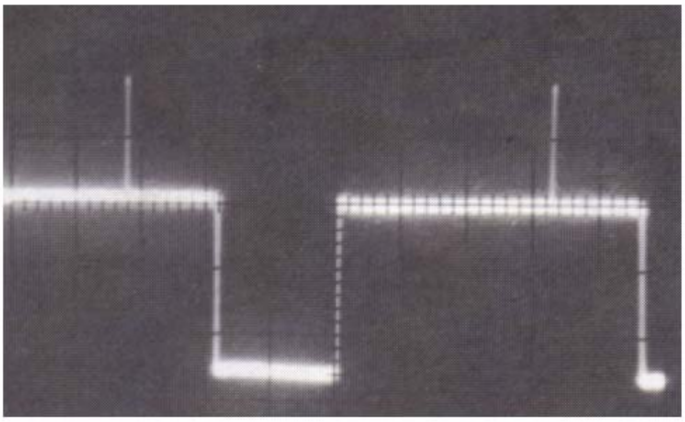


Photo 37

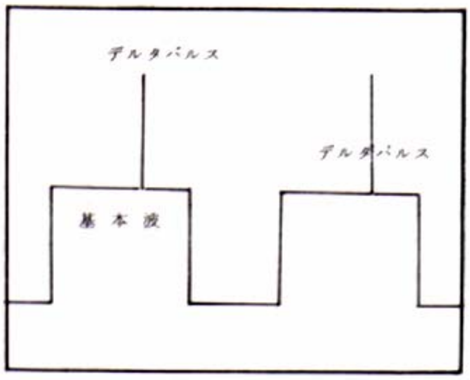


Fig. 89

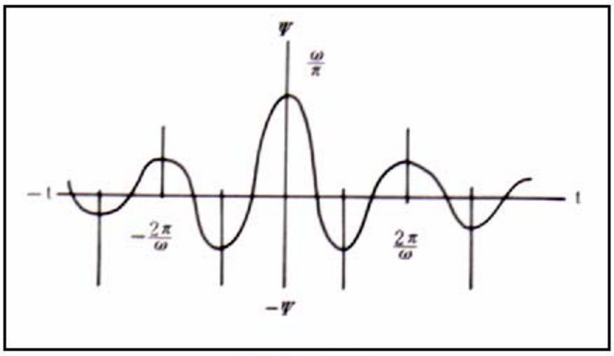


Fig. 90

goes up to infinity as it is defined by the limit of /

$$\delta(t) = \lim_{\omega \to \infty} \frac{\sin \omega t}{\pi t}$$

as shown upon the following drawing. Peak at origin attain infinity and wave lenght does zero when

$$\omega = 2\pi f \to \infty.$$

Very high frequency corresponds with negative time to <Mixed Transistorized Coil> when that frequency comes down as upon the next drawing.

That is to say, time of delta pulse is reflected (negative time).

Detection of this pulse gives fading as that of Moscow

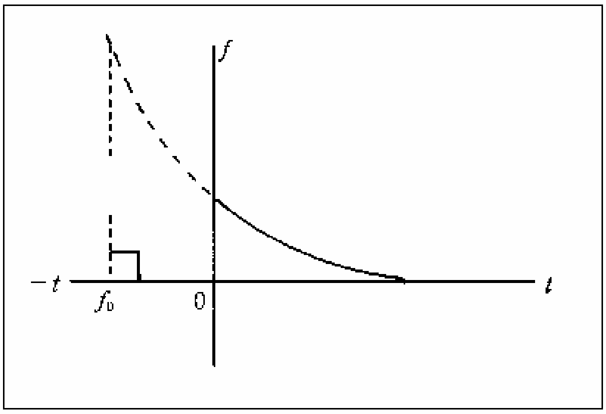


Fig. 91

Broad Casting.

We shall remember relativistic (four dimensional) distance of /

$r^2 = x^2 + y^2 + z^2 - c^2 t^2$

or /

$= x^2 + y^2 + z^2 + c^2 t^2$ (Eulidean space−time)

Electromagnetic wave from Moscow owns fading, and that (relativistic) distance is great when it belongs to remote time. This fading maintains that it belongs to remote past.

r is high in Euelidean space−time. We should remember that Gegenbauer ultra spherical harmonics can be obtained when it is analytically continued from Minkowskean space−time on to Euclidean space-time.

Direction of current in 2SC2120 (NPN type transistor) of <Mixed Transistorized Coil> is opposite to that of 2SB175 (PNP type of transistor), which corresponds with opposite turning coil.

As hole is in state of negative energy,

$$W = mc^2 \frac{dt}{d\tau} < 0$$

which leads us to /

$$\frac{dt}{d\tau} < 0,$$

and to negative time /

$$t < 0,$$

which generates the pulse of very high ω (delta pulse).

§ 11 Inverse-G Space Vehicle of John R.R. Searl's

(11 − 1) Experimental Results in United Kingdom

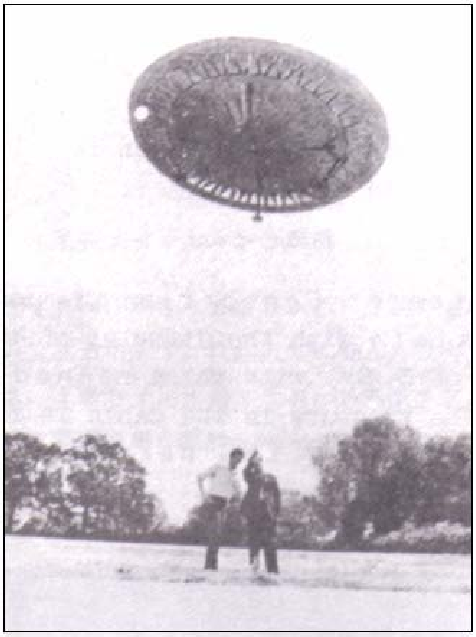
Rotating electric field of inverse-G engin is realized by (α) charging or discharging n **spherical condensers** set at n verteces of regular n-polygon with **n-phases current** or (β) **rotating electric dipole** of a pair of charged spheres. **John R. R. Searl** (17 Stephen's Close, ***MORTIMER***, Berkshire, RG 7−3 TX, ***ENGLAND***) produced inverse-G field by rotating segmented rotors between electromagnets, which corresponds with the method of (β). The craft was dramatically repelled by the earth g-field as calculated in the chapter 10, and just as in Picture 17 and 18.

Picture 17

Mr. Searl (the left) and his disc which dramatically floats in g-space.

(11−1) Experimental Results in United Kingdom

Picture 18



Mr. Searl, one of his friends and his disc which shows **pair annhilation glow** on the rim.

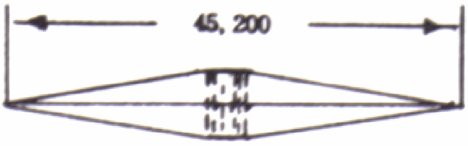
On the other hand, induced electric potential as stated by (8−17), is obtained, which is fed back to electro-magnets. The carft herself is a great electric generator. In virtue of this feed-back the rotor speeds up on and on, and finally attains a certain equilibrium. It is, then, at the electric potential of some modest 10^{13} (ten trillion) **volt**. Ambient vacuum which is characteristic to negative energy (concerned with pair annhilation) makes it keep such an ultra high electric potential.

On the third hand, flowing rate of energy from outer g-space is estimated $10^{14} \sim 10^{16}$ (hundreds trillion or ten thousands trillion) **watts** (thousands billion ~ ten trillion horse-power), which has been predicted by (8−28). This working corresponds with $\mu = 5$ ton in (8−28).

Mr. Searl has constructed **40 vehicles**, several of which are operating. Most of them have the diameter of about twenty feet, while the largest that of about 38 feet (Ref. 68 and 69). He sent her drawing as in Fig. 35.

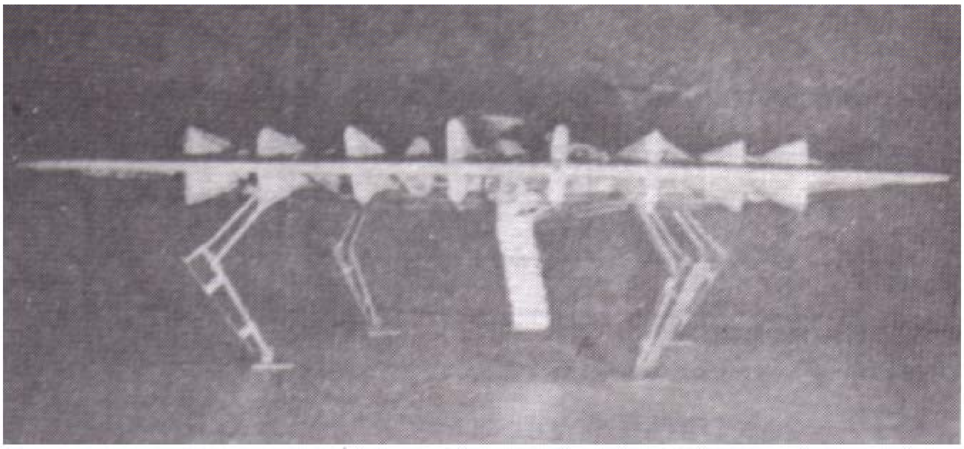
(11−1) Experimental Results in United Kingdom

Fig. 35



Rough Sketch of Starship Ezekiel which is intended to go over to the moon.

National Space Research Consortium is constructing <Starship Ezekiel> with the diameter of 45. 20 meter and the summit of 5.8m, with which manned lunar flight is planned. The pressure in the cabin is adjustable from 5 LBS per SQ. inch to 7 LBS per SQ. inch, temparature from 60° F to 105° F.
He showed her structure as in Picture 19.



Picture 19 Structure of Searl's Disc.

(11−2) The Searl Effects

(1) Inverse Gravitation

Gravitation to negative energy state is repulsive, according to which negatively energied body is repelled by Earth.
The law of Newtonian gravitation is described by,

$$f = \frac{kMm}{r^2}, \qquad (11-1)$$

in which f stands for a force when masses of m and M interact at the distance of r.
Positive sign corresponds with attractive force. On the other hand, we have known Einsteinean formula of mass-energy relation of,

$$W = mc^2 , \tag{11−2}$$

and

$$W' = Mc^2 , \tag{11−3}$$

from which we have

$$m = \frac{W}{c^2} , \tag{11−4}$$

and

$$M = \frac{W'}{c^2} , \tag{11−5}$$

If we put (11−4) and (11−5) into (11−1), we derive

$$f = \frac{kWW'}{c^4 r^2} , \tag{11−6}$$

in which the signs of f are different in the cases of

$$ {}_2C_1 \times {}_2C_1 = 4$$

for $W \lesseqgtr 0$ or $W' \gtreqless 0$.
They are tabulated in TABLE 5.

TABLE 5

W	+	+	−	−
W′	+	−	+	−
f	+	−	−	+

The positive sign stands for attractive gravitation, while the negative for repulsive. Positively energied bodies or negatively energied ones attract each other, while repulsive force acts upon positively energied body and negatively.

(2) Electromagnetic Induction with G-deceleration

The generator produces D.C. static field with negative polarity at the rim and positive at the center. However the magnetic field from the generator produces induction in conductive loops when there is no relative movement. It seems therefore that the flux from the generator is continuelly expanding. This implies that growth of internal momentum of atoms in rotor by g-deceleration of (8−10) produces electromagnetic induction.

(3) Working of Gravitation

G-stress energy flows into the craft when gravitation works upon the growing internal momentum. That working amounts to 10^{14} watts ($\approx$ thousands billion horsepower) $\sim 10^{16}$ watts ($\approx$ 10 trillion horsepower), which is about identical with the value of (8−29) of

$$\mu = 5 \text{ ton}.$$

(4) Threshold Electric Potential

The craft sufficiently operates at the potential higher than 10^{13} volt, which implies that thermodynamical probability attains $L(\beta) \approx 1$

[See (8−18)] at such a higher potential.

(5) Thrust

Horizontal propulsion can also be obtained by changing the potential distribution of the surface of the craft.
This is because the plane upon which electric field rotates [See (4−8)] inclines.

(6) Pair Annhilation Glow

Pair annhilation gives rise to a transluscent glow surrounding the craft and glowing trails such that

$$e^{+} + e^{-} \rightarrow \gamma, \qquad (11-7)$$

which is accompanied with negative energy.

(7) Permanent Electric Polarity

One notices that after working near craft or generators he has a <cobweb> sensation on the skin. His clothes clung to him and also the bed linen. This was accompanied by occasional crackling and lasted some hours. This effect could be attributed to a permanent polarity. <Paraelectric substance> such as clothes can enjoy a sufficent polarity with

$$L(\beta) \rightarrow 1, \qquad (11-8)$$

by higher electromagnetic field surrounding a craft.

(8) Matter Snatch during Acceleration

This occurs when the craft is on the ground and the drive is suddenly switched on. The rising craft takes up a lump of the ground with it, leaving the well known hole in the ground.

(11−3) Geodesic Sailing towards the Moon (The Lunar Trip)

Ordinary chemical rockets get large kinetic energy at launch, but it is gradually lost in g-field of the earth and reaches the equilibrium point of gravitation of the earth-moon line. Passing that point it is gradually accelerated, while <inverse atomic motor> is gradually done, but decelerated in g-field of the moon, after reaching the maximal velocity at the equilibrium point.

Under g-acceleration of the earth Eqn. of motion may easily be found to have the form of,

$$(\mu+\nu)\frac{d^2x}{dt^2}=(\mu-\nu)\frac{kM}{x^2}, \tag{11-9}$$

where μ and ν are defined by (9−14).

$$\frac{\mu-\nu}{\mu+\nu}\approx 1, \tag{11-10}$$

holds when quantal seeds are far greater than payloads, namely the vehicle has quite a large <inverse-G engine>.

(11−9) leads us to

$$\frac{d^2x}{dt^2}=\frac{kM}{x^2}, \tag{11-11}$$

where x, k and M stand for the distance from center of the earth on the earth-moon line, Newtonean constant of gravitation and mass of the earth, respectively.

We know a relation of (9−13) among the radius of the earth and them. (11−11) reduces to a differential Eqn. of separable variable with respect to p and x, if we put

$$\frac{dx}{dt}=p.$$

(11−3) Geodesic Sailing towards the Moon (The Lunar Trip)

We shall suppose that the vehicle start from the resting state on the surface of the earth, namely at the boundary condition

of $\qquad p = 0$,

at $\qquad x = R$.

Then, we find an Eqn. of.

$$\frac{dx}{dt} = \sqrt{2gR}\,\sqrt{1-\frac{R}{x}}. \tag{11-12}$$

and,
$$\sqrt{2kM}\;t = 2R^{\frac{3}{2}}\int_0^{\theta}\frac{d\theta}{\cos^3\theta}. \tag{11-13}$$

with
$$\sin\theta = \sqrt{\frac{x-R}{x}}. \tag{11-14}$$

The moon is situated from the earth

$$a = 38.44\times10^4\ \mathrm{Km}, \tag{11-15}$$

on **the earth−moon line**, while her mass being

$$m = 0.0123\ \mathrm{AU}. \tag{11-16}$$

If the equilibrium point is r_1 from the earth and r_2 from the moon we find

$$\frac{k\times1}{r_1^2} = \frac{k\times0.0123}{r_2^2}, \tag{11-17}$$

which leads us to

$$\frac{r_1}{r_2} = 9.02\ . \tag{11-18}$$

We namely derive $\qquad r_1 = 34.6\times10^4\ \mathrm{Km}$. (11−19)

The maximal velocity of <**inverse−G space vehicle**> on her lunar trip is,

$$\frac{dx}{dt} \approx 11.3\ \mathrm{Km/sec}. \tag{11-20}$$

in recourse to (11−12).

We shall call this process <**geodesic sailing**> since she only depends upon g-acceleration, following **A. Einstein** who called g-trajectory <**geodetic**>. This trajectry can represent **the nearest path** however space-time may be curved.

The integral of (11−13) of,

$$i = \int_0^{\theta}\frac{d\theta}{\cos^3\theta}, \tag{11-21}$$

reduces to

$$=\frac{1}{2}[\lambda\sqrt{1+\lambda^2}+\ln(\lambda+\sqrt{1+\lambda^2})]=\frac{1}{2}[\frac{\sqrt{x(x-R)}}{R}+\ln\frac{\sqrt{x-R}+\sqrt{x}}{\sqrt{R}}]$$

$$[=\int_0^{\lambda}\sqrt{1+\lambda^2}\,d\lambda], \qquad (11-22)$$

if we put $\tan\theta=\lambda$. Using

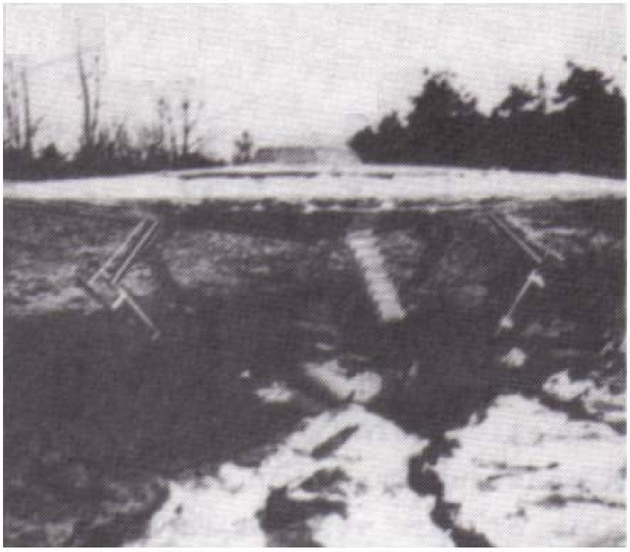
$$x=r_1=34.5\times10^4\ \mathrm{Km},$$

of (11−13) and (11−19), we obtain

$$t\approx 8.94\ \text{hours}, \qquad (11-23)$$

which shows that it takes only about **nine hours** to reach the g-field of the moon.

You will please remember that chemical rockets of NASA take nearly three days, and how fast it is. We finally show **<inverse-G space vehicle>** which is on the ground.



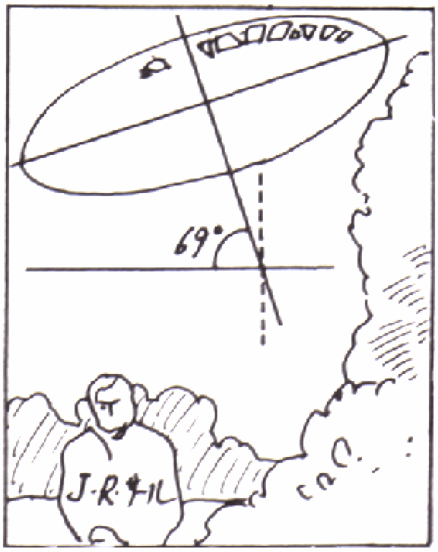
Picture 20

Inverse-G Space Vehicle on the ground.

(11-3) Geodesic Sailing towards the Moon (The Lunar Trip)

Dip of geomagnetic field is 69 degree in Berkshire. Leaning angle of Levity Disc is also 69 degree in Picture17

Fig. 50

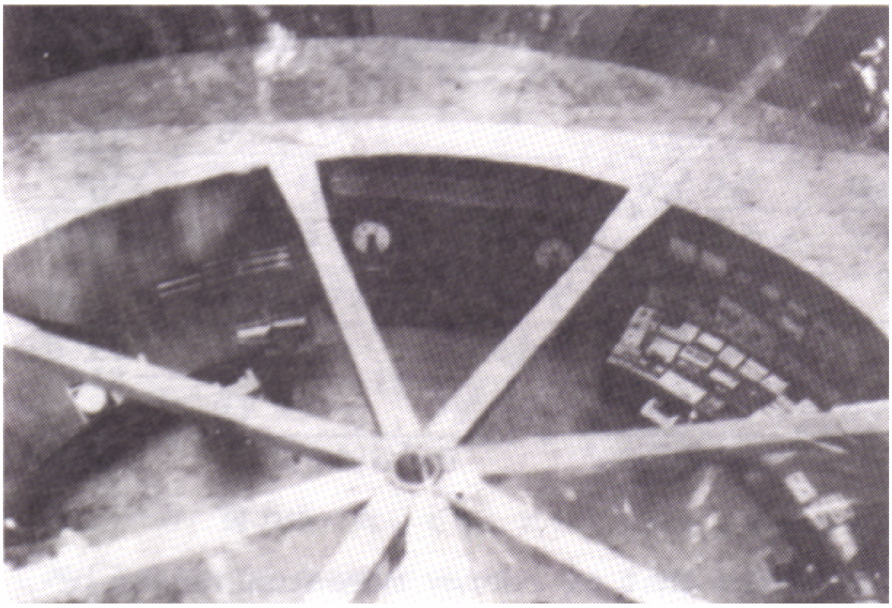


(Inverse-G Space Vehicle orients in geomagnetic direction)

Namely, Z-direction of Nuclear Electric Resonance coincides with geomagnetic. We can find that geomagnetic field is made use of resonance magnetic field.

Mr. Searl has been constructing Demonstration Craft #1 (February in 1972). Cabin of this vehicle is shown on Picture #23, where we can find a large number of controlling panels.

Pic. 23



This Demonstration Craft is to be used as training vehicle of launching and landing. Star Ship Ezekiel with diameter of about 50 meters is, furthermore, constructed for Lunar Journey.

§ 12 The Tenth Planet

(12−1) Introduction

It has often been said that unknown planets may be present **outside Pluto.** We shall examine this problem and where it is. The planets in the solar system are **Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto,** so far. The planet just outside **Pluto** is the tenth. These nine ones are classified into three groups of (A) **Terrestrial Planets** (Mercury, Venus, Earth and Mars). (B) **Giant Planets** (Jupiter, Saturn, Uranus and Neptune) and finally (C) **Pluto** (which belongs to **Terrestrial Planets**).

(12−2) Distribution of Energy Tensor

Potential of energy momentum tensor of electromagnetic field obeys **Tetra-Harmonic Equation** of,

$$\Box^4 \varphi^{jk}(x) = 0\ , \qquad (12-1)$$

as stated in the seventh chapter, which further takes the form of,

$$\Delta^4 \varphi^{jk}(x,\ y,\ z) \qquad (12-2)$$

$$= (\frac{\partial^8}{\partial x^8} + \frac{\partial^8}{\partial y^8} + \frac{\partial^8}{\partial z^8} + 4\frac{\partial^8}{\partial y^6\,\partial z^2} + 4\frac{\partial^8}{\partial z^6\,\partial y^2} + 4\frac{\partial^8}{\partial x^6\,\partial y^2}$$

$$+ 4\frac{\partial^8}{\partial x^6\,\partial z^2} + 4\frac{\partial^8}{\partial y^6\,\partial x^2} + 4\frac{\partial^8}{\partial z^6\,\partial y^2} + 6\frac{\partial^8}{\partial x^4\,\partial y^4} + 6\frac{\partial^8}{\partial x^4\,\partial z^4}$$

$$+ 6\frac{\partial^8}{\partial y^4\,\partial z^4} + 12\frac{\partial^8}{\partial x^4\,\partial y^2\,\partial z^2} + 12\frac{\partial^8}{\partial x^2\,\partial y^4\,\partial z^2} + 12\frac{\partial^8}{\partial x^2\,\partial y^2\,\partial z^4}$$

$$\times \varphi^{jk}(x,\ y,\ z) = 0\ ,$$

to static field, while that of energy momentum tensor of g-field of $\Psi^{jk}(x)$ ($j \neq k$, j, $k = 1 \sim 4$) is thought to also obey the equation with the form of (12−1) or (12−2). For (A) g-field G is related to polar angular momentum density of Я [as stated in (9－1)] by,

$$\frac{G}{\sqrt{1-\beta^2}} = -\frac{k}{c}\text{Я} \;, \qquad (12-3)$$

which implies elasticity in the direction of time since

$$i\,\text{Я} = (M^{41},\ M^{42},\ M^{43})$$

are the components of total angular momentum density associated with time-suffix.

The two masses with positive energy which attract each other (See Fig. 36) are bound by polar angular momentum density line of force whose flux would shrink longitudinally, while elongate laterally.

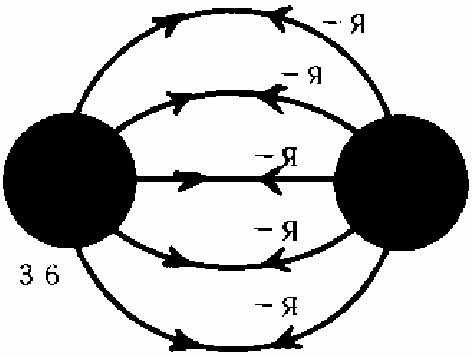


Fig. 36

Polar Angular Momentum Density Lines of Force which would shrink longitudinally, while elongate laterally.

Potential $\Psi^{jk}(x, y\cdot z)$ of energy momentum tensor in static g-field obeys partial differential equation of the eighth order of,

$$\Delta^4 \varphi^{jk}(x,\ y,\ z) = 0\,, \qquad (12-4)$$

where $\quad T^{jk} = \partial_j\, \partial_k\, \psi^{mn} \;(j \neq k)$

$$T^{jj} = -(\partial_k^2\, \Psi^{mn} + \partial_m^2\, \Psi^{nk} + \partial_n^2\, \Psi^{mk})\;, \qquad (12-5)$$

in recourse to the same kind of analysis which leads to (7－24). The appendix (A－9) states that stress tensor (on hyper surfaces) is governed by the same potential as energy momentum tensor.

Owing to (12－4) and (12－5), energy momentum tensor of T^{jk} associated with the zeroth hyper surface are :

$$T^{01} = T^{02} = T^{03} = 0\,,$$

$$\begin{aligned} T^{00} = 45A\{ & -\frac{28}{R^3} + 2[17(x^4+y^4+z^4) + 35(y^2z^2+z^2x^2+x^2y^2)]/R^7 \\ & + 7[(y^2z^4+z^2x^4+x^2y^4) + 78x^2y^2z^2 + (y^4z^2+z^4x^2+x^4y^2)]/R^9 \\ & + 126(y^4z^4+z^4x^4+x^4y^4)/R^{11}\}\,, \end{aligned} \qquad (12-6)$$

where T^{44} differs from T^{00} by the factor of -1.

$$c\rho=\sqrt{(T^{00})^2-((T^{01})^2+(T^{02})^2+(T^{03})^2)}=|T^{00}|, \qquad (12-7)$$

stands for mass density, because four momentum density of (p, iq) is associated with the tensor by,

$$p=(T^{01}, T^{02}, T^{03}),$$
$$q=-T^{00}. \qquad (12-8)$$

For T^{03} means the third component of momentum on the zeroth hyper surface.

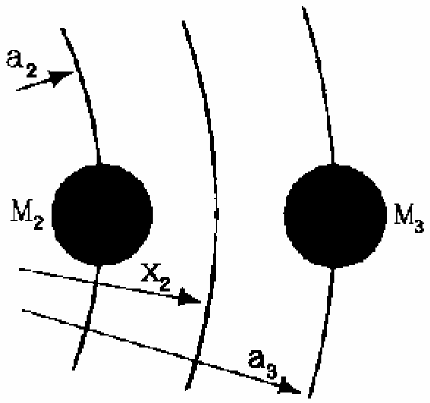
(12−3) Mass Distribution of Terrestrial Planets

At the origin of solar system mass distribution is governed by the equation of (12−4) and (12−5), center of the sun being the origin. We obtain

$$x_2=\frac{a_2 M_3+a_3 M_2}{M_2+M_3}, \qquad (12-9)$$

when we denote the distance from the origin to the point which divides $a_2 \sim a_3$ by $M_2 : M_3$, a_3, a_4 and a_2 being radii of Earth, Mars and Venus. Mass inside infinite cylinder with inner radius of a_2 and outer of x_2 is concentrated on to M_2, while that inside infinite (vertical) one with inner radius of x_2 and outer of a_3 is done onto M_3 when M_2 and M_3 are at a certain radius of the orbit of M_3

Fig. 37



Inner radius and outer of vertical infinite cylinder which contained the mass that is concentrated upon the planet.

This point is supposed to divide mass distribution at the origin of formation of solar system. We namely have a relation of,

$$M_3 = \int_{x_2}^{x_1}\int_{-\infty}^{\infty}\int_{0}^{2\pi} \left|\frac{T^{00}}{c}\right| r\,d\,r\,d\,z\,d\,\varphi$$

with
$$\begin{cases} x = r\cos\varphi\ , \\ y = r\sin\varphi\ , \\ z = z\ , \end{cases} \qquad (12-10)$$

since mass distributed inside a **vertical infinite cylinder** with inner radius of x_2 and outer of x_3 is concentrated upon M_3.

Performing integrations, we obtain

$$= B\log\frac{x_3}{x_2}\ , \qquad (12-11)$$

because the last term of the part which is inversely proportional to R^{11} is, for instance,

$$I = \int_{x_2}^{x_3}\int_{-\infty}^{\infty}\int_{0}^{2\pi} \frac{126\,r^8\cos^4\varphi\sin^4\varphi\,r\,d\,r\,d\,z\,d\,\varphi}{(r^2+z^2)^{\frac{11}{2}}}$$

$$= 252\int_{x_2}^{x_3}\int_{0}^{\infty}\int_{0}^{2\pi} \frac{r^9\cos^4\varphi\sin^4\varphi\,d\,r\,d\,z\,d\,\varphi}{(x^2+z^2)^{\frac{11}{2}}}\ .$$

This integrand becomes

$$= 252\int_{x_2}^{x_1}\frac{d\,r}{r}\int_{0}^{\frac{\pi}{2}}\cos^9\lambda\,d\,\lambda\int_{0}^{2\pi}\cos^4\varphi\sin^4\varphi\,d\,\varphi\ , \qquad (12-12)$$

if we put $\qquad z = r\tan\lambda\ .$

All the remaining terms are proportional to

$$\ln\frac{x_3}{x_2}\ ,$$

which can be transformed into log and we finally obtain (12-11)

Normalization constant of B can be determined such that

$$B = 4.5776\ \ (A.\,U.) \qquad (12-13)$$

in virtue of mass of **Earth**, **Venus** and **Mars**, and radii of their orbits, where these constants are tabulated in TAB. 2.

TABLE 2

	Mercury	Venus	Earth	Mars	Pluto
radii	0.3871	0.7233	1.00	1.5237	39.5
mass	0.054	0.815	1.00	0.108	0.8

We have supposed their orbits to almost be circles since their eccentricities are so small. With reference to (12−13) and the TABLE 2 we can calculate masses of Mercury, Venus and Mars as in TABLE 3.

TABLE 3

	Mercury	Venus	Earth	Mars
Observ-ation	0.054	0.815	1.00	0.108
Theory	0.105 (rather larger)	1.452 (rather larger)	1.00 (standard)	0.068 (rather smaller)

The distribution law of logarithm is quite appropriate to Terrestrial Planets. We must select the other normalization constant with the boundary condition of Jupiter to Giant Planets.

(12−4) The Orbit of the Tenth Planet

Normalization constant to Terrestrial Planets are applied to Pluto and the other planets since mass of Pluto is :

$$M_9 = 0.8 \quad (\mathrm{A.U.})$$

which is nearer to mass of the earth.

x_9 of the radius which determines mass distribution between Pluto and the Tenth Planet is calculated by

$$0.8 = 4.5776 \log \frac{x_9}{39.112}, \qquad (12-14)$$

where $\quad x_8 = 39.112 \quad (\mathrm{A.U.})$

shows the point which divides mass distribution between

Neptune and Pluto. We namely obtain

$$x_9 = 62.02 \quad (\text{A. U.}). \tag{12−15}$$

Next we shall suppose that the Tenth Planet belongs to Terrestrial Family and owns the mass of about 0.8 A. U. Then, x_{10} of the radius of outer dividing point is determined by

$$0.8 \approx 4.5776 \log \frac{x_{10}}{62.02}, \tag{12−16}$$

namely deriving

$$x_{10} \approx 94.20. \tag{12−17}$$

On the other hand, a_{10} of the orbit of the Tenth Planet is calculated such that

$$x_9 = 62.02 = \frac{0.8\,a_9 + 0.8\,a_{10}}{0.8 + 0.8}, \tag{12−18}$$

in recourse to (12−9), having namely

$$a_{10} = 84.54, \tag{12−19}$$

which reduces to

$$a_{10} = 125.7 \times 10^8 \text{ Km}, \tag{12−20}$$

if we take the number of $\quad$ I. A. U. $= 1.495 \times 10^8$ Km.

On the third hand, astronomers predicted that

$$a_{10} \approx 126 \times 10^8 \text{ Km}, \tag{12−21}$$

in virtue of the orbits of comets (Ref. 72), which is just identical with our result. We can predict that the Tenth Planet is present at the distance of 126×10^8 Km from the sun, owing to both of the conclusions.

§ 13 Periodic Chart of Elementary Particles

(13−1) Intrinsic Principal Quantum Number

In accordance with **orbital quantum number** of L of,

$$< L^2 > = L(L+1)\hbar^2 , \qquad (13-1)$$

spin quantum number of s of,

$$< s^2 > = s(s+1)\hbar^2 , \qquad (13-2)$$

is present. On the other hand, **principal quantum number** of n is defined with **relativistic angular momentum** (See the chapter 2) of,

$$< L^2 + (i\text{я})^2 > = (n^2 - 1)\hbar^2 . \qquad (13-3)$$

The components with time suffices $i\lambda$ of relativistic spin are also present, in recourse to which we naturally introduce

$$< s^2 + (i\lambda)^2 > = (\lambda^2 - 1)\hbar^2 , \qquad (13-4)$$

in analogy of,

$$(13-1) \rightleftarrows (13-2) .$$

We shall call λ <**intrinsic principal quantum number**> which also takes the eigen value of half odd integer since s is so although L nonnegative integer only.

To electrons we know that

$$i\lambda = \begin{cases} -\frac{i}{2}\hbar\gamma^4\gamma^1 \\ -\frac{i}{2}\hbar\gamma^4\gamma^2 \\ -\frac{i}{2}\hbar\gamma^4\gamma^3 , \end{cases} \qquad (13-5)$$

while $i\lambda$ may take various eigen values to particles in general where γ^j stands for Diracean spinor.

Then, the eigen value of $i\text{я}$ associated with orbital motion of particles are expressed by

$$< \text{я}^2 > = [(n^2 - 1) - L(L+1)]\hbar^2 , \qquad (13-6)$$

(See the chapter 2), where we have applied unitary trick to **Klein-Gordon Equation**. Accordingly, the eigen value classified with (λ, s) as that of elements with (n, L). We have known spin quantum numbers of all the elementary particles. We emphatically find that mass of a particle with $s=1/2$ is a little less than that with $s=0$ which has the same intrinsic principal quantal number of λ. Meanwhile we have known that μ meson owns a little less mass than π meson, which seems to imply that they do the same λ but the former does $s=1/2$ while the latter $s=0$. Accordingly we may determine their λ so that the ratio of their masses may be 134.975 : 105.659, which leads us to

$$\lambda = 2 .$$

We, therefore, obtain normalization constant of

$$K = \frac{134.975}{\sqrt{2^2-1}} \approx 77.91409 , \qquad (13-13)$$

making use of π^0 as boundary condition.
This normalization constant gives a little larger mass of calculation of

$$m_\mu = 116.8711 \text{ Mev},$$

than observed.
If we take $\lambda = \frac{3}{2}$
which is just before $\lambda = 2$ or $\lambda = \frac{5}{2}$
which is just after, theoretical ratio of their masses does not agree with observed. Thus, we may determine intrinsic principal quantum number of pion and muon to be

$$\lambda = 2 . \qquad (13-14)$$

and that mass of muon is a little smaller than that of pion because of the difference of spin quamtum number of s.

(13−2) Classification with Intrinsic Principal Quantum Number and Spin

In recourse to the conclusion in the former section we have the following periodic chart making use of normalization constant of (13−13), where ж, э, ю and я stand for the state of $s = 0$, $s = \frac{1}{2}$

(13−2) Classification with Intrinsic Principal Quantum Number and Spin

$s = 1$ and $s = \frac{3}{2}$,

respectively. Their symbols correspond with s, p, d and f in the periodic chart of elements. For instance, (20 я) means that it is in the eigen state of $\lambda = 20$ and $s = \frac{3}{2}$.

TABLE 6

particles	eigen state	theory (Mev)	observation (Mev)
μ	(2 э)	116.871	105.659
$\pi^{\pm}$ π^{0}	(2 ж)	134.975	139.578 134.975
$K^{\pm}$	($\frac{13}{2}$ ж)	500.411	493.88
p n	(12 э)	929.374	938.256 939.550
λ^{0}	($\frac{29}{2}$ э)	1,125.041	1,115.6
Σ^{+} Σ^{0} Σ^{-}	($\frac{31}{2}$ э)	1,203.227	1,189.4 1,192.5 1,197.3
ξ^{-} ξ^{0}	(17 э)	1,321.578	1,321 1,315
Ω^{-}	($\frac{43}{2}$ я)	1,667	1,672

§ 14 Solid State Battery (Revised) (Ceased)

§15 Decay of Lucifer

There are many small planets, called Asteroid, between the orbit of Mars and that of Jupiter. Most of them are smaller than even ordinary sattellites, and some of them are not spherical.

Representative one are Ceres, Pallas, Juno, Vesta, Eros, Icarus and so on. Their masses and radii are tabulated in TABLE 7.

TABLE 7

(See the right. Specifications of Asteroid.)

More than 1,600 are found. There will be more than fifty thousand, including the smallest which is now undiscovered. They will be the ruins of one more mother planet which was decayed in the ancient Era. It has been called < Lucifer > by some astronomers. We shall study specifications of that marvelous planet in this chapter. It is situated on the fifth orbit.

We, therefore, call the fifth planet. Bode number is 2.8 to the fifth. That is to say, the mother planet had enjoyed the orbit of 2.8 Astronomical Unit from the Sun.

The specifications are tabulated on the TABLE 8, along with the inner planet of Mars and the outer of Jupiter.

TABLE 8

	Mars	Lucifer	Jupiter
radii of orbits	1.524	2.8	5.203
Mass	0.108	x	317.904

§15 Decay Lucifer

As studied in the twelfth chapter, the following Eqn. determines the mass of terrestrial planet,

$$x = 4.5776 \log \frac{y}{Z} \qquad (15-1)$$

where Z and y are radius which distributes energy tensor to the inner planet and that one, and what does the euter planet and that, concerned. Would you please read the Eqn. of (12-9)?

From inside, we shall denote the masses of three planets with m, n and p. The following Eqn. reads

$$Z = \frac{2.8m + nu}{m + n} , \qquad (15-2)$$

$$y = \frac{nu + 2.8p}{n + p} , \qquad (15-3)$$

where

m, n and p are mass of Mars, that of Lucifer and that of Jupiter. u and p are radius of Martian orbit and that of Jupiterean one. The reader can find the reason in section (12-3). (15-2) and (15-3) give the radius of the orbit at which g-potential of the inner planet and the outer are equal.

We must know mass of Lucifer so that we may determine them (the radii of orbits). With regards to terrestrial planet, they become larger, Mercury → Venus → Earth, and the final Mars is smaller than Earth, as indicated in Fig. 49.

Fig. 49

The sizes of terrestrial planets

Accordingly, Lucifer is about equal to Mars or owns about the same mass as Mars. Therefore,

$$Z \approx 2.8$$

as Jupiter's mass is about 3,000 times that of Mars, if we use

0.108

§15 Decay Lucifer

to Lucifer.

Similarly,

$$y = \frac{1.524 + 2.8}{2} = 2.162 \qquad (15\text{-}4)$$

as mass of Mars and that of Lucifer are supposed equal.

Then, we obtain

$$x \approx 0.52 \quad \text{(Astronomical Unit)},$$

and x is also expressed by

$$\approx 3.1 \times 10^{27}\text{gr} . \qquad (15\text{-}5)$$

On the other hand, total mass of Asteroid are calculated as

$$x' = 1.7 \times 10^{24}\text{gr} . \qquad (15\text{-}6)$$

That is to say,

$$\frac{x'}{x} \approx 5.5 \times 10^{-4} .$$

Only 0.06 per cent of mass remains when decayed. The other mass was decayed into Gamma ray and so on. 10^{47} ergs of energy were made free. There was an astounding explosion.

Thirdly, mean density of Asteroids are known

$$3.5 \ \text{gr}/cm^3 ,$$

which shows that of Lucifer.

In virtue of mathematical formulae of sphere

$$3.5 \times \frac{4\pi}{3} R^3 = 3.1 \times 10^{27} , \qquad (15\text{-}7)$$

we finally derive the radius of,

$$R \approx 6,000\text{km} .$$

The size of Lucifer was about identical with that of Earth.

§ 16 Experimental Results

(16−1) Imaginary Output Potential with G−Kleinean Coil

Firstly we fabricated three phases current source of about 1MHz as shown in the following circuit. The core of the center oscllating coil, for instance, owns the size as displayend in the following figure.

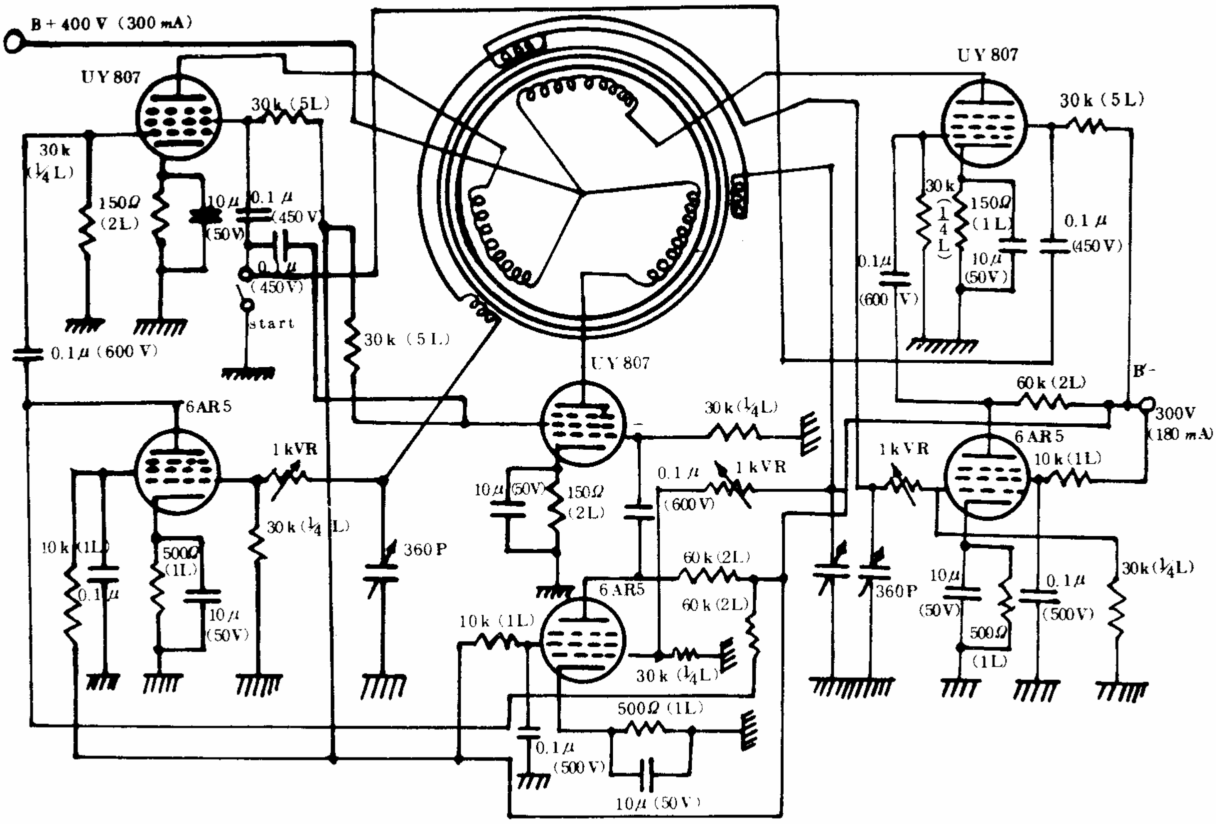


Fig. 51

The oscillating coil should be composed of Kleinean Roll instead of Solenoid.

The 3 phases current is fed onto 3 spherical condensers of G−generator upon Fig.13 as, for instance, in the next figure.

The output coil of ④ in Fig.13 should also be done of Kleinean Roll.

We secondly measure gravitoelectric output potential of this coil with high frequency AC transistorized volt meter, through the switching device as shown in the succeeding figure.

RMS (Root Mean Square) output electric potential in the one electrical direction differs from another as shown in the foll-owing pictures.

One example is displayed in the next table with experimental specifications.

Fig. 52

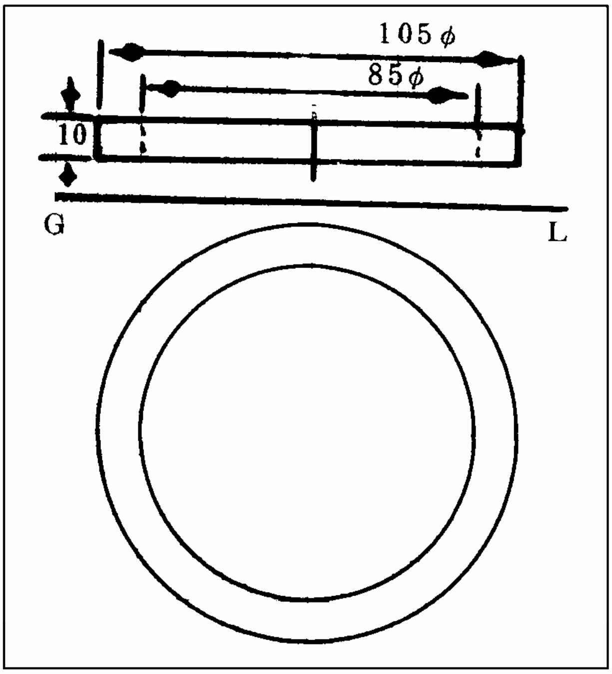
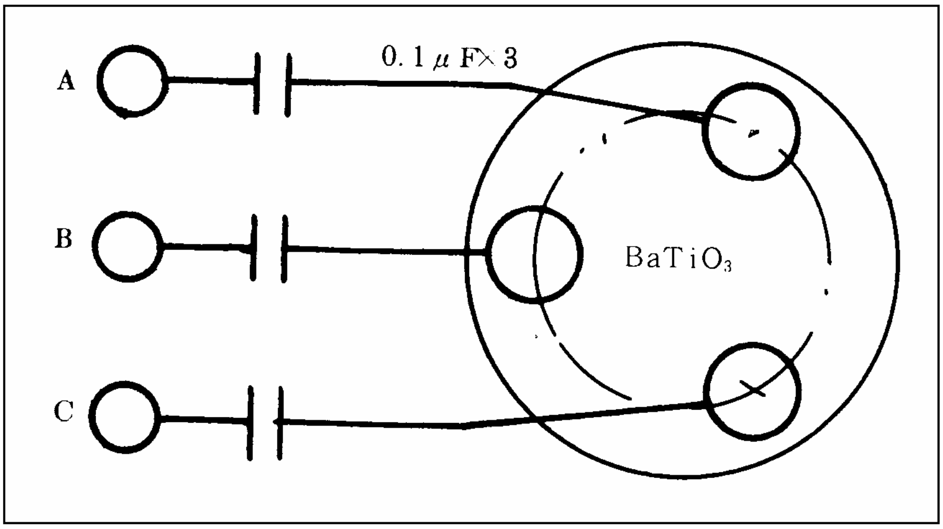
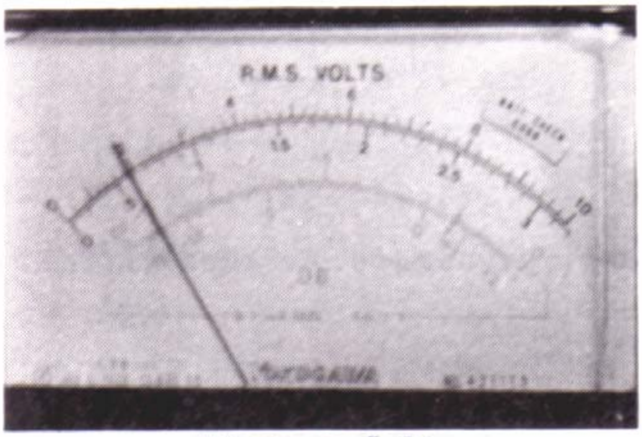


Fig. 53



(16 − 1) Imaginary Output Potential with G−Kleinean Coil



Picture # 24

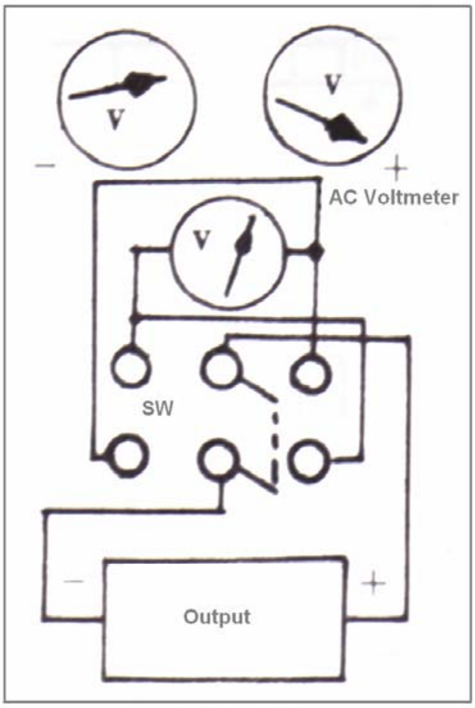
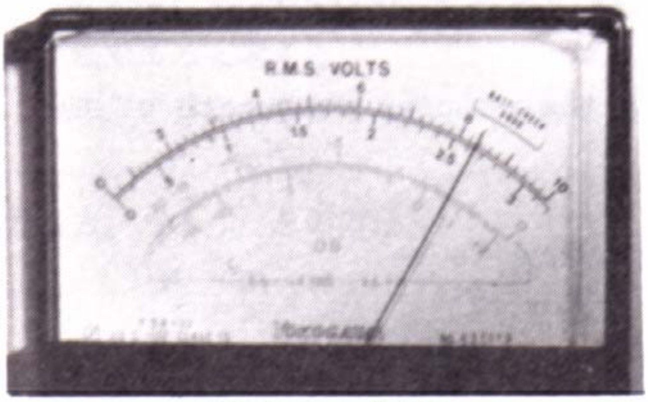


Fig. 54



Picture # 25

RMS Output in the one direction	1.9 V
another switching direction	1.6 V
frequency of 3 phases current	2 MHz
3 phases current potential	100 V
Output Coil	20 Kleinean Turns (of vinyl cupper wire)
$BaTiO_3$ Disc	diameter of 40 m/m
Date	45/20h/18/March/1974

(16−1) Imaginary Output Potential with G-Kleinean Coil

If we suppose the output potential in the one electrical direction to be

$$\Psi_1 = x + \Psi_0\ e^{i\omega t},$$

another must be

$$\Psi_2 = -\ \Psi_1 = -\ x - \Psi_0\ e^{i\omega t},$$

owing to the conventional electrodynamics. We easily find the difference of,

$$\Psi_1 - \Psi_2 = 2\ (\ x + \Psi_0\ e^{i\omega t}),$$

the RMS value of which is thought to be,

$$\Psi = 2\ x,$$

but, marvelously, we can not detect with DC meter.

We can not but conclude that x is quite particular.

The author suppose this difference must be that between complex conjugates.

Namely, the former value is the complex conjugate of the latter as

$$\Psi_1 = \Psi_2^{*}$$

We should express the difference to be,

$$\Psi_1 - \Psi_2 = x + \Psi_0\ e^{i\omega t} - x - \Psi_0\ e^{-i\omega t}$$
$$= 2\ i\ \Psi_0\ \sin\omega t,$$

which is purely imaginary. With reference to the topological characteristics of Kleinean rolled coil is this suggestion quite natural ?

(16−2) Tachyon Oscillator (Revised) (Ceased)

§ 17 Electro − G Induction

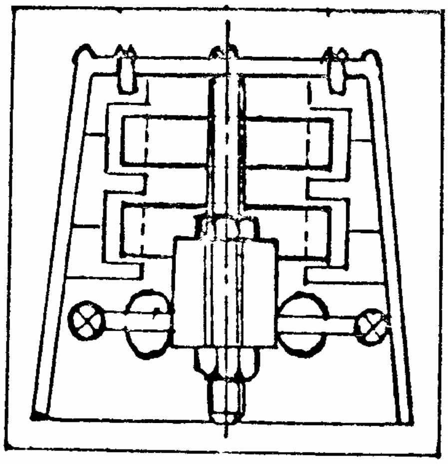
(17−1) Increasing Electro-g Induction

In Fig.13, we use single toroidal ferrite core, upon which three divided Kleinean Roll Coils are wound, as in the following Fig.57. The upper coil is Opt. coil, electric potential of which was measured day after day.

We drove three spherical condensers with 2SC42PP (transistorized) three phases current of which has the frequency of about 1.5 MHz. The potential amplitude was 200V. The Opt. potential increased hour by hour, day after day as g-stress energy flows in the set.

That increasing curve is shown in the following Fig.58. In three months the final potential became 37 volt, compared with the initial of 2 volt.

Fig. 58



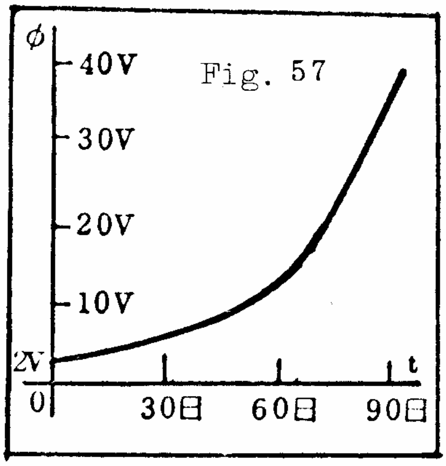
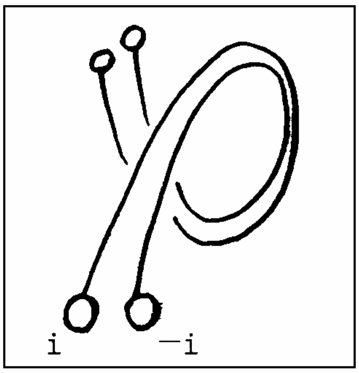


Fig. 57

(17−2) Topological Translation of Möbius Strip into Electronic Circuit

Reverse side of Möbius Strip can be expressed by, as it were, imaginary ground in electronic circuit, because of which that electrical translation is double solenoid.

Fig. 59



(17−3) Double Solenoid Circuit

One of the examples with Double Solenoid is shown in the succeeding Fig. which is blocking oscillator with double solenoid. Opt. electric potential is 300 V, which is realized by Tachyon fully stored in space-time.

25 turns double coil is used as spherical condenser, as it were.

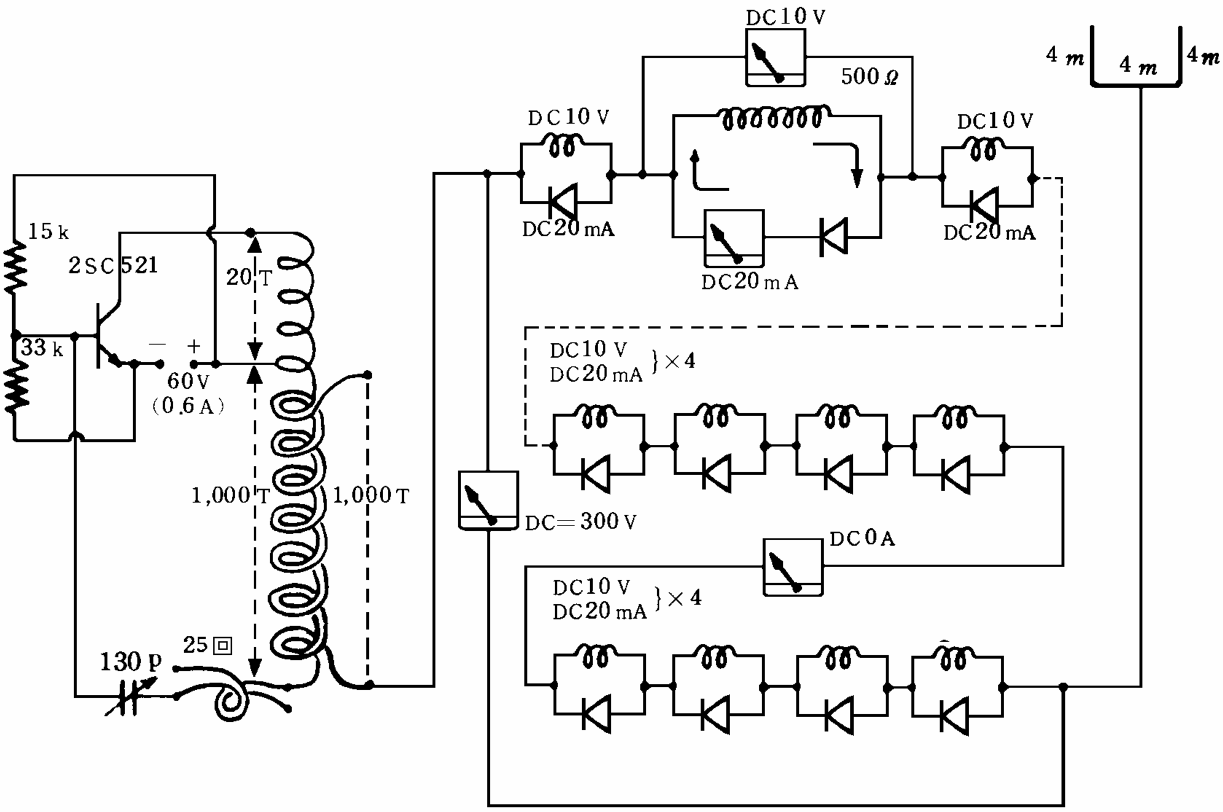


Fig. 60

(17−4) (17−5) (Revised) (Ceased)

§18 Properties of about Tachyon

(18−1) Four Vectors about Tachyon

The square of any four vector of particles forms constant as

$$p^2-(p^0)^2=-(mc)^2, \qquad (18-1)$$

where

$$p^0=mc\frac{dt}{d\tau}$$

and

$$cp^0=W$$

which is called energy.

Naturally, we can form

$$A_x^2+A_y^2+A_z^2-\frac{\varphi^2}{1-\beta^2}=-\varphi^2 \qquad (18-2)$$

to particles, in which φ is electric potential. and in analogy to which we obtain

$$A_x^2+A_y^2+A_z^2-\frac{\varphi^2}{\beta^2-1}=-(i\varphi)^2 \qquad (18-3)$$

to super signal particle.

Of course, A_x, A_y and A_z are spatial components of vector potential. We can call φ rest potential.

Real current j_z is defined by

$$j_z=\frac{e}{c}\cdot\frac{dz}{d\tau}, \qquad (18-4)$$

which naturally leads us to

$$j_t=\frac{e}{c}\cdot c\frac{dt}{d\tau},$$

where $\qquad d\tau=\sqrt{1-\beta^2}\,dt$.

Namely we obtain

$$j_t=\frac{e}{\sqrt{1-\beta^2}}, \qquad (18-5)$$

and also

$$j_x^2+j_y^2+j_z^2-j_t^2=constant. \qquad (18-6)$$

The principle of four vector is that : the 4 th component is relativistically variable (: increasing or decreasing) one, the constant of which gives the right hand side of formulae of this kind.

The constant may easily be found to become

$$e$$

in (18-6).

Moreover we also derive

$$j_x^2+j_y^2+j_z^2-j_t^2=-(ie)^2 \qquad (18-7)$$

to tachyon (to, for instance, tachy-electron or that proton).

$$jt=\frac{ie}{\sqrt{1-\beta^2}}=\frac{e}{\sqrt{\beta^2-1}} \qquad (18-8)$$

can be given as real like that W is real (energy) to super signal particle, in G.Feinberg's formula.

These are also Lorentz increase of electric potential and that of charge.

The word of rest charge is given to e. Finally we shall proceed to four vector of acceleration of,

$$\alpha_x^2+\alpha_y^2+\alpha_z^2-\alpha_t^2=const. \qquad (18-9)$$

where

$$\alpha_t=\frac{d^2t}{d\tau^2} \quad .$$

We already found :

$$\frac{dt}{d\tau}=\frac{W}{mc^2} \qquad (18-10)$$

because of which we express

$$\frac{d^2t}{d\tau^2}=\frac{1}{mc^2}\cdot\frac{dW}{d\tau}=\frac{1}{mc^2}\cdot\frac{1}{\sqrt{1-\beta^2}}\cdot\frac{dW}{d\tau}$$

$$=\frac{1}{mc^2\sqrt{1-\beta^2}}\cdot S, \qquad (18-11)$$

where

$$S = \frac{dW}{dt}$$

is the so-called power (energy flowing rate), which leads us to

$$mc^2 \alpha_t = \frac{S}{\sqrt{1-\beta^2}} \quad . \tag{18-12}$$

In any relativistic case of four vector constant term in the right hand side has been that of 4th (0-th) component.

This conception finally leads us to

$$\alpha_x^2 + \alpha_y^2 + \alpha_z^2 - \left(\frac{S}{mc^2\sqrt{1-\beta^2}}\right)^2 = -S^2 \quad . \tag{18-13}$$

The 4-th component denotes Lorentz increase of power, where S is rest power (working).

We shall proceed to the case of Tachyon. From (18-13) that notation is easily found to have the form

$$\alpha_x^2 + \alpha_y^2 + \alpha_z^2 - \left(\frac{S}{mc^2\sqrt{\beta^2-1}}\right)^2 = S^2 \ , \tag{18-14}$$

by replacing S in the former formula with iS.

We have oversighted the most basic physical quantity of

$$\vec{x} = (x, \ y, \ z, \ ict) \ . \tag{18-15}$$

The reader will easily find :

$$x^2 + y^2 + z^2 - c^2 t^2 = -c^2 T^2 \ , \tag{18-16}$$

where T is invariant time. This time seems to coincide with Enatsuean invariant one stated in the former chapter (the 3rd one). Especially to Tachyon

$$x^2 + y^2 + z^2 - c^2 t^2 = c^2 T^2 \ , \tag{18-17}$$

replacing T with iT.

(18-2) Kinetic Energy of Tachyon

Total energy of tachyon is given by the familiar form of,

$$W=\frac{\mu c^2}{\sqrt{\beta^2-1}}=\frac{\mu c^2}{\beta}\left(1-\frac{1}{\beta^2}\right)^{-\frac{1}{2}}\ \left(\beta=\frac{V}{c}\ ,\ \ i\mu=m\right),$$

(18-18)

which is developed by Laurent expansion of,

$$=\frac{\mu c^2}{\beta}\left[1+\frac{1}{2}\cdot\frac{1}{\beta^2}+\frac{3}{8}\cdot\frac{1}{\beta^4}+\cdots\cdots\right]$$

$$=\mu c^2\left(\frac{c}{V}\right)+\frac{\mu c^2}{2}\left(\frac{c}{V}\right)^3+\frac{3}{8}\mu c^2\left(\frac{c}{V}\right)^5+\cdots\cdots\ .$$

(18-19)

The first term gives what corresponds with rest energy of real particle, but super signal particle never enjoys such state. It is interpreted to be rest one when one observes tachyon from moving frame at signal velocity.

The second term of,

$$\frac{\mu c^2}{2}\left(\frac{c}{V}\right)^3,$$

is that kinetic energy, which decreases with V at super signal. The remaining terms are corrections to that kinetic energy.

Momentum of tachyon owns the form of,

$$P=\frac{\mu V}{\sqrt{\beta^2-1}}\ , \qquad (18-20)$$

which is developed into Laurent series such that,

$$=\mu c+\frac{\mu c}{2}\left(\frac{c}{V}\right)^2+\frac{3}{8}\mu c\left(\frac{c}{V}\right)^4+\cdots\cdots, \qquad (18-21)$$

the first term of which,

$$\mu c$$

should be called < fundamental momentum of tachyon >.

The remaining

$$\frac{\mu c}{2}\left(\frac{c}{V}\right)^2+\frac{3}{8}\mu c\left(\frac{c}{V}\right)^4+\cdots\cdots \qquad (18-22)$$

are correction terms.

(18-3) Periodic Chart of Tachyon

Absolute value of, as it were, rest mass of Tachyon of,

$$|i\mu|=m, \qquad (18-22)$$

probably takes discrete value. For instance, proton can arrive super signal when accelerated by g. It takes certain value of μ which corresponds with that mass on the zeroth hyper surface.

Mass formula of periodic chart of elementary particles (table 6) took the form of,

$$m=77.91409\sqrt{\lambda^2-1-s(s+1)}\ (MeV), \qquad (18-23)$$

where λ is called <intrinsic principal quantum number> and what enjoys analytic continuation of eigen value upon ultra spherical harmonics of (referred to chapter 2),

$$\Theta_n^L(\cos\theta)=\sin^L\theta\left[\frac{d}{d(\cos\theta)}\right]^L C_{n-1}^1(\cos\theta). \qquad (18-24)$$

A. Z. Dolginov finds that principal quantum number of n enjoys analytic continuation upon the other ultra spherical harmonics of,

$$\Theta_n^L(\theta)=\frac{i(ch\theta)^L}{M_L}\left[\frac{d}{d(sh\theta)}\right]^{L+1}\cos(N+1)\left(\theta+\frac{i\pi}{2}\right), \qquad (18-25)$$

where

$$M_L^2=N^2(N^2+1^2)(N^2+2^2)\cdots\cdots\times(N^2+L^2),$$

[referred to section (2-3)]

$$n=iN. \qquad (18-26)$$

It is quite natural that <intrinsic principal quantum number> corresponding with (18-26) should be pure imaginary such that

$$n \to \lambda = i\,Z \ . \qquad (18-27)$$

Then, tachyon enjoys different eigen state from that in periodic chart of real particles in section 13 . We, therefore. put

$$\lambda = i\,Z,$$

in mass formula of (18－23).

We easily find that it takes the form of,

$$m = 77.91409\,i\sqrt{Z^2+1+s\,(s+1)}, \qquad (18-28)$$

which reveals that, as it were, rest mass of tachyon is specified by instrinsic quantum nunrbers, and is pure imaginary.

The N given by A.Z.Dolginov of (18－25) is real and serial. Then, we naturally regard Z in (18－27) as real serial number. The author, however, propose that super signal proton (tachy-proton) can be labelled by letting it analytically continue onto 12 iə (eigen state on the first hyper surface), and that all the real particles can be done similarly.

A super signal particle with

$$Z = 12 \ ,$$

and

$$s = \frac{1}{2},$$

is present on the first hyper surface (neighbouring hyper surface) when we take up (18－28) as formula of periodic chart of tachyon. This particle should be called tachy-proton (the first hyper surface entity analytically continued from the zeroth hyper surface ; ordinary physical space).

Then, we finally obtain

$$m = 939.4105\,i\ MeV, \qquad (18-29)$$

from mass formula of (18－28).

Proton owns mass of,

$$m = 938.256\,MeV, \qquad (18-30)$$

than which absolute value of (18－29) is a little larger.

Most of scientists understand that they must not simply conclude imaginary mass of tachy-proton to be,

$$m' = 938.256\,i \quad \text{MeV}.$$

They also know how much different it is from m' with (18－29). Generally speaking, absolute value of tachyon's imaginary mass is a little larger than corresponding real particle on the zeroth hyper surface.

We finally derive the following table by making calculations to the former periodic chart of real particles.

TABLE 14

eigen state	real particles		tachyons
2 i Э	μ	105.659	186.830 i
2 i Ж	$\pi^{\pm}$ π^{0}	139.578 134.975	174.224 i
$\frac{13}{2}$ i Ж	$K^{\pm}$	493.82	512.402 i
12 i Э	P n	938.256 939.550	939.410 i
$\frac{29}{2}$ i Э	λ^{0}	1,115.6	1,134,468 i
$\frac{31}{2}$ i Э	Σ^{+} Σ^{0} Σ^{-}	1,189.4 1,192.5 1,197.3	1,212,032 i
17 i Э	ξ^{-} ξ^{0}	1,321 1,315	1,328,552 i
$\frac{43}{2}$ i Я	Ω^{-}	1,672	1,675.149 i

For instance, 2 i Э means analytic continuation of eigen state of 2 onto the first hyper surface.

§ 19 Time Reversing Oscillator (Revised/Ceased)

§ 20 Imaginary Distance (Ceased)

(21-1) Signal Number
(21-2) Cross Word Transcendental Number

§21 Signal Number

(21−1) Signal Number

Signal velocity is widely known to be,

$$c = 2.997929 \times 10^{10}\ \mathrm{cm/sec}$$

which happens to be expressed by the transcendental number of,

$$2\pi \log 3 = 2.9978458\ ,$$

the 3 of which seems to be planetary number of earth.

If a particle attains 99% of signal velocity;

$$V = 0.99\,c\ , \qquad (21-3)$$

Lorentz factor happens to become integer of,

$$\begin{aligned} r\,(0.99\,c) &= \frac{1}{\sqrt{1-\left(\frac{0.99\,c}{c}\right)^2}} \\ &= 7.088815 \\ &\fallingdotseq 7. \end{aligned} \qquad (21-4)$$

We shall discuss physical meaning of this characteristic value of V elsewhere.

(21−2) Cross Word Transcendental Number

Two transcendental number are present

$$\left.\begin{aligned} e &= 2.71828 \\ \pi &= 3.14159 \end{aligned}\right\} \qquad (21-5)$$

$$(\ e < 2\pi\log 3 < \pi\ ,\quad e \approx 2\pi\log 3 \approx \pi \approx 3\ )$$

one of which is a little smaller, while the other of which a little larger. These transcendental numbers forms the following relation:

$$\begin{aligned} e - 2\pi\log 3 + \pi &= 2.88202\ \ (2\pi\log 3) \\ -e + 2\pi\log 3 + \pi &= 3.40116\ \ (\pi) \\ e + 2\pi\log 3 - \pi &= 2.54906\ \ (e) \end{aligned} \qquad (21-6)$$

Three transcendental numbers in parenthesises means that numerical values on the right hand side nearly equal respectively.

Sum of transcendental numbers seems to produce transcendental ones, because of which we put these into parenthesises.

In recourse to characteristic form of (21-6) we call these <cross word transcendental number>, which seems to play important roles when one performs analysis of fundamental physical relations.

We shall discuss elsewhere.

(21-3) Signal Velocity on Other Planets

As signal number of,

$$C_0 = 2\pi \log 3 \times 10^{10} \ \text{cm/sec}$$
$$= 2.9978458 \times 10^{10} \ \text{cm/sec}$$

is nothing but,

$$= 2\pi \log(\text{planet number}) \times 10^{10} \ \text{cm/sec} \quad (21-7)$$

that upon Mars as the 4th planet would be,

$$C_4 = 2\pi \log 4 \times 10^{10} \ \text{cm/sec}$$
$$= 3.7828544 \times 10^{10} \ \text{cm/sec} \quad (21-8)$$

Photo 34

(21−3) **Signal Velocity on Other Planets**

In <Special Relativity> invariant is the signal velocity throughout entire space-time, but Einsteinean <General Relativity> maintains that it is variable throughout that space time.

Namely, it starts from the invariance of,

$$ds^2 = g_{11}\, dx^2 + g_{12}\, dx\, dy + g_{13}\, dx\, dz + g_{14}\, dx\, du + \cdots\cdots + g_{44}\, du^2 , \qquad (21-9)$$

where s stands for geodetic, and

$$u = ict ,$$

g^{ik} being functions depending upon space-time co-ordinate of (x, y, z, u).

In Minkowskean space-time blonging to <Special Relativity> Einstein defines

$$g_{44} = -1 ,$$

accordingly

$$ds^2 = dx^2 + dy^2 + dz^2 - c^2\, dt^2 , \qquad (21-10)$$

which leads us to that g_{00} becomes square of signal velocity.

If g_{44} is a function depending upon space-time co-ordinate, cannot signal number be that of space-time co-ordinate? Then, it becomes variable throughout entire space-time. That is to say, one finds that the formula of (21−8) is general relativist

With reference to (21−7) we obtain the following table, calculating signal velocities from Venus to the 10th planet.

Table 15

planet	signal velocity	signal number
Venus	1.8914272 × 10 cm/sec	$2\pi \log 2$
Earth	2.9978458 〃	$2\pi \log 3$
Mars	3.7828544 〃	$2\pi \log 4$
(Lucifer	4.3917579 〃	$2\pi \log 5$)
Jupiter	4.8892668 〃	$2\pi \log 6$
Saturn	5.3099072 〃	$2\pi \log 7$
Uranus	5.6742817 〃	$2\pi \log 8$
Neptune	5.9956854 〃	$2\pi \log 9$
Pluto	6.2831852 〃	$2\pi \log 10$
(The 10th Planet	6.543265 〃	$2\pi \log 11$)

§ 22 Center of Wave

Mass is called <wavicle> which means that it is a particle, and also wave on the other hand.

Both center of mass and of wave are, therefore, present.

For instance, a swing moves without external force. It has been interpreted to move by transition of center of mass, but slip of center of mass and that of wave provoke a motion without external force.

Real particle is absorbing and emitting tachyons. One of the expressions of microscopic motion is given by imaginary quantities.

This quantity periodically changes such that,

$$m = iW \sin(\omega t + \alpha), \tag{22-1}$$

when center of wave moves, while center of mass similarly does :

$$M = \mu \sin \omega t \tag{22-2}$$

Resultant quantity owns the form of,

$$\nu = \mu \sin \omega t + iW \sin(\omega t + \alpha), \tag{22-3}$$

root mean square of which becomes

$$\bar{\nu}^2 = \frac{1}{T}\int_0^T \nu^2 \, dt \tag{22-4}$$

$$= \int_0^T \frac{1}{T}\left[\mu^2 \sin^2 \omega t + 2i\mu W \sin \omega t \ \sin(\omega t + \alpha) - W^2 \sin^2(\omega t + \alpha)\right] dt$$

$$= \frac{1}{2}(\mu^2 - W^2 + i\mu W \cos\alpha). \tag{22-5}$$

Taking square root of (22−5), we obtain

$$\bar{\nu} = \sqrt{\frac{\mu^2 - W^2 + i\mu W \cos\alpha}{2}}, \tag{22-6}$$

$$(0 < \mu, \quad 0 < W)$$

which reduces to

$$\bar{\nu} = \sqrt{\frac{\mu^2 - W^2}{2}}, \tag{22-7}$$

when

$$\alpha = \frac{\pi}{2} .$$

If $\mu < W$

(22−7) leads us to

$$\bar{\nu} = i\sqrt{\frac{W^2-\mu^2}{2}} . \tag{22-8}$$

Inertia becomes pure imaginary. Then, test piece loses weight, and rests on balancer. Weight namely vanishes when it enjoys periodic motion with slip of center of mass and wave.

To any value of α we have general solution : putting

$$\left.\begin{aligned} \frac{\mu^2-W^2}{2} &= A, \\ \frac{(\cos\alpha)\mu W}{2} &= B \end{aligned}\right\} \tag{22-9}$$

$$\sqrt{A+Bi} = x+yi , \tag{22-10}$$

we find :

$$\left.\begin{aligned} x^2-y^2 &= A \\ 2xy &= B \end{aligned}\right\}, \tag{22-11}$$

and that

$$(x^2+y^2)^2 = A^2+B^2 ,$$

$$\therefore \quad \left.\begin{aligned} x^2+y^2 &= \sqrt{A^2+B^2} \\ x^2y^2 &= \frac{B^2}{4} \end{aligned}\right\} \tag{22-12}$$

from which parameter Eqn. of

$$t^2 - \sqrt{A^2+B^2}\, t + \frac{B^2}{4} = 0, \tag{22-13}$$

appears. Then,

$$t = \frac{\sqrt{A^2+B^2} \pm |A|}{2} ,$$

is obtained along with

$$\left.\begin{aligned} x &= \pm\sqrt{\frac{\sqrt{A^2+B^2}+|A|}{2}} \\ y &= \pm\sqrt{\frac{\sqrt{A^2+B^2}-|A|}{2}} \end{aligned}\right\}, \tag{22-14}$$

four combinations of sign are possible .

One finds different solution to

$$0 \leqq \alpha \leqq \frac{\pi}{2},$$

and

$$\frac{\pi}{2} < \alpha < \frac{3}{2}\pi \ ,$$

respectively, since

$$xy = \frac{|B|}{2} = \begin{cases} \dfrac{B}{2} & (0 \leqq B) \\ -\dfrac{B}{2} & (B < 0) \ , \end{cases}$$

holds.

For instance, one obtains

$$\sqrt{A+Bi} = \frac{1}{2}\left\{\sqrt{\sqrt{(\mu^2 - W^2)^2 + \mu^2 W^2 \cos^2\alpha} + |\mu^2 - W^2|} \right.$$
$$\left. + i\sqrt{\sqrt{(\mu^2 - W^2)^2 + \mu^2 W^2 \cos^2\alpha} - |\mu^2 - W^2|}\right\},$$

in case of,

$$0 \leqq \alpha \leqq \frac{\pi}{2} \ (0 \leqq B) \ .$$

After some arithmetics the solution will be found in case of $\frac{\pi}{2} < \alpha < \frac{3}{2}\pi$.

Concluding Remarks

Just after the revised edition, there was a remarkable dovelopement of the theory.

We came to realize **Möbius coils** and **Kleinean coil**. We are publishing the fifth and revised edition, for one of the reasons of which many Brothers and Sisters had recently requested this title. For the new readers we remark that **Levity Disc** of **Mr. John Roy Robert Searl** is a realization of <**Inverse−G Engine**> stated in the 9th chapter. A little difference is that it becomes negatively energied state with a rotor. while our <**Inverse−G Engine**> does with a rotary electric field. There is no mechanical revolution. **Levity Disc** was at such a high imaginary electric potential of **Ten trillion i volt** that could have never been realized in the realm of **accelerator physics** or electrical engineering. The output power of **a thousand billion～ten trillion** horse power could have never been. Even **Saturn Rocket of NASA** could have never attained. Even existcnce of **inverse gravitation** has a significant meaning in Physics. We can find that **the late A. Einstein** tacitly predicted. **P. A. M. Dirac** made negatively energied state of unoccupied own a characteristic meaning.

By this title and the deed of Mr. Searl's **unoccupied state of positive energy** and **occupied state of negative energy** also become physically meaningful (See the table **#1** in the 9th chapter). The author expresses a scincere gratitude to **Mr. Lars−Uno Bernhardsson** in Sweden for his first information, and does to **Mr. William T. Sherwood** for his latest information when he called on Mr. Searl, and for his wide introduction in the scientific realm of U. S. A. He also thanks **Mrs. Alice B. Pomeroy** for her international introduction.

In Japan, many members of The Association of Aeronautical and Space Sciences, and the Physical Society of Japan, the readers of <SPACE VEHICLE> did him a favour to appreciately read, for which he thanks very much, and is presenting a sequential reports.

<Mobius Coil Element> and <Kleinean Bottle> are inheritances of classical topology. They contribute to the new machines, which is interesting.

On the other hand scientists became to much be interested in Super Signal Moving Matter since Dr. G. Feinberg presented F Faster-Than-Light Particles of tachyons (ref 73). We have used real super signal mass to Super Signal Lorentz Transformation in the 6 th chapter which may appreciately be compared with imaginary super signal mass of G. Feinberg's.

This conception is the sequential of the late A. Einstein's but it contains some latent ones, which was indebted to Prof. Shoji MAEBARA of Department of Pure and Applied Mathematics, Tokyo University of Education, who is one of the authorities of Relativity.

We have called <Anti-atomic Motor> in the first edition <Inverse Atomic Engine> in this edition. As explained in the second edition, anti-particles have positive energy, while negative energy is inverse state of particles and anti-particles.

Just by these conceptions we surely recognize that negatively energied state has quite deeper meaning, and that inverse atomic engine can be realized without dangers of pair annhilation.

After we published the revised edition, the author appeared on TV, which was supported by youth throughout the country. He thanks on this section. He also expresses nostalgic thanks to Mr. Takumi SHIBANO (Rei of KOZUMI=Cosmic Ray) who is a pioneer of G-field engine. He is also indebted to Mr. Akiharu SHIGEMATSU who gave the strongest support, and to Mr. Sadaaki NISHIDA for his valuable kindness.

He also does scincere gratitude to Mr. Masakatsu OKI who fabricated educational model of Kleinean bottle. This technology of mold belongs to the most difficult.

Also in the earlier stage, an old person in Kyohto, a youth in Settsu City and a person in Suita City financially supported him, which are recorded in his internal empire of his heart. He pays a scincere respect to Mr. Hachiroh KUBOTA and a college teacher in Zama City who continuelly encouraged him, and to Toshihiko ICHIMURA (physicist), and finally to Mr. T of electronics company for his fabrication of three phases generator.

Would you understand that the perticles in the 13th chapter is the simplest classification? Could you think that ＜Decay of Lucifer (the fifth planet)＞ and Prediction of the Tenth Planet are magnificent analysis?

The 4th edition states several experimental results, too, by which the readers will understand physical meaning of Kleinean Roll.

The 5th edition also does many experimental results, for which the author is indebted to the late Kohji TAKAMURA and Mr. W. P.

The last section states Time Reversing Oscillator, which was fabricated by W. P. and no earth people owns yet.

The author emphasizes that he thanks Masayuki JINBO and Miki NISHINA for their financial support throughout the construction of G-research Laboratory (The right picture shows this laboratory).

Swedish Royal Academy of Science in which Nobel Prize Committee is present, purchased 14 copies of this title.

Notice : Would you do us a favour to enclose two or more International Reply Coupons when you communicate G-research Laboratory?

☆ Just after the 7th edition the author succeeded in the experiment of ＜Loss of Weight＞, which the 8th edition includes.

Concluding Remarks

The author makes use of Moebius Wound. About a century has passed since Moebius Strip appeared. Tachyon plays an important role, the theory of which was proposed in 1967, and about 20 years have passed. The readers will deeply be impressed at realization of inverse (anti-) G in their long history.

Photo 29

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Appendix (A) Mathematics and Physics

1. Transformations of Four Dimensional Co-ordinate.

(1-1) Four Dimensional Curvilinear Co-ordinate

If we express four dimensional polar co-ordinate by

$x^1 = x = r\sin\theta\sin\varphi\cos\Psi$, $\quad x^2 = y = r\sin\theta\sin\varphi\sin\Psi$, $\quad x^3 = z = r\sin\theta\cos\varphi$, $\quad x^4 = u = r\cos\theta$,

with $\quad 0 \leqq r < \infty$, $\quad 0 \leqq \theta \leqq \pi$, $\quad 0 \leqq \varphi \leqq \pi$, $\quad$ and $\quad 0 \leqq \Psi \leqq 2\pi$,

line elements of that co-ordinate become

$ds^1 = dr$ (in r-direction), $\qquad ds^2 = r\,d\theta$ (in θ-direction),

$ds^3 = r\sin\theta\,d\varphi$ (in φ-direction), $\qquad ds^4 = r\sin\theta\sin\varphi\,d\Psi$ (in Ψ-direction).

When we denote the transformations a^{jk}_{mn} among $dx^j dx^k$ and $ds^m ds^n$ with

$dx^j dx^k = a^{jk}_{mn} ds^m ds^n$ $\quad$ (contracted over m and n),

and

$$a^{jk}_{mn} = \frac{\partial x^j}{\partial s_m}\cdot\frac{\partial x^k}{\partial s_n} + \frac{\partial x^k}{\partial s_m}\cdot\frac{\partial x^j}{\partial s_n},$$

we obtain the transformation matrix of,

$$(a^{jk}_{mn}) = \left\{\begin{array}{llllll}
\cos\theta\cos 2\varphi\sin\Psi, & \sin\theta\cos 2\varphi\sin\Psi, & \cos\theta\sin\theta\sin 2\varphi\sin\Psi, & \sin\theta\cos\varphi\cos\Psi, & \cos\theta\cos\varphi\cos\Psi, & -\sin\varphi\cos\Psi, \\
\cos\theta\cos 2\varphi\cos\Psi, & \sin\theta\cos 2\varphi\cos\Psi, & \cos\theta\sin\theta\sin 2\varphi\cos\Psi, & -\sin\theta\cos\varphi\sin\Psi, & -\cos\theta\cos\varphi\sin\Psi, & \sin\varphi\sin\Psi, \\
\cos\theta\sin 2\varphi\cos\Psi\sin\Psi, & \sin\theta\sin 2\varphi\cos\Psi\sin\Psi, & \sin 2\theta\sin 2\varphi\cos\Psi\sin\Psi, & \sin\theta\sin\varphi\cos 2\Psi, & \cos\theta\sin\varphi\cos 2\Psi, & \sin\theta\cos\varphi\cos 2\Psi \\
-\sin\theta\cos\varphi\cos\Psi, & \cos\theta\cos\varphi\cos\Psi, & \cos 2\theta\sin\varphi\cos\Psi, & -\cos\theta\sin\Psi, & \sin\theta\sin\Psi, & 0, \\
-\sin\theta\cos\varphi\sin\Psi, & \cos\theta\cos\varphi\sin\Psi, & \cos 2\theta\sin\varphi\sin\Psi, & \cos\theta\cos\Psi, & -\sin\theta\cos\Psi, & 0, \\
-\sin\theta\sin\varphi, & -\cos\theta\sin\varphi, & \cos 2\theta\sin\Psi, & 0, & 0, & 0.
\end{array}\right\}$$

where the suffix of the second rank tensor runs like (23, 31, 12, 41, 42, 43). The same notice is asked in the succeeding parts.

(1-2) Four Dimensional Volume Elements

$$d\tau = r^3 \sin^2\theta \sin\varphi \, dr d\theta d\varphi d\Psi ,$$

(in Euclidean space-time)($0 \leqq r < \infty$, $0 \leqq \theta \leqq \pi$)

$$d\tau = r^3 \mathrm{sh}^2\theta \sin\varphi \, dr d\theta d\varphi d\Psi$$

(in Minkowskean space-time, $0 \leqq r < \infty$, $-\infty < \theta < \infty$)

(1-3) Hyper Surface Segment

(3-a) Polar co-ordinate

$$dydzdu = r^3 \sin^3\theta \sin^2\varphi \cos\Psi \, d\theta d\varphi d\Psi ,$$
$$dzdudx = r^3 \sin^3\theta \sin^2\varphi \sin\Psi \, d\theta d\varphi d\Psi ,$$
$$dudxdy = r^3 \sin^3\theta \sin\varphi\cos\varphi \, d\theta d\varphi d\Psi ,$$
$$dxdydz = r^3 \sin^2\theta \cos\theta \sin\varphi \, d\theta d\varphi d\Psi ,$$

(in Euclidean space-time)

$\theta \to i\theta$ ($-\infty < \theta < \infty$) in Minkowskean space-time.

(3-b) Cylindrical co-ordinate.

$$x = r\sin\theta\cos\Psi , \qquad z = z ,$$
$$y = r\sin\theta\sin\Psi , \qquad u = r\cos\theta ,$$

$$dS_{r\theta z} = dS_{r\theta\Psi} = dS_{rz\Psi} = 0 , \qquad dS_{\theta z\Psi} = r^2 \sin\theta \, d\theta d\Psi dz ,$$

on a hyper sphere of,

$$r = a ,$$

in Euclidean space-time.

$\theta \to i\theta$ ($-\infty < \theta < \infty$) in Minkowskean space-time.

(3-c) Three Dimensional Polar co-ordinate.

$$dydzdu = r^2 \sin^2\varphi \cos\Psi \, d\varphi d\Psi du ,$$
$$dzdudx = r^2 \sin^2\varphi \sin\Psi \, d\varphi d\Psi du ,$$
$$dudxdy = r^2 \sin\varphi\cos\varphi \, d\varphi d\Psi du ,$$
$$dxdydz = 0 ,$$

with

$$x = r\sin\varphi\cos\Psi , \qquad z = r\cos\varphi ,$$
$$y = r\sin\varphi\sin\Psi , \qquad u = u$$

(3-d) Polar co-ordinate on a hyper sphere of $r = a$,

$$d S_{r\theta\Psi} = d S_{r\theta\varphi} = d S_{r\varphi\Psi} = 0 ,$$
$$d S_{\theta\varphi\Psi} = r^3 \sin^2\theta \sin\varphi \, d\theta \, d\varphi \, d\Psi .$$

(1−4) Four Dimensional Jacobian and Fransformations among Derivatives.

Four dimensional Jacobian to polar co-ordinate

$$\beta = \frac{\partial(r, \theta, \varphi, \Psi)}{\partial(x^1, x^2, x^3, x^4)} = \frac{\partial(r, \theta, \varphi, \Psi)}{\partial(x, y, z, u)} =$$

$$\begin{pmatrix} \sin\theta\sin\varphi\cos\Psi , & \dfrac{\cos\theta\sin\varphi\cos\Psi}{r} , & \dfrac{\cos\varphi\cos\Psi}{r\sin\theta} , & -\dfrac{\sin\Psi}{r\sin\theta\sin\varphi} , \\ \sin\theta\sin\varphi\sin\Psi , & \dfrac{\cos\theta\sin\varphi\sin\Psi}{r} , & \dfrac{\cos\varphi\sin\Psi}{r\sin\theta} , & -\dfrac{\cos\Psi}{r\sin\theta\sin\varphi} , \\ \sin\theta\cos\varphi , & \cos\theta\cos\varphi / r , & -\sin\varphi / r\sin\theta , & 0 , \\ \cos\theta , & -\sin\theta / r , & 0 , & 0 , \end{pmatrix}$$

$$\alpha = \frac{\partial(x^1, x^2, x^3, x^4)}{\partial(r, \theta, \varphi, \Psi)} = \frac{\partial(x, y, z, u)}{\partial(r, \theta, \varphi, \Psi)} =$$

$$\begin{pmatrix} \sin\theta\sin\varphi\cos\Psi , & \sin\theta\sin\varphi\sin\Psi , & \sin\theta\cos\varphi , & \cos\theta \\ r\sin\theta\sin\varphi\cos\Psi , & r\cos\theta\sin\varphi\sin\Psi , & r\cos\theta\cos\varphi , & -r\sin\theta \\ r\sin\theta\cos\varphi\cos\Psi , & r\sin\theta\cos\varphi\sin\Psi , & -r\sin\theta\sin\varphi , & 0 \\ -r\sin\theta\sin\varphi\sin\Psi , & r\sin\theta\sin\varphi\cos\Psi , & 0 , & 0 \end{pmatrix}$$

Derivatives transform such that ;

$$\beta \begin{pmatrix} \dfrac{\partial}{\partial r} \\ \dfrac{\partial}{\partial\theta} \\ \dfrac{\partial}{\partial\varphi} \\ \dfrac{\partial}{\partial\Psi} \end{pmatrix} = \begin{pmatrix} \partial_1 \\ \partial_2 \\ \partial_3 \\ \partial_4 \end{pmatrix}$$

(1−5) Surface Segments on Hyper Sphere.

$$d S_{r\theta} = d S_{\Psi r} = d S_{r\varphi} = 0, \qquad d S_{\theta\varphi} = a^2 \sin\theta \, d\theta \, d\varphi,$$
$$d S_{\varphi\Psi} = a^2 \sin^2\theta \sin\varphi \, d\varphi \, d\Psi, \qquad d S_{\Psi\theta} = a^2 \sin\theta \sin\varphi \, d\theta \, d\Psi,$$

on a hyper sphere of $r = a$.

2. Elementary Solutions to Multi–Harmonic Equation.

(2—A) Bi-Harmonic Equation.

$$\varphi = A r \Psi \sin\Psi,$$

to $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}\right)^2 \varphi = 0,$ with $\begin{cases} x = r\cos\Psi \\ y = r\sin\Psi, \end{cases}$

(2—B) Tri-Harmonic Equation

$$\varphi^j = A r^3$$

to $\Delta^3 \varphi^j = \left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}\right)^3 \varphi^j = 0,$

with $r^2 = x^2 + y^2 + z^2,$

(2—C) Tetra-Harmonic Equation

(C-1) which depends upon time.

$$\varphi^{jk} = A r^4 \ln r,$$

to $\square^4 \varphi^{jk} = \left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2} + \frac{\partial^2}{\partial u^2}\right)^4 \varphi^{jk} = 0,$

along with $r^2 = x^2 + y^2 + z^2 + u^2,$

(C-2) which is static.

$$\varphi^{jk} = A R^5,$$

to $\Delta^4 \varphi^{jk} = \left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}\right)^4 \varphi^{jk} = 0,$

with $R^2 = x^2 + y^2 + z^2,$

in all the case of which the constant A is normalized owing to boundary conditions.

3. Lorentz Transformarions

(3—A) Four Vector $(A^1,\ A^2,\ A^3,\ A^4)$

(A−1) Infra Signal :

$$'A^1 = \frac{A^1 + i\beta A^4}{\sqrt{1-(\frac{V}{C})^2}},\quad 'A^2 = A^2,\quad 'A^3 = A^3,\quad 'A^4 = \frac{A^4 - \frac{iV}{C} A^1}{\sqrt{1-(\frac{V}{C})^2}}.$$

Examples are vector potential $(A^1,\ A^2,\ A^3,\ A^4 = i\varphi)$, spin potential $(\varphi^1,\ \varphi^2,\ \varphi^3,\ \varphi^4)$, space-time co-ordinate $(x^1,\ x^2,\ x^3,\ x^4 = ict)$ and derivatives $(\partial_1,\ \partial_2,\ \partial_3,\ \partial_4)$.

(3—B) Electromagnetic Field

$$H'_x = H_x$$

$$H'_y = \frac{H_y + \beta E_z}{\sqrt{1-\beta^2}},\qquad H'_z = \frac{H_z - \beta E_y}{\sqrt{1-\beta^2}},$$

$$E'_x = E_x,$$

$$E'_y = \frac{E_y - \beta H_z}{\sqrt{1-\beta^2}},\qquad E'_z = \frac{E_z + \beta H_y}{\sqrt{1-\beta^2}}.$$

(A−2) Super Signal (on the first hyper surface. $c < v$)

$$'A^1 = \frac{A^1 + i\frac{C}{V} A^4}{\sqrt{1-(\frac{C}{V})^2}},\quad 'A^2 = A^2,\quad 'A^3 = A^3,\quad 'A^4 = \frac{A^4 - i\frac{C}{V} A^1}{\sqrt{1-(\frac{C}{V})^2}}.$$

(3—C) Magnetization of I and Electric Polarization of P.

$$I'_x = I_x,$$

$$I'_y = \frac{I_y + \beta P_z}{\sqrt{1-\beta^2}},\qquad I'_z = \frac{I_z - \beta P_y}{\sqrt{1-\beta^2}},$$

$$P'_x = P_x,$$

$$P'_y = \frac{P_y - \beta I_z}{\sqrt{1-\beta^2}},\qquad P'_z = \frac{P_z + \beta I_y}{\sqrt{1-\beta^2}},$$

(3—D) Kelvinean Temparature $T' = \dfrac{T}{\sqrt{1-\beta^2}}$.

(3—E) Quantity of Heat $Q' = Q/\sqrt{1-\beta^2}$.

(3—F) Entropy $S' = S$.

(3—G) Impedance,

Inductance : $L' = \dfrac{\gamma}{1+\beta^2}\left(L + \dfrac{\beta^2}{c_0}\right)$,

Capacitance : $\dfrac{1}{c_0'} = \dfrac{\gamma}{1+\beta^2}\left(\dfrac{1}{c_0} + \beta^2 L\right)$,

Resistance : $R' = R$,

where they are defined per unit length of transmission line, which you will please see (6-2), γ being Lorentz factor of $\gamma = \dfrac{1}{\sqrt{1-\beta^2}}$.

(3—H) Six Angular Momentum

$$Ж_x' = Ж_x,$$

$$Ж_y' = \frac{Ж_y + \beta Я_z}{\sqrt{1-\beta^2}}, \qquad Ж_z' = \frac{Ж_z - \beta Я_y}{\sqrt{1-\beta^2}},$$

$$Я_x' = Я_x,$$

$$Я_y' = \frac{Я_y - \beta Ж_z}{\sqrt{1-\beta^2}}, \qquad Я_z' = \frac{Я_z + \beta Ж_y}{\sqrt{1-\beta^2}},$$

which you will please see (1-13).

(3—I) Six Bending Moment

$$n_x' = n_x,$$

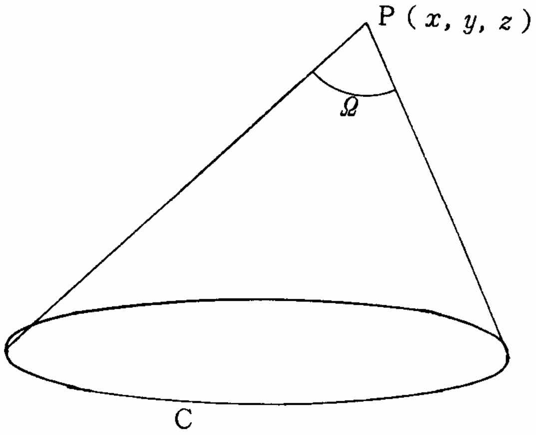
$$n_y' = \frac{n_y - \beta m_z}{\sqrt{1-\beta^2}}, \qquad n_z' = \frac{n_z + \beta m_y}{\sqrt{1-\beta^2}},$$

$$m_x' = m_x,$$

$$m_y' = \frac{m_y + \beta n_z}{\sqrt{1-\beta^2}}, \qquad m_z' = \frac{m_z - \beta n_y}{\sqrt{1-\beta^2}},$$

4. 立体角の解析表示

（第８図）



第０超平面上の点Ｐ（ｘ，ｙ，ｚ）から閉曲線Ｃを見込む立体角Ωは，

$$\mathrm{grad}\,\Omega = \mathrm{rot}\,\alpha, \qquad \alpha = \oint_{\circ} \frac{ds}{r},$$

但し，ｒはＰからＣ上の点P'（x'，y'，z'）迄の距離で，$ds = (dx', dy', dz')$

5. 常微分方程式

随伴ゲーゲンバウエル微分方程式，

$$\left[(1-z^2)\frac{d^2}{dz^2} - 3z\frac{d}{dz} - \frac{L(L+1)}{1-z^2} - (n^2-1)\right]\mathrm{H}^{L}_{n}(\theta) = 0,$$

$$z = \cos\theta,$$

$$\left\{\mathrm{cosec}^2\theta\frac{\partial}{\partial\theta}\left(\sin^2\theta\frac{\partial}{\partial\theta}\right) + L(L+1)\cot^2\theta - [n^2-1-L(L+1)]\right\}$$

$$\times\mathrm{H}^{L}_{m}(\theta) = 0,$$

$\mathrm{H}^{L}_{m}(\theta)$ は，極性角運動量の固有関数，$\pi^2\,\Pi(\theta, \varphi, \Psi) = [n^2-1-L(L+1)]\,\Pi(\theta, \varphi, \Psi)$，但し，(1)の４次元球座標に依拠した。ユークリッド時空の場合は，□をユークリッド時空へ解析延長（unitary trick）。

Ｌ：方位量子数

$Y_L^m(\varphi, \Psi)$ being spherical harmonice of Legendre's.
Four dimensional polar co-ordinate of (1−1) is used, and unitary trick of continuing D'Alembertian ($\square$) into Eudidean space-time ($\square \to -\Delta_4$) is made use of.
Ortho-normal relations are

$$\int_0^\pi Ⓗ_n^L(\cos\theta)\, Ⓗ_{n'}^L(\cos\theta)\sin^2\theta\, d\theta = \frac{\pi}{2}\cdot\frac{(n+L)!}{n[(n-L-1)!]}\,\delta_{nn'}$$

where $\delta_{nn'}$ means Kronecker's delta.

6. Differentiators and Integrators

(A) Miller Differentiator

Fig. 32
(See the right leaf.)

$$e_0 = -C_1 R_1 \frac{de_i}{dt},$$

holds if we denote output electric potential and input with e_0 and e_i, respectively. C_1 and R_1 are coupling capacitor and feedback resister, respectively.

(B) Miller Integrator

Fig. 33
(See the right leaf.)

$$e_0 = \frac{1}{C_1 R_1}\int e_i\, dt,$$

holds if we denote output electric potential and input with e_0 and e_i, respectively. C_1 and R_1 are, at this time, feedback capacitor and coupling resister, respectively.

7. Laplace Transformation with respect to Proper Time

(A) Laplace Transformation with respect to Proper Time :

$$P(s) = \int_0^\infty P(\tau)\exp(-s\tau)\, d\tau,$$

n：主量子数。　　$L+1\leqq n$。

直交関係：$\overset{\times}{}\pi(\theta,\varphi,\Psi)=Ⓗ_m^L(\theta)\,Y_L^m(\varphi,\Psi)$ の第1角部分。

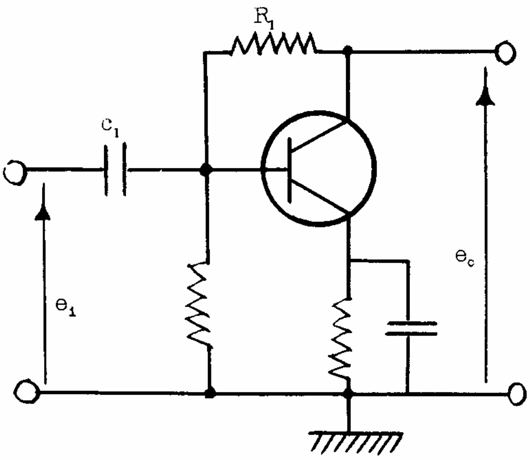
$\pi^2=(iя)^2$。

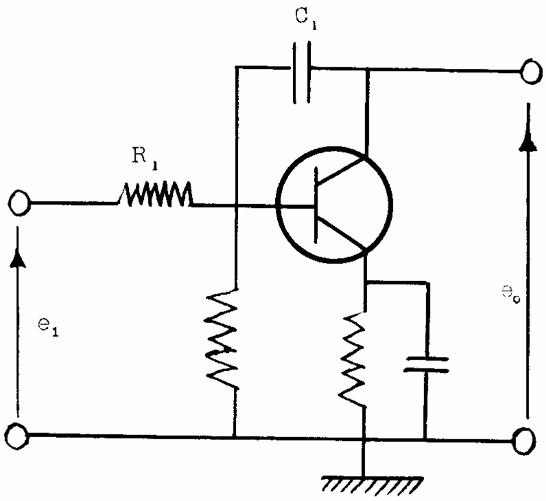
$$\int_0^{\pi}Ⓗ_m^L(\cos\theta)\,Ⓗ_{m'}^{L}(\cos\theta)\sin^2\theta\,d\theta=\frac{\pi}{2}\cdot\frac{(n+L)!}{n[(n-L-1)!]}\times\delta nn',$$

6. 微　積　分　器

(A) ミラー微分器　(第32図)

(B) ミラー積分器　(第33図)





$$e_0=-C_1R_1\frac{de_i}{dt},$$

$$e_0=-\frac{1}{C_1R_1}\int e_i\,dt,$$

7. ラプラス変換

(A) ラプラス変換：$P(s)=\int_0^{\infty}P(\tau)\exp(-s\tau)\,d\tau,$

(B) 同逆変換：$P(\tau)=\dfrac{1}{2\pi i}\displaystyle\int_{\gamma-i\infty}^{\gamma+i\infty}P(s)\exp s\tau\,ds,$

但し，τは江夏の不変時（文献 33）又は，固有時。又(B)の積分路は，P(s)の全ての極を右に見て廻る。

(A) **Mathematics and Physics**

(B) Laplace Inversion :

$$P(\tau)=\frac{1}{2\pi i}\int_{\gamma-i\infty}^{\gamma+i\infty}P(s)\exp s\tau ds,$$

where τ stands for proper time or Enatsuean invariant time (Ref. 33). The contour of (B) is taken clock-wise with respect to all the poles of P(s) upon complex plane of s.

(C) Various Theorems. Laplace transformation of $\dfrac{d^n P(\tau)}{d\tau^n}$ is :

$$\frac{d^n}{d\tau^n}P(\tau)\supset s^n P(s)-s^{n-1}P'(0)-\cdots\cdots-P^{(n-1)}(0),$$

Final Value Theorem : $P(\infty)=\lim_{s\to 0} sP(s)$,

Initial Value Theorem : $P(0)=\lim_{s\to\infty} sP(s)$.

8. Behaviours of State Angular Momentum

(A) Frenker-Kramers Equation

$$\frac{dж}{d\tau}=\alpha\,(ж\times H-я\times E),\qquad \frac{dя}{d\tau}=\alpha\,(ж\times E+я\times H),$$

where α, ж, я, E, H and τ stand for coupling constant of electromagnetic interaction, axial angular momentum, polar, electromagnetic field and proper time, respectively. See the Ref. 38 and the 4th chapter.

(B) Landau-SEIKE-Frenker-Kramers Equation

$$\left[\frac{d}{d\tau}+\alpha\left(H+iE-\frac{\mu}{|Y|}\cdot\frac{dY}{d\tau}\right)\times\right]Y=0,$$

$$\left[\frac{d}{d\tau}+\alpha\left(H-iE-\frac{\nu}{|Z|}\cdot\frac{dZ}{d\tau}\right)\times\right]Z=0,$$

where $Y=I+iP$, and $Z=I-iP$, I and P being such that $I=\alpha ж$, and $P=\alpha я$, respectively. μ is damping factor $(0<\mu,\ \nu)$. See the 4th chapter.

9. Four Dimensional Vector Analysis

(A) Four Dimensional Rotation $(ж,\ -iя)=\mathrm{Rot}\,A$, where A means four vector and Rot is defined by

$$\mathrm{Rot}\,A = \partial_j A_k - \partial_k A_j \quad (\text{six components})$$

as six vector, which splits into a pair of vectors on the zeroth hyper surface (Ordinary Physical Space).

(B) Four Dimensional Divergence

$$\mathrm{Div}\,A = \partial_j A^j = \partial_1 A^1 + \partial_2 A^2 + \partial_3 A^3 + \partial_4 A^4 .$$

(C) Four Dimensional Green's Formula

$$\iiiint \mathrm{Div}\,A\, d\tau = \iiint A^1 dF^1 + \iiint A^2 dF^2 + \iiint A^3 dF^3 + \iiint A^4 dF^4 ,$$

where $dF = (dy\,dz\,du,\ dz\,du\,dx,\ du\,dx\,dy,\ dx\,dy\,dz)$ (hyper surface segment)

and $d\tau = dx\,dy\,dz\,du \quad (u = x^4 = ict)$.

(D) Four Dimensional Stokes'es Formula

$$\iint \mathrm{Rot}\,A \cdot dS = \oint_c A \cdot ds ,$$

where $ds = (dx^1, dx^2, dx^3, dx^4)$,

c being a four dimensionally closed curve.

(E) Vector Product and Scalar Product

(E−1) Vector Product

$$x \times P = x^j P^k - x^k P^j \quad (\text{six components}),$$

which is six angular momentum, $x = (x^1, x^2, x^3, x^4)$ and P being space-time co-ordinate and four momentum, respectively.

(E−2) Scalar Product

$$A \cdot P = A^1 P^1 + A^2 P^2 + A^3 P^3 + A^4 P^4 ,$$

in which A denotes four vector potential.

10. Maxwellean Equation

(10−1) Relativistic Representation

$$\partial_k F^{jk}(x) = 4\pi I^j , \qquad \partial_k {}^{*}F^{jk}(x) = 0 ,$$

where F^{jk} stands for electromagnetic tensor, namely

$$H = (F_{23}, F_{31}, F_{12}), \qquad iE = (F_{41}, F_{42}, F_{43}).$$

asterisk denotes the dual of,

$${}^{*}F^{jk} = \frac{\varepsilon^{jkmn}}{2!} F_{mn} ,$$

ε^{jkmn} being Eddington's perfectly skew symmetric tensor of the 4th rank, and $I = (I^1, I^2, I^3, I^4)$ standing for four current.

(10−2) Solution to magnetic dipole or electric.

(a)
$$E_r = \frac{p}{\varepsilon}\left(\frac{2}{r^3} + \frac{2ik}{r^2}\right)\cos\varphi \exp i(\omega t - kr),$$
$$E_\varphi = \frac{p}{\varepsilon}\left(\frac{1}{r^3} + \frac{ik}{r^2} - \frac{k^2}{r}\right)\sin\varphi \exp i(\omega t - kr),$$
$$H_\psi = \frac{i\omega p}{c}\left(\frac{1}{r^2} + \frac{ik}{r}\right)\sin\varphi \exp i(\omega t - kr),$$
$$H_\varphi = H_r = E_\psi = 0, \quad k^2 = \frac{\omega^2 \varepsilon \mu}{c^2}, \quad r^2 = x^2 + y^2 + z^2,$$

when electric dipole of $p \exp(i\omega t)$, is present at the origin, orineting in Z-direction.

(b)
$$H_r = \frac{m}{\mu}\left(\frac{2}{r^3} + \frac{2ik}{r^2}\right)\cos\varphi \exp i(\omega t - kr),$$
$$H_\varphi = \frac{m}{\mu}\left(\frac{1}{r^3} + \frac{ik}{r^2} - \frac{k^2}{r}\right)\sin\varphi \exp i(\omega t - kr),$$
$$E_\psi = \frac{i\omega\mu}{c}\left(\frac{1}{r^2} + \frac{ik}{r}\right)\sin\varphi \exp i(\omega t - kr),$$
$$E_\varphi = E_r = H_\psi = 0,$$

when magnetic dipole of $m \exp i\omega t$ is present at the origin, orienting in Z-direction [in which we replace $E \to H$, and $H \to -E$.].

11. Spin Wave Equation in Relativistic Form

$$\partial_k m^{jkp}(x) = 4\pi T^{jp}(x), \qquad \partial_k {}^{*}m^{jkp}(x) = 0,$$

where m^{jkp} is the jk component of angular momentum density on the p-th hyper surface and T^{jp} stands for energy tensor. Asterisk denotes the dual of,

$${}^{*}m^{jkp} = \frac{\varepsilon^{jkmn}}{2!} m^{p}_{mn}.$$

12. Self Inductance and Mutual

With respect to P and r in Fig. 9, mutual inductance between vertical infinite line and a torus coil is determined by

$$L_{12} = 4\pi n\,(R - \sqrt{R^2 - r^2})\ ,$$

as calculated in appendix 8, while self inductance by

$$L_{11} = 4\pi n^2\,(R - \sqrt{R^2 - r^2})\quad (\text{Ref. } 59)\ .$$

13. Three Dimensional Vector Analysis
(for beginners)

(13−A) Scalar Product of Three Dimensional Vector Analysis

Scalar product of a pair of three dimensional vectors of,

$A = (A^1,\ A^2,\ A^3)$ and $B = (B^1,\ B^2,\ B^3)$

is : $A \cdot B = A^1 B^1 + A^2 B^2 + A^3 B^3 = |A||B| \cos\varphi$,

$|A|^2 = (A^1)^2 + (A^2)^2 + (A^3)^2$, and $|B|^2 = (B^1)^2 + (B^2)^2 + (B^3)^2$,

A and B forming the angle of φ.

(13−B) Vector product $A \times B$ (A cross B) is determined by,

$$A \times B = (A^2 B^3 - A^3 B^2,\ A^3 B^1 - A^1 B^3,\ A^1 B^2 - A^2 B^1) = |A||B| \sin\varphi .$$

(13−C) Divergence

$$\operatorname{div} A = \frac{\partial A^1}{\partial x} + \frac{\partial A^2}{\partial y} + \frac{\partial A^3}{\partial z} = \partial \cdot A ,$$

along with $\partial = \left(\frac{\partial}{\partial x},\ \frac{\partial}{\partial y},\ \frac{\partial}{\partial z}\right)$.

(13−D) Gradient

$$\operatorname{grad} \varphi = \left(\frac{\partial \varphi}{\partial x},\ \frac{\partial \varphi}{\partial y},\ \frac{\partial \varphi}{\partial z}\right) .$$

(13−E) Rotation

$$\operatorname{rot} A = \left(\frac{\partial A^3}{\partial y} - \frac{\partial A^2}{\partial z},\ \frac{\partial A^1}{\partial z} - \frac{\partial A^3}{\partial x},\ \frac{\partial A^1}{\partial x} - \frac{\partial A^1}{\partial y}\right) = \partial \times A \quad (\partial \text{ cross } A)$$

(13−F) Mutual Operations $\operatorname{rot}(\operatorname{grad}\varphi) \equiv 0$,

$\operatorname{div}(\operatorname{rot} A) \equiv 0$, $\operatorname{div}(\operatorname{grad}\varphi) = \Delta\varphi$,

$\operatorname{rot}(\operatorname{rot} A) = \operatorname{grad}(\operatorname{div} A) - \Delta A$,

$\operatorname{div} \varphi A = \varphi \operatorname{div} A + A \cdot \operatorname{grad}\varphi$,

$\operatorname{rot} \varphi A = \varphi \operatorname{rot} A - A \cdot \operatorname{grad}\varphi$,

$\operatorname{div}(A \times B) = B \cdot \operatorname{rot} A - A \cdot \operatorname{rot} B$,

$\operatorname{rot}(A \times B) = A \operatorname{div} B - B \operatorname{div} A + (B \cdot \partial) A - (A \cdot \partial) B$.

(13−G) Green's Theorem

$$\iiint_V \operatorname{div} A \, dx\, dy\, dz = \iint_S A \cdot dS ,$$

where V denotes the domain inside a closed surface of S, and $dS=(dy\,dz,\ dz\,dx,\ dx\,dy)$.

That four dimensional extension was stated in (9−C).

(13−H) Stokes'es Theorem

$$\int_c A\cdot ds=\iint_s \mathrm{rot}\,A\cdot dS$$

where C stands for a closed curve on the zeroth hyper surface (Ordinary Physical Space), and S for that corresponding surface. This formula is applied to the third set of Maxwellean Equation and to the first and the third of total angular momentum wave equation of (1−3).

(A−2) Calculation of a Seqular Equation

We shall rewrite the seqular equation of the 7th chapter, defining the matrix as $\xi - m\,\eta$

and putting the terms with the form of $(a+b)^2$

diagonally and counter dictionary wise by

row wise : (3→1, 2→2, 1→3, 4→4, 5→5, 6→5)

and column wise : (6→1, 5→2, 4→3, 1→4, 2→5, 3→6)

such that

$$\xi=\begin{pmatrix} 0, & a(\square-d), & b(\square-d), & a(\square-c), & b(\square-c), & (a+b)(c+d) \\ a(\square-d), & 0, & c(\square-d), & a(\square-b), & (a+c)(b+d), & c(\square-b) \\ b(\square-d), & c(\square-d), & 0, & (a+c)(b+d), & b(\square-a), & c(\square-a) \\ a(\square-c), & a(\square-b), & (a+d)(b+c), & 0, & d(\square-c), & d(\square-b) \\ b(\square-c), & (b+d)(c+a), & b(\square-a), & d(\square-c), & 0, & d(\square-a) \\ (c+d)(a+b), & c(\square-b), & c(\square-a), & d(\square-b), & d(\square-a), & 0 \end{pmatrix}$$

and the coefficient of η of,

$$\eta=\begin{pmatrix} (a+b)^2, & bc, & ca, & bd, & da, & 0 \\ bc, & (c+a)^2, & ab, & cd, & 0, & da \\ ca, & ab, & (b+c)^2, & 0, & cd, & db \\ ba, & cd, & 0, & (d+a)^2, & ab, & ca \\ da, & 0, & cd, & ab, & (b+d)^2, & bc \\ 0, & da, & ba, & ca, & bc, & (c+d)^2 \end{pmatrix}$$

We apparently find det $(\xi - m\eta)$ to be symmetrical with respect to a, b, c and d. At first we easily find det β = det$(\xi - m\eta)$ to have the factor of d^2 : because

$$\eta = \left(\begin{array}{c|l} & \text{parts which are proportional to d.} \\ \hline & a^2+2da+d^2, \quad ab, \quad ca \\ & ab, \quad b^2+2bd+d^2, \quad bc \\ & ca, \quad bc, \quad c^2+2cd+d^2 \end{array}\right),$$

the latter three columns of which are proportional to : rank 1 + what are proportional to d, and are a : b : c except what are proportional to d. We can let the two columns of the three be proportional to d.

The coefficient of 1 of ξ is given by,

$$\xi = \left(\begin{array}{c|lll} & (a+b)b+ad, & (a+b)b+bd, & (u+b)c+(a+b)d \\ & (c+a)a+da, & (c+a)b+(c+a)d, & (c+a)c+cd \\ & (b+c)a+(b+c)d, & (b+c)b+bd, & (b+c)c+cd \\ \hline & \text{what are proportional to d.} & & \end{array}\right),$$

the latter three columns of which are a : b : c except what are proportional to d. Thus, the sixth column and the fifth in both of ξ and η can be let proportional to d if we subtrat, for instance, the fourth column multiplied by c/a from the fifth. We finally find det β to be proportional to d^2 since the denominator has not what d concerns. We shall further proceed to the sequential discussion. We next put the representative D of the factor concerned to be zero (at this time D = d). det β owns the factor of D^k if we find that rank to be smaller by k than the formal order (at this time, 6). In the above example, the rank is not greater than four. det β must own the factor of $D^{6-4} = d^2$. It also has the factor of $a^2 b^2 c^2 d^2$ from the symmetry with respect to a, b, c and d. We shall thirdly how many D'Alembertians are contained. ξ becomes

$$\xi \to \begin{pmatrix} 0, & -da, & -bd, & -ca, & -bc, & -(a+b)^2 \\ -da, & 0, & -cd, & -ab, & -(c+a)^2, & -bc \\ -bd, & -cd, & 0, & -(b+c)^2, & -ab, & -ca \\ -ca, & -ab, & -(d+a)^2, & 0, & -cd, & -db \\ -ca, & -(b+d)^2, & -ba, & -cd, & 0, & -da \\ -(c+d)^2, & -bc, & -ca, & -db, & -da, & 0 \end{pmatrix}$$

although η is rather invariant, where the relation of

$$a+b=\square-(c+d)=-(c+d)$$

is used to the toppest of the last column of ξ. This matrix resembles η very well. From this symmetry ξ is almost identical with η if we perform

$$\det\begin{pmatrix} A & B \\ C & D \end{pmatrix}=\frac{1}{2}\det\begin{pmatrix} A-B, & A+B \\ C-D, & C+D \end{pmatrix}$$

$$=\left(\frac{1}{2}\right)^2\det\begin{pmatrix} A-B-(C-D), & A+B-(C+D) \\ A-B+C-D, & A+B+C+D \end{pmatrix},$$

with the 2×2 matrix of A, B, C and D.

If we arrange such that (the first column) − (the sixth column) → (the first column),

and (the first column) + (the sixth column) → (the sixth column),

and, futhermore, (2) − (5) → (2) and (2) + (5) → (5),

and (the first row) − (the sixth row) → (the first row),

and (the first row) + (the sixth row) → (the sixth row),

we obtain

$$\xi=\left(\begin{array}{c|c} \begin{matrix}-(a+b)^2-(bc-ad)\\ -2(ac-bd)-(c+d)^2\end{matrix} & 0 \\ \hline 0 & \begin{matrix}(a+d)^2+(b+c)^2+2(ab+cd)\\ +2(ca+bd)\end{matrix} \end{array}\right)$$

$$\eta=\left(\begin{array}{c|c} \begin{matrix}-(a+b)^2-2(bc-da)\\ -2(ca-bd)-(c+d)^2\end{matrix} & 0 \\ \hline 0 & \begin{matrix}-(a+d)^2+(b+c)^2-2(ab+cd)\\ -2(ca+bd)\end{matrix} \end{array}\right),$$

where we put $d=\square-(a+b+c)=-(a+b+c)$

to the first, the second and the third row (column), deriving

$$\xi=\eta=\left(\begin{array}{ccc|c} -2(a+b)^2, & -2(a+b)(c+a), & -2(a+b)(b+d) & \\ -2(c+a)(a+b), & -2(c+a)^2, & -2(c+a)(b+c) & 0 \\ -2(b+c)(a+b), & -2(b+c)(c+a), & -2(b+c)^2 & \\ \hline & 0 & & \times \end{array}\right)$$

the rank of which is 1. We also have (the fourth column) $=0$, in virtue of $a+b+c+d=\square=0$, when we make (the 4 th column) + (the 5 th column) + (the sixth column) $\to$ (the 4 th column). The rank of the part $\times$ is not greater than a ($\leqq 2$). Then, $\text{rank}\leqq 3$, to $\square=0$,
which shows that $\det\beta$ owns the factor of $\square^3$. We finally find that there is the factor of, $a^2b^2c^2d^2\square^3$,
which is a homogeneous of the eleventh order. The remaining factor is a homogeneous of the first order. This is noting but $a+b+c+d=\square$. Now we finally put

$$\det\beta=a^2b^2c^2d^2\square^4 f(m),$$

$f(m)$ of which we shall determine. When we put $a=b=c=d=1$, then we derive

$$\det\beta\,(a=b=c=d=1)=(1^2)^4\cdot 4^4\cdot f(m),$$

$$\xi\,(a=b=c=d=1)=\begin{pmatrix} 0, & 3, & 3, & 3, & 3, & 4 \\ 3, & 0, & 3, & 3, & 4, & 3 \\ 3, & 3, & 0, & 4, & 3, & 3 \\ 3, & 3, & 4, & 0, & 3, & 3 \\ 3, & 4, & 3, & 3, & 0, & 3 \\ 4, & 3, & 3, & 3, & 3, & 0 \end{pmatrix}$$

$$\eta\,(a=b=c=d=1)=\begin{pmatrix} 4, & 1, & 1, & 1, & 1, & 0 \\ 1, & 4, & 1, & 1, & 0, & 1 \\ 1, & 1, & 4, & 0, & 1, & 1 \\ 1, & 1, & 0, & 4, & 1, & 1 \\ 1, & 0, & 1, & 1, & 4, & 1 \\ 0, & 1, & 1, & 1, & 1, & 4 \end{pmatrix}$$

$$\therefore \det\beta=\begin{vmatrix} -4m, & 3-m, & 3-m, & 3-m, & 3-m, & 4 \\ 3-m, & -4m, & 3-m, & 3-m, & 4, & 3-m \\ 3-m, & 3-m, & -4m, & 4, & 3-m, & 3-m \\ 3-m, & 3-m, & 4, & -4m, & 3-m, & 3-m \\ 3-m, & 4, & 3-m, & 3-m, & -4m, & 3-m \\ 4, & 3-m, & 3-m, & 3-m, & 3-m, & -4m \end{vmatrix}$$

$$
=\begin{vmatrix}
-4(m+1), & 0, & 0, & 3-m, & 3-m, & 4 \\
0, & -4(m+1), & 0, & 3-m, & 4, & 3-m \\
0, & 0, & -4(m+1), & 4, & 3-m, & 3-m \\
0, & 0, & 4(m+1), & -4m, & 3-m, & 3-m \\
0, & 4(m+1), & 0, & 3-m, & -4m, & 3-m \\
4(m+1), & 0, & 0, & 3-m, & 3-m, & -4m
\end{vmatrix}
$$

$$
\det \beta = \left(\begin{array}{c|c}
\begin{matrix} -4(m+1), & 0, & 0 \\ 0, & -4(m+1), & 0 \\ 0, & 0, & -4(m+1) \end{matrix} & * \\
\hline
0 & \begin{matrix} 4(1-m), & 2(3-m), & 2(3-m) \\ 2(3-m), & 4(1-m), & 2(3-m) \\ 2(3-m), & 2(3-m), & 4(1-m) \end{matrix}
\end{array}\right)
$$

$$
=[-4(m+1)]^3 \left|\begin{array}{c|c}
\begin{matrix} 1, & 0, & 0 \\ 0, & 1, & 0 \\ 0, & 0, & 1 \end{matrix} & * \\
\hline
0 & \begin{matrix} -2(1+m), & 0, & 2(3-m) \\ 0, & -2(1+m), & 2(3-m) \\ 2(3-m), & 2(1+m), & 4(1-m) \end{matrix}
\end{array}\right|
$$

$$
=-4^3(m+1)^3 \left|\begin{array}{c|c}
\begin{matrix} 1, & 0, & 0 \\ 0, & 1, & 0 \\ 0, & 0, & 1 \end{matrix} & * \\
\hline
0 & \begin{matrix} -2(1+m), & 0, & 2(3-m) \\ 0, & -2(1+m), & 2(3-m) \\ 0, & 0, & 16-8m \end{matrix}
\end{array}\right|
$$

$$
=-4^3(m+1)^3[-2(m+1)]^2 8(2-m)
$$

$$
=(-1)(-1)^2(-1)(m+1)^5 \cdot 4^3 \cdot 2^2 \cdot 8(m-2)
$$

$$
=4^4 \cdot 8(m+1)^5(m-2),
$$

We lastly obtain $f(m)=8(m+1)^5(m-2)$,

which leads us to

$$
\det \beta = 8(m+1)^5(m-2)(abcd)^2 \square^4
$$

This result is made use of in the 4th chapter.

(A − 3) Circulation of Spin Density Line of Force

Fig. 26

(See the right leaf.)

When momentum segment $P\delta(z)$ is concentrated at the origin such that $\int_{-\infty}^{\infty} P\delta(z)\,dz = P$ along vertical infinite line of Z-axis, we shall determine the components of spin density at (r, 0, R) .

From (1 − 19) we obtain

$$P\,ds \times \vec{r} = [\,0,\ rP\delta(z)dz,\ 0\,], \qquad (A-3-1)$$

and $|\vec{r}|^3 = [\,r^2 + (R-z)^2\,]^{\frac{3}{2}}$,

which leads us to $Ж_x = Ж_z = 0$,

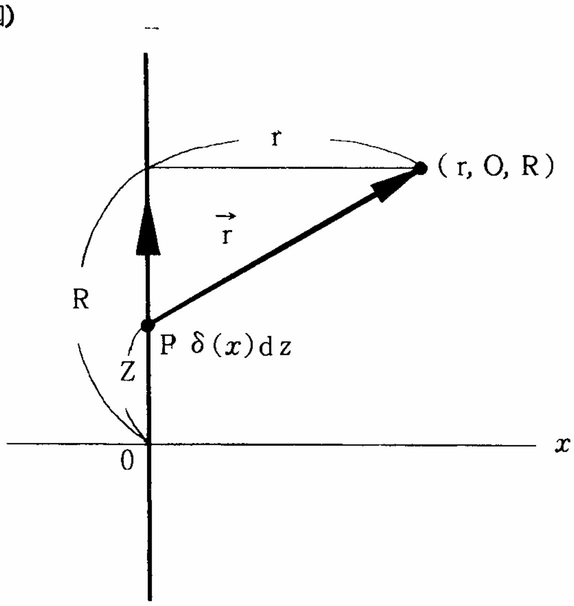
and

$$Ж_y = \int_{-\infty}^{\infty} \frac{rP\delta(z)\,d}{[\,r^2 + (R-z)^2\,]^{\frac{3}{2}}} = \frac{rP}{(r^2+R^2)^{\frac{3}{2}}}, \qquad (A-3-2)$$

there being a circulation of spin density line of force around momentum flux.

(A－3) スピン循環の計算

(第26図)



今，鉛直無限直線c上に，運動量素片$P\delta(z)dz$が，運動量全体が，

$$\int_{-\infty}^{\infty} P\delta(z)\,dz = P$$

となる様に原点附近に集中して（0＜r，0＜R）上のスピン密度の成分を求める。（1－19）式から，

$$Pds\times\vec{r} = (0,\ rP(z)\delta(z)dz,\ 0), \qquad (A-3-1)$$

と，

$$|\vec{r}|^3 = [\,r^2 + (R-z)^2\,]^{\frac{3}{2}}$$ ですので，

$$Ж_x = Ж_z = 0,$$

$$Ж_y = \int_{\infty}^{\infty} \frac{rP(z)\delta(z)dz}{[\,r^2+(R-z)^2\,]^{\frac{3}{2}}} = \frac{rP}{(r^2+R^2)^{\frac{3}{2}}}, \qquad (A-3-2)$$

となって，運動量の柱の周囲にスピン密度力線の循環が出来る（第25図）。

(第25図参照)

但し，（A－3－2）では，$\int_{\infty}^{\infty} f(z)\,\delta(z)\,dz = f(0)$なる関係を用いました。

Fig. 25

(See the right leaf.)

We have used a famous relation of,

$$\int_{-\infty}^{\infty} f(z)\,\delta(z)\,dz = f(0)$$

in (A − 3 − 2).

(A − 4) Determination of Reduced Mass

If masses of m_1 and m_2 are present at the one point of

$$\vec{x}_1 = (x_1^1,\ x_1^2,\ x_1^3,\ x_1^4)$$

and another of,

$$\vec{x}_2 = (x_2^1,\ x_2^2,\ x_2^3,\ x_2^4)\ , \tag{A−4−1}$$

the center of mass is expressed by

$$\vec{x} = \frac{m_1 \vec{x}_1 + m_2 \vec{x}_2}{m_1 + m_2}\ , \tag{A−4−2}$$

in Minkowskean space-time. Four dimensional angular momentum around the center of mass is given by,

$$\begin{aligned} \boldsymbol{M} &= (\vec{x}_1 - \vec{x}) \otimes m_1 \frac{d\vec{x}_1}{d\tau} + (\vec{x} - \vec{x}_2) \otimes m_2 \frac{d x_2}{d\tau} \\ &= \frac{m_1 m_2}{m_1 + m_2} (\vec{x}_1 - \vec{x}_2) \otimes \frac{d}{d\tau} (\vec{x}_1 - \vec{x}_2) \\ &= \mu\, (\vec{x}_1 - \vec{x}_2) \otimes \frac{d}{d\tau} (\vec{x}_1 - \vec{x}_2)\ , \end{aligned} \tag{A−4−3}$$

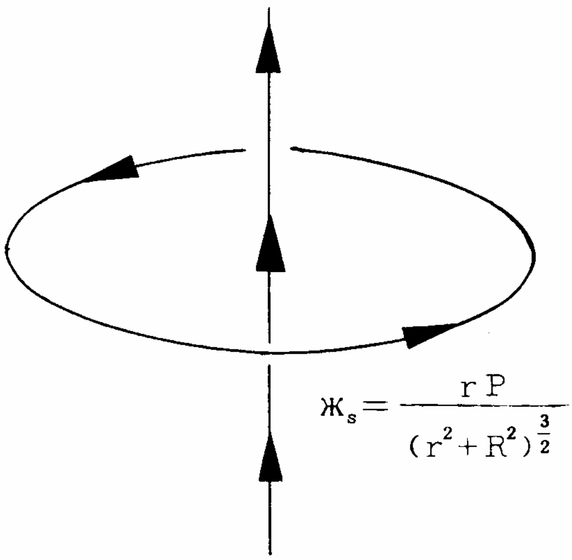
in which τ and μ stand for proper time to the center of mass and a new reduced mass of,

$$\mu = \frac{m_1 m_2}{m_1 + m_2}\ . \tag{A−4−4}$$

$\otimes$ means four dimensional vector product, for instance, of,

$$\begin{aligned} \vec{x}_1 \otimes \vec{x}_2 = (&x_1^2 x_2^3 - x_1^3 x_2^2,\ x_1^3 x_2^1 - x_1^1 x_2^3,\ x_1^1,\ x_2^2 - x_1^2 x_2^1,\ x_1^4 x_2^1 - x_1^1 x_2^4, \\ &x_1^4 x_2^2 - x_2^4 x_2^2,\ x_1^4 x_2^3 - x_2^4 x_1^3)\ . \end{aligned}$$

（第２５図）



(A−4) 換算質量の算定

ミンコウスキ時空内の２点

$$\vec{x}_1 = (x_1^1,\ x_1^2,\ x_1^3,\ x_1^4)$$

及び

$$\vec{x}_2 = (x_2^1,\ x_2^2,\ x_2^3,\ x_2^4), \qquad (A-4-1)$$

に質点m_1及びm_2が有るとすれば，其の重心は，

$$\vec{X} = \frac{m_1 \vec{x}_1 + m_2 \vec{x}_2}{m_1 + m_2}, \qquad (A-4-2)$$

です。重心の周囲の４次元的角運動量は，

$$M = (\vec{x}_2 - \vec{X}) \otimes m_2 \frac{d\vec{x}_2}{d\tau} + (\vec{x}_1 - \vec{X}) \otimes m_1 \frac{d\vec{x}_1}{d\tau}$$

$$= \frac{m_1 m_2}{m_1 + m_2} (\vec{x}_2 - \vec{x}_1) \otimes \frac{d}{d\tau} (\vec{x}_2 - \vec{x}_1),$$

$$= \mu (\vec{x}_2 - \vec{x}_1) \otimes \frac{d}{d\tau} (\vec{x}_2 - \vec{x}_1), \qquad (A-4-3)$$

です。μが新しい質量ですが，此れは，

$$\mu = \frac{m_1 m_2}{m_1 + m_2}, \qquad (A-4-4)$$

(A−5) Generation of Rotating Electric Field

Three spherical condensers are situated at the tops of an equilateral triangle in Fig. 10.

Fig. 3 C

(See the right leaf.)

We shall again illustrate them in Fig. 30 and charge and discharge them with three phases current of $\Psi_0 \sin \Omega \tau$, $\Psi_0 \sin(\Omega \tau + \frac{2}{3}\pi)$ and $\Psi_0 \sin(\Omega \tau + \frac{4}{3}\pi)$. Then, electric potentials across A, B; B, C and C, A are expressed by

$$\begin{aligned}\Psi_{BA} &= \Psi_0 [\sin(\Omega \tau + \tfrac{2}{3}\pi) - \sin \Omega \tau] \\ &= 2\Psi_0 \cos(\Omega \tau + \tfrac{\pi}{3}) \sin \tfrac{\pi}{3} \\ &= \sqrt{3}\, \Psi_0 \cos(\Omega \tau + \tfrac{\pi}{3}),\end{aligned}$$

$$\begin{aligned}\Psi_{CB} &= \Psi_0 [\sin(\Omega \tau + \tfrac{4}{3}\pi) - \sin(\Omega \tau + \tfrac{2}{3}\pi)], \\ &= \sqrt{3}\, \Psi_0 \cos(\Omega \tau + \pi),\end{aligned}$$

and

$$\begin{aligned}\Psi_{AC} &= \Psi_0 [\sin \Omega \tau - \sin(\Omega \tau + \tfrac{4}{3}\pi)] \\ &= -\sqrt{3}\, \Psi_0 \cos(\Omega \tau + \tfrac{2}{3}\pi).\end{aligned}$$

で換算質量です。尚，⊗は４次元の外積で，例えば，

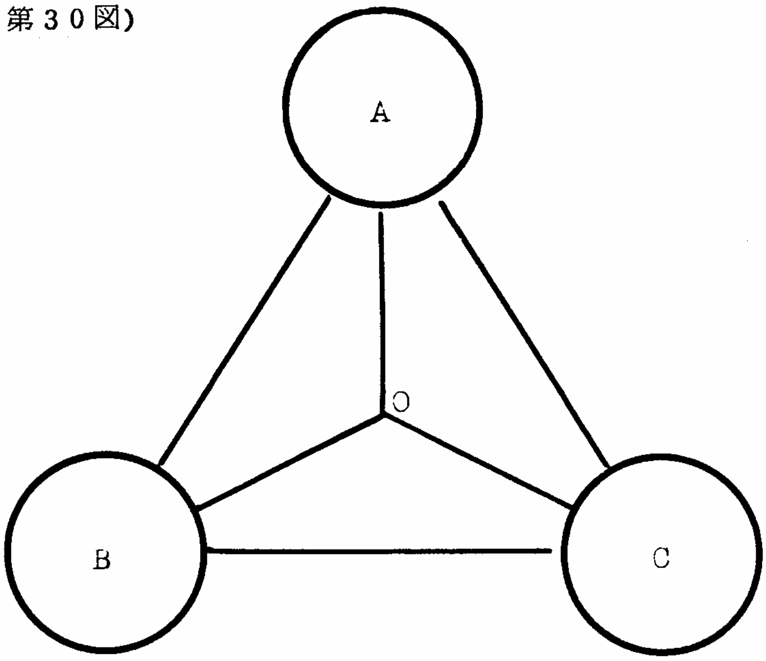
$$\vec{x}_1 \otimes \vec{x}_2 = (x_1^2\, x_2^3 - x_1^3\, x_2^2,\ x_1^3\, x_2^1 - x_1^1\, x_2^3,\ x_1^1\, x_2^2 - x_2^1\, x_1^2,\ x_1^4\, x_2^1 - x_2^4\, x_1^1,\ x_1^4\, x_2^2 - x_2^4\, x_1^2,\ x_1^4\, x_2^3 - x_2^4\, x_1^3)$$

となります。

(A−5)　回転電場の創生

第１０図の３個の球型コンデンサは，正三角形の３個の頂点上に位置して居る。

（第３０図）



此れを第３０図の様に示し，各コンデンサに三相交流の各相 $\Psi_0 \sin\omega\tau$，$\Psi_0 \sin(\omega\tau + \frac{2}{3}\pi)$ 及び $\Psi_0 \sin(\omega\tau + \frac{4}{3}\pi)$ を充放電すると，A，B；B，C・及びC，A間の電位差は，

$$\Psi_{BA} = \Psi_0 [\sin(\omega\tau + \frac{2}{3}\pi) - \sin\omega\tau] = 2\Psi_0 \cos(\omega\tau + \frac{\pi}{3}) \sin\frac{\pi}{3}$$
$$= \sqrt{3}\,\Psi_0 \cos(\omega\tau + \frac{\pi}{3})$$
$$\Psi_{CB} = \Psi_0 [\sin(\omega\tau + \frac{4}{3}\pi) - \sin(\omega\tau + \frac{2}{3}\pi)] = \sqrt{3}\,\Psi_0 \cos(\omega\tau + \pi)$$
$$\Psi_{AC} = \Psi_0 [\sin\omega\tau - \sin(\omega\tau + \frac{4}{3}\pi)] = -\sqrt{3}\,\Psi_0 \cos(\omega\tau + \frac{2}{3}\pi), \tag{A−5−1}$$

If a side of the equilateral triangle is l, we derive electric fields of,

$$E_{BA}=\frac{\sqrt{3}\,\Psi_0}{l}\cos\left(\Omega\tau+\frac{\pi}{3}\right),$$

$$E_{CB}=\frac{\sqrt{3}\,\Psi_0}{l}\cos\left(\Omega\tau+\pi\right),$$

and

$$E_{AC}=\frac{\sqrt{3}\,\Psi_0}{l}\cos\left(\Omega\tau+\frac{5}{3}\pi\right), \qquad \text{(A-5-2)}$$

along the sides. E_{AC} is obtained by making use of a relation of, $\cos(\Omega\tau+\pi)=-\cos\Omega\tau$.

Transforming (A-5-2) into star diagram with star-delte transformation (Ref. 61), we have Fig. 31 (Ref. 62),

Fig. 31

(See the right leaf.)

owing to which we finally obtain

$$|E_A|=|E_B|=|E_C|=\frac{|E_{BC}|}{\sqrt{3}}=\frac{|E_{CA}|}{\sqrt{3}}=\frac{|E_{AB}|}{\sqrt{3}}=\frac{\Psi_0}{l}$$

$$E_A=\frac{\Psi_0}{l}\cos\left(\Omega\tau+\frac{\pi}{3}\right), \qquad E_B=\frac{\Psi_0}{l}\cos\left(\Omega\tau+\pi\right),$$

and

$$E_C=\frac{\Psi_0}{l}\cos\left(\Omega\tau+\frac{5}{3}\pi\right).$$

Putting $\Omega\tau+\frac{\pi}{3}$ to be θ, we find

$$E_A=\frac{\Psi_0}{l}\cos\theta, \qquad E_B=\frac{\Psi_0}{l}\cos\left(\theta+\frac{2}{3}\pi\right),$$

and

$$E_C=\frac{\Psi_0}{l}\cos\left(\theta+\frac{4}{3}\pi\right).$$

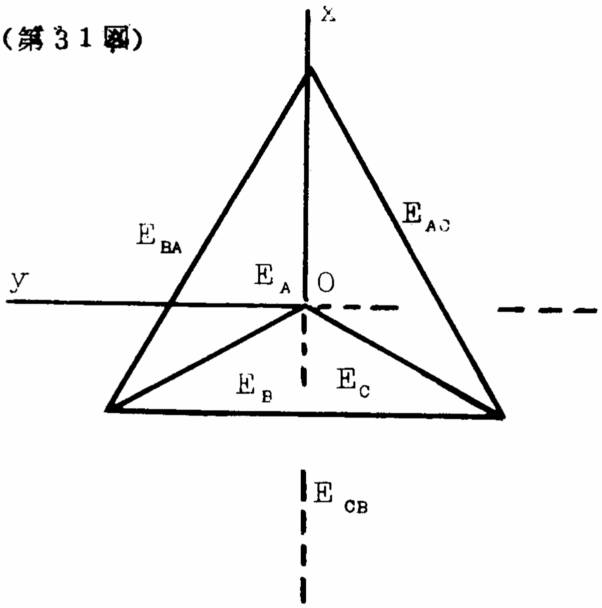
となります。正三角形の一辺の長さをlと致しますれば，各々

$$E_{BA}=\frac{\sqrt{3}\,\Psi_0}{l}\cos\left(\omega\tau+\frac{\pi}{3}\right)\qquad E_{CB}=\frac{\sqrt{3}\,\Psi_0}{l}\cos(\omega\tau+\pi)$$

$$E_{AC}=\frac{\sqrt{3}\,\Psi_0}{l}\cos\left(\omega\tau+\frac{5}{3}\pi\right),\qquad\text{(A−5−2)}$$

の電場が，各辺に沿つて得られます。E_{AC} の表現は，（Ａ－５－１）から（Ａ－５－２）に移る時に，$\cos(\omega\tau+\pi)=-\cos\omega\tau$ の関係を用いました。此れをスタ・デルタ変換（文献６１）に依拠してスタ型に変換致しますと，第３１図の様になります（文献６２）。

（第３１図）



$$|E_A|=|E_B|=|E_C|=\frac{|E_{BA}|}{\sqrt{3}}=\frac{|E_{CB}|}{\sqrt{3}}=\frac{|E_{AC}|}{\sqrt{3}}=\frac{\Psi_0}{l}$$，ですので，

$$E_A=\frac{\Psi_0}{l}\cos\left(\omega\tau+\frac{\pi}{3}\right),\qquad E_B=\frac{\Psi_0}{l}\cos(\omega\tau+\pi),$$

$$E_C=\frac{\Psi_0}{l}\cos\left(\omega\tau+\frac{5}{3}\pi\right)$$

です。$\omega\tau+\frac{\pi}{3}=\theta$ と置きますと，

$$E_A=\frac{\Psi_0}{l}\cos\theta,\qquad E_B=\frac{\Psi_0}{l}\cos\left(\theta+\frac{2}{3}\pi\right),\qquad E_C=\frac{\Psi_0}{l}\cos\left(\theta+\frac{4}{3}\pi\right)$$

The components of electric field of E_x and E_y are ;

$$E_x=\frac{\Psi_0}{l}\cos\theta\cos 0+\frac{\Psi_0}{l}\cos\left(\theta+\frac{2}{3}\pi\right)\cos\frac{2}{3}\pi+\frac{\Psi_0}{l}\cos\left(\theta+\frac{4}{3}\pi\right)$$
$$\times\cos\frac{4}{3}\pi=\frac{3\Psi_0}{2l}\cos\theta,$$
$$E_y=\frac{\Psi_0}{l}\cos\theta\sin 0+\frac{\Psi_0}{l}\cos\left(\theta+\frac{2}{3}\pi\right)\sin\frac{2}{3}\pi+\frac{\Psi_0}{l}\cos\left(\theta+\frac{4}{3}\pi\right)$$
$$=\frac{3\Psi_0}{2l}\sin\theta, \tag{A-5-3}$$

if we take $x-0-y$ axises as in Fig. 31.

Thus $\boldsymbol{E}=(E_x, E_y)$

forms the angle of φ with x-axis such that :

$$\varphi=\mathrm{Arctan}\,\frac{E_y}{E_x}=\mathrm{Arctan}\,(\tan\theta)=\theta=\omega\tau+\frac{\pi}{3}, \tag{A-5-4}$$

which shows that elictric field rotates.

The amplitude of the field is given by

$$|E|=\sqrt{E_x^2+E_y^2}=\frac{3\Psi_0}{2l}\sqrt{\cos^2\theta+\sin^2\theta}=\frac{3\Psi_0}{2l}.$$

(A − 6) Gyrational Effect of Equation of Gyro

Equation of gyro
[for instance, SEIKE-Kramers Equation (the 4th chapter)]
enjoys gyrational effect when we go over to a new co-ordinate by

$$y'=\alpha y, \tag{A-6-1}$$

if α is a function of proper time of τ, where y, y' and α are column vectors and a matrix with three rows and as many columns.

Inverse transformation of (A − 6 − 1) gives

$$y=\alpha^{-1}\cdot y'=\beta\cdot y', \tag{A-6-2}$$

which leads us to

$$\frac{dy}{d\tau}=\frac{d\beta}{d\tau}\cdot y'+\beta\cdot\frac{dy'}{d\tau}, \tag{A-6-3}$$

if we differentiate (A − 6 − 2). We next obtain

$$\frac{d^{*}y}{d\tau}=\alpha\cdot\frac{d\beta}{d\tau}\cdot y'+\alpha\cdot\beta\cdot\frac{dy'}{d\tau}=(\alpha\cdot\frac{d\beta}{d\tau}+\alpha\cdot\beta\frac{d}{d\tau})\,y',$$

(A-6-5)

if $\frac{dy'}{d\tau}$ is related to $\frac{dy}{d\tau}$ by,

$$\frac{dy'}{d\tau}=\alpha\cdot\frac{dy}{d\tau}, \tag{A-6-4}$$

owing to (A-6-3). $\alpha\cdot\beta=1$

holds β is inverse of α. We thirdly derive

$$=(\frac{d}{d\tau}+\alpha\cdot\frac{d\beta}{d\tau})\,y'. \tag{A-6-6}$$

Asterisk shows the differentiation with respect to the new co-ordinate such that

$$\frac{d*}{d\tau}=\frac{d}{d\tau}+\alpha\cdot\frac{d\beta}{d\tau}. \tag{A-6-7}$$

Inverse of the transformation matrix of (4-9) is given by,

$$\beta=\begin{pmatrix}\cos\Omega\tau, & -\sin\Omega\tau, & 0\\ \sin\Omega\tau, & \cos\Omega\tau, & 0\\ 0, & 0, & 1\end{pmatrix},$$

which leads us to

$$\frac{d*}{d\tau}=\frac{d}{d\tau}+\vec{\Omega}\times, \tag{A-6-8}$$

where $\vec{\Omega}=(0,\ 0,\ \Omega)$.

With respect to α_1 of (10-12) we further obtain

$$\frac{d*}{d\tau}=\frac{d}{d\tau}+\vec{\omega}\times, \tag{A-6-9}$$

where $\vec{\omega}=(-\Omega\sin\omega\tau,\ \Omega\cos\omega\tau,\ \omega)$, (A-6-10)

which is the reason why the solution became rather complicated when we solve Kramers Equation to spherically polarized electromagnetic field.

(A-7) Probability of Statistical Thermodynamics

Taking the angles of α, β and Ψ as in Fig. 3 and putting

$$p=\frac{-4\pi a^2\ (Я\times Ж)}{c}$$

The measure along p axis is $\sin\Psi\, d\Psi\, d\alpha$ and the measure around that axis $d\beta$. Putting unit vector in the I direction to be $\bar{\mathrm{I}}$, that in the P to be $\bar{\mathrm{P}}$ and that in the p to be $\bar{\mathrm{p}}$, where

$$\mathrm{I}=\alpha Ж \qquad \text{and} \qquad \mathrm{P}=-\alpha Я,$$

we find

$$(\bar{\mathrm{I}},\ \bar{\mathrm{P}},\ \bar{\mathrm{p}}) = \begin{pmatrix} \cos\alpha, & -\sin\alpha, & 0 \\ \sin\alpha, & \cos\alpha, & 0 \\ 0, & 0, & 1 \end{pmatrix}\begin{pmatrix} \cos\Psi, & 0, & -\sin\Psi \\ 0, & 1, & 0 \\ \sin\Psi, & 0, & \cos\Psi \end{pmatrix}$$

$$\times\begin{pmatrix} \cos\beta, & -\sin\beta, & 0 \\ \sin\beta, & \cos\beta, & 0 \\ 0, & 0, & 1 \end{pmatrix}=\begin{pmatrix} a_{11}, & a_{12}, & a_{13} \\ a_{21}, & a_{22}, & a_{23} \\ a_{31}, & a_{32}, & a_{33} \end{pmatrix}, \qquad (A-7-2)$$

which leads us to

$$\cos\theta = a_{11} = \cos\alpha\cos\beta\cos\Psi - \sin\alpha\sin\beta,$$

$$\cos\varphi = a_{22} = -\sin\alpha\sin\beta\cos\Psi + \cos\alpha\cos\beta,$$

if magnetic field forms the angle θ with I and electric φ with P. Thus, we have a Hamiltonian of,

$$\{ -(|\mathrm{I}||\mathrm{H}|\cos\alpha\cos\beta - |\mathrm{P}||\mathrm{E}|\sin\alpha\sin\beta)\cos\Psi + (|\mathrm{I}||\mathrm{H}|\sin\alpha\sin\beta - |\mathrm{P}||\mathrm{E}|\cos\alpha\cos\beta) \} / \gamma,$$

where it is given in recourse to (3−13). The probability of this dynamical system in the interval of $[\Psi,\ \Psi+d\Psi]$ is determined by,

$$\begin{aligned} \mathrm{P}\,d\Psi = \sin\Psi\, d\Psi \int_0^{\pi} d\beta \int_{-\pi}^{\pi} d\alpha\ \exp[\,(|\mathrm{I}||\mathrm{H}|\cos\alpha\cos\beta - |\mathrm{P}||\mathrm{E}|\sin\alpha\sin\beta \\ - |\mathrm{P}||\mathrm{E}|\sin\alpha\sin\beta)\cos\Psi - (|\mathrm{I}||\mathrm{H}|\sin\alpha\sin\beta - |\mathrm{P}||\mathrm{E}|\cos\alpha \\ \times\cos\beta)\,] / kT\gamma \div \int_0^{\pi}\sin\Psi\, d\Psi \int_{-\pi}^{\pi} d\alpha \int_0^{\pi} d\beta\ \exp[\qquad // \qquad] \end{aligned} \qquad (A-7-4)$$

If we put

$$2\cos\alpha\cos\beta = \cos(\alpha+\beta) + \cos(\alpha-\beta)$$
$$= \cos u + \cos V,$$
$$2\sin\alpha\sin\beta = -\cos(\alpha+\beta) + \cos(\alpha-\beta)$$
$$= -\cos u + \cos v$$

Fig. 34

(See the right leaf.)

we further obtain

$$\int_{-\pi}^{\pi} d\alpha \int_{0}^{\pi} d\beta f(\alpha, \beta) = \int_{-\pi}^{\pi} du \int_{-\pi}^{\pi} dv g(u, v)$$

$$d\alpha\, d\beta = \frac{1}{2} du\, dv.$$

We namely have

$$\therefore P d\Psi = \frac{1}{2} \sin\Psi\, d\Psi \int_{-\pi}^{\pi} du \int_{-\pi}^{\pi} dv$$

$$\times \exp \frac{[(|H||I| + |P||E|)(\cos\Psi + 1)\cos u + (|H||I| - |P||E|)(\cos\Psi - 1)\cos v]}{\gamma k T}$$

$$\div \frac{1}{2} \int_{0}^{\pi} \sin\Psi\, d\Psi \int_{-\pi}^{\pi} du \int_{-\pi}^{\pi} dv \exp \frac{[\quad // \quad]}{\gamma k T}.$$

while $\int_{-\pi}^{\pi} \exp(a \cos u)\, du = 2\pi J_0(ia) = 2\pi I_0(a)$, (A-7-6)

where $J_0(z)$ and $I_0(z)$ stand for Bessel function of the lowest order and modified Bessel, respectively.

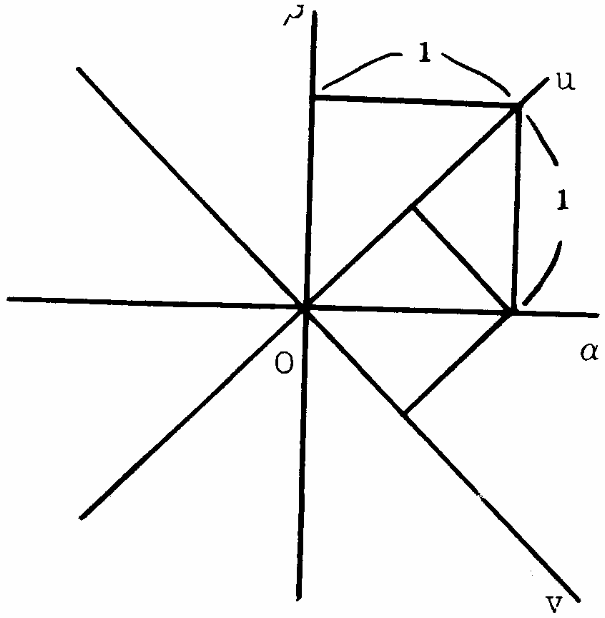
In virtue of (A-7-6) we derive

$$= \frac{\frac{4\pi^2}{2} \sin\Psi\, d\Psi\, J_0\left[\frac{i|I||H|}{kT\gamma}(\cos\Psi + 1)\right] J_0\left[\frac{i|P||E|(\cos\Psi - 1)}{kT\gamma}\right]}{\frac{4\pi^2}{2} \int_{0}^{\pi} J_0\left[\frac{i|H||I|}{kT\gamma}(\cos\Psi + 1)\right] J_0\left[\frac{i|P||E|(\cos\Psi - 1)}{kT\gamma}\right] \sin\Psi\, d\Psi}$$

$$= \frac{dz\, J_0\left[\frac{|I||H|}{kT\gamma}(z+1)\right] I_0\left[\frac{|P||E|(z-1)}{kT\gamma}\right]}{\int_{-1}^{1} dz\, I_0\left[\frac{|I||H|(z+1)}{kT\gamma}\right] I_0\left[\frac{|P||E|(z-1)}{kT\gamma}\right]},$$

(A-7-7)

(第34図)



第34図を参照して,

$$\int_{-\pi}^{\pi} d\alpha \int_{0}^{\pi} d\beta f(\alpha, \beta) = \int_{-\pi}^{\pi} du \int_{-\pi}^{\pi} dv g(u, v),$$

$$d\alpha d\beta = \frac{1}{2} du dv.$$

$$\therefore P d\Psi = \frac{1}{2}\sin\Psi d\Psi \int_{-\pi}^{\pi} du \int_{-\pi}^{\pi} dv$$

$$\exp\frac{[(|H||I| + |P||E|)(\cos\Psi+1)\cos u + (|H||I| - |P||E|)(\cos\Psi-1)\cos v]}{\gamma kT}$$

$$\div \frac{1}{2}\int_{0}^{\pi}\sin\Psi d\Psi \int_{-\pi}^{\pi} du \int_{-\pi}^{\pi} dv \exp\times\frac{[\quad {}'' \quad]}{\gamma kT}$$

となる。一方,

$$\int_{-\pi}^{\pi} \exp(a\cos u) du = 2\pi J_0(ia) = 2\pi I_0(a), \qquad (A-7-6)$$

であって, $J_0(z)$ 及び $I_0(z)$ は最低次のベセル関数及び変型ベセル関数である。従って,

$$= \frac{\frac{4\pi^2}{2}\sin\Psi d\Psi J_0\left[\frac{i|I||H|}{kT\gamma}(\cos\Psi+1)\right] J_0\left[\frac{i|P||E|(\cos\Psi-1)}{kT\gamma}\right]}{\frac{4\pi^2}{2}\int_{0}^{\pi} J_0\left[\frac{i|H||I|}{kT\gamma}(\cos\Psi+1)\right] J_0[\quad {}'' \quad] d\Psi \sin\Psi}$$

which leads us to

[the mean of $\cos\Psi$]

$$=\int_0^{\pi}\cos\Psi\sin\Psi\, I_0\left[\frac{|H||I|}{kT\gamma}(\cos\Psi+1)\right] I_0\left[\frac{|P||E|(\cos\Psi-1)}{kT\gamma}\right] d\Psi$$

$$\div\int_0^{\pi} I_0\left[\frac{|I||H|}{kT\gamma}(\cos\Psi+1)\right] I_0\left[\frac{|P||E|(\cos\Psi-1)}{kT\gamma}\right]\sin\Psi\cot\Psi\, d\Psi. \tag{A-7-8}$$

Taking γ to be unity to the system of internal motion, we finally find

$$=\int_0^{\pi} I_0[a(\cos\Psi+1)]\, I_0[b(\cos\Psi-1)]\sin\Psi\cos\Psi\, d\Psi\div\int_0^{\pi} I_0[a(\cos\Psi+1)]\, I_0[b(\cos\Psi-1)]\sin\Psi\, d\Psi, \tag{A-7-9}$$

in which $a=\dfrac{|I||H|}{kT}$ and $b=\dfrac{|P||E|}{kT}$.

Integrating (A-7-6) terms by terms with

$$\exp x=\sum_{n=0}^{\infty}\frac{x^n}{n!},$$

and in recourse to

$$\int_0^{\pi}\cos^n u\, du=\begin{cases}0\ ;\ n:\ \text{odd}\\ \dbinom{n}{\frac{n}{2}}\left(\dfrac{1}{2}\right)^n\pi\ ;\ n:\ \text{even},\end{cases}$$

we obtain

$$=\frac{ab\left\{\dfrac{1}{3!}+\dfrac{2(a^2+b^2)}{5!}+\dfrac{3[(a^2+b^2)^2+a^2b^2]}{7!}+\cdots\cdots\right.}{1+\dfrac{a^2+b^2}{3!}+\dfrac{(a^2+b^2)^2+2a^2b^2}{5!}+\dfrac{(a^2+b^2)[(a^2+b^2)^2+6a^2b^2]}{7!}+\cdots} \tag{A-7-10}$$

convergence radii of $|a+b|$ and $|a-b|$ being $2\sim4$.

(A − 8) Calculation of Mutual Inductance

Fig. 24

(See the right leaf.)

Mutual inductance L between vertical infinite line and a torus coil is determined by

$$\Psi = -\frac{L}{c^2} \cdot \frac{\partial i}{\partial t} = -\frac{1}{c} \iint_F \frac{\partial H}{\partial t} \cdot dF, \qquad (A-8-2)$$

where the circumference of torus coil is expressed by,

$$(x-R)^2 + y^2 = r^2, \qquad (A-8-1)$$

to R and r in Fig. 9 and taking vertical infinite line to be y-axis (in Fig. 24) .

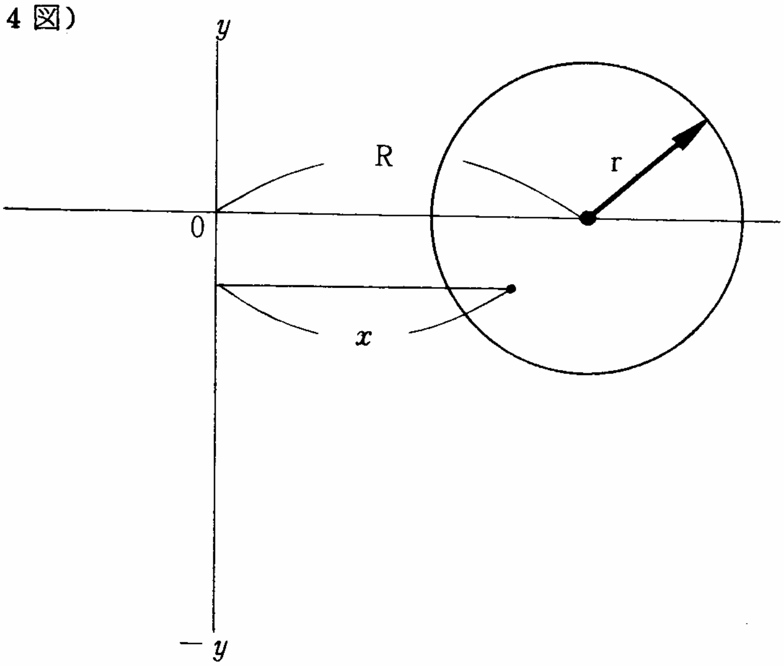
(A − 8 − 2) is nothing but Faraday's induction law in which the interval F of integrand is inside the circle of (A − 8 − 1) with that circumference. (A − 8 − 2) leads to

$$= \frac{\pi}{5c^2} \cdot \frac{\partial i}{\partial t} \iint_F \frac{dx\,dy}{x}. \qquad (A-8-3)$$

We must perform the integral of,

(A−8) 相互インダクタンスの計算

(第24図)



$$(x-R)^2+y^2=r^2$$

$$H=\frac{\pi i}{5cx} \qquad y=\pm\sqrt{r^2-(x-R)^2},$$

$$R-r\leqq x\leqq R+r$$

無限鉛直線とトーラスコイル間の相互インダクタンスLは，第9図の如くR及びrを採ると，無限鉛直線をy軸として，トラスコイルの円周を方程式

$$(x-R)^2+y^2=r^2 \qquad \text{(A−8−1)}$$

で示すと(第24図)，

$$\Psi=-\frac{L}{c^2}\cdot\frac{\partial i}{\partial t}=-\frac{1}{c}\iint_F\frac{\partial H}{\partial t}\cdot dF \qquad \text{(A−8−2)}$$

である。但し此れはファラデの誘導則であって，面積分の変域Fは，円(A−8−1)の内部及び周上である。

$$=\frac{\pi}{5c^2}\cdot\frac{\partial i}{\partial t}\iint_F\frac{dx\,dy}{x} \qquad \text{(A−8−3)}$$

となるから，積分

$$I = \int_{R-r}^{R+r} \frac{\sqrt{r^2 - (R-x)^2}}{x} dx, \qquad (A-8-4)$$

which leads us to

$$I = \lim_{\epsilon \to 0} \int_{R-r+\epsilon i}^{R+r+\epsilon i} \frac{\sqrt{r^2 - (x-R)^2}}{x} dx$$

$$= \frac{1}{2} \oint_{c_1} \frac{\sqrt{r^2 - (x-R)^2}}{x} dx,$$

c_1 representing a contour in Fig. 23.

Fig. 23

(See the right leaf.)

$$= \frac{1}{2} [-i \oint_{|x|=\epsilon \to \infty} \frac{\sqrt{(x-R)^2 - r^2}}{x} dx + i \oint_{|x|=\epsilon \to 0} \frac{\sqrt{(R-x)^2 - r^2}}{x} dx].$$

Expanding the first term and taking the branch into consideration,

$$= \frac{1}{2} [-i \oint (1 - \frac{R}{x} + \cdots\cdots) dx + i \oint \frac{\sqrt{(R-x)^2 - r^2}}{x} dx]$$

$$= \frac{2\pi i}{2} [\frac{i}{2\pi i} \oint (1 - \frac{R}{x} + \cdots\cdots) dx + i \oint \frac{\sqrt{(R-x)^2 - r^2}}{2\pi i x} dx],$$

$$I=\int_{R-r}^{R+r}\frac{\sqrt{r^2-(R-x)^2}}{x}dx \qquad (A-8-4)$$

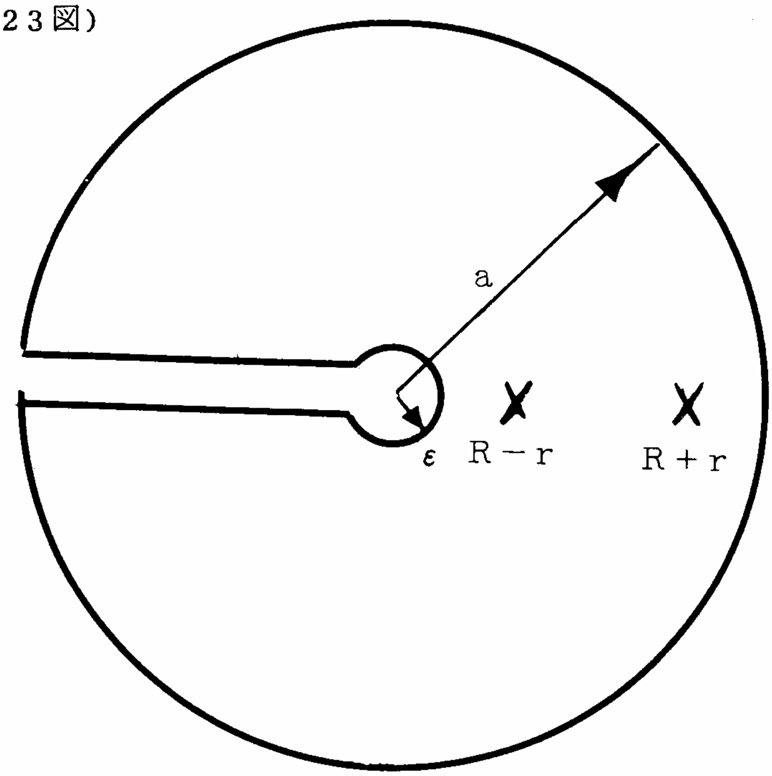
が問題である。

$$I=\lim_{\varepsilon\to 0}\int_{R-r+\varepsilon i}^{R+r+\varepsilon i}\frac{\sqrt{r^2-(x-R)^2}}{x}dx$$

$$=\frac{1}{2}\oint_{C1}\frac{\sqrt{r^2-(x-R)^2}}{x}dx$$

であって，c_1 は第２３図の積分路である。

（第２３図）



$$=\frac{1}{3}\left[-i\oint_{|x|=\varepsilon\to\infty}\frac{\sqrt{(x-R)^2-r^2}}{x}dx+i\oint_{|x|=\varepsilon\to 0}\frac{\sqrt{(R-x)^2-r^2}}{x}dx\right]$$

第１項を分枝に注意して展開し，

$$=\frac{1}{2}\left[-i\oint\left(1-\frac{R}{x}+\cdots\cdots\right)dy+i\oint\frac{\sqrt{(R-x)^2-r^2}}{x}dx\right]$$

$$=\frac{2\pi i}{2}\left[\frac{1}{2\pi i}\oint\left(1-\frac{R}{x}+\cdots\cdots\right)dx+i\oint\frac{\sqrt{(R-x)^2-r^2}}{2\pi i k}dx\right]$$

コシの留数定理から

which finally reduces to

$$=\pi i[i(-R)+i\sqrt{R^2-r^2}]=\pi(R-\sqrt{R^2-r^2}). \qquad (A-8-5)$$

Comparing (A-8-3) with the first side of (A-8-2) and taking the factor 10 when we express magnetic field in C. G. S. (gauss), we find

$$L=4\pi(R-\sqrt{R^2-r^2}), \qquad (A-8-6)$$

which reduces to

$$\approx \frac{2\pi r^2}{R} \ (cm) \qquad (A-8-7)$$

when $r \ll R$.

(A-9) Equilibrium Equation of Four Dimensional Stress Tensor

There are four dimensional stress components of f^{41}, f^{32}, f^{43} and f^{44} upon infinitesimal hyper surface element of

$$dF^4=dx\,dy\,dz.$$

We have known that :

f^{41} = (x component of internal force upon dF^4),
f^{42} = (y component of internal force upon dF^4),
f^{43} = (z component of internal force upon dF^4),
f^{44} = (t component of internal force upon dF^4).

$$dF^4=dx\,dy\,dz,$$

is called **hyper surface**, but is essentially a solid element as indicated in the sixth chapter. On the other hand, volumetric force owns four components such that

$$F=(f^1,\ f^2,\ f^3,\ f^4).$$

Equilibrium of

$$f^4\,d\tau=f^4\,dx\,dy\,dz\,du$$

with internal force is described by,

$$(f^{41}+\frac{\partial f^{41}}{\partial x}-f^{41})\,dF^1+(f^{42}+\frac{\partial f^{42}}{\partial y}-f^{42})\,dF^2+(f^{43}+\frac{\partial f^{43}}{\partial z}dz-f^{43})\,dF^3+(f^{44}+\frac{\partial f^{44}}{\partial u}du-f^{44})\,dF^4=f^4\,dx\,dy\,dz\,du, \qquad (A-9-1)$$

whose details are tabulated as follows :

volume on which stress acts	Direction of Action of Stresses			
	x-direction	y-direction	z-direction	u-direction
dy dz du	$f^{11}+\frac{\partial f^{11}}{\partial x}dx$ $-f^{11}$	$f^{12}+\frac{\partial f^{12}}{\partial y}dx$ $-f^{12}$	$f^{13}+\frac{\partial f^{13}}{\partial z}dz$ $-f^{13}$	$f^{14}+\frac{\partial f^{14}}{\partial u}dx$ $-f^{14}$
dz du dx	$f^{21}+\frac{\partial f^{21}}{\partial x}dy$ $-f^{21}$	$f^{22}+\frac{\partial f^{22}}{\partial y}dy$ $-f^{22}$	$f^{23}+\frac{\partial f^{23}}{\partial z}dy$ $-f^{23}$	$f^{24}+\frac{\partial f^{24}}{\partial u}dy$ $-f^{24}$
du dx dy	$f^{31}+\frac{\partial f^{31}}{\partial x}dz$ $-f^{31}$	$f^{32}+\frac{\partial f^{32}}{\partial y}dz$ $-f^{32}$	$f^{33}+\frac{\partial f^{33}}{\partial z}dz$ $-f^{33}$	$f^{34}+\frac{\partial f^{34}}{\partial u}dz$ $-f^{34}$
dx dy dz	$f^{41}+\frac{\partial f^{41}}{\partial x}du$ $-f^{41}$	$f^{42}+\frac{\partial f^{42}}{\partial y}du$ $-f^{42}$	$f^{43}+\frac{\partial f^{43}}{\partial z}du$ $-f^{43}$	$f^{44}+\frac{\partial f^{44}}{\partial u}du$ $-f^{44}$

TABLE 4

Normal of dF^1 is x-axis, while that of dF^2 y-axis, that of dF^3 z-axis and finally that of dF^4 time-axis, respectively, by which we can understand TABLE 4. (A−9−1) can be derived by thinking of the last row in TABLE 4.

Secondly we shall consider on equilibrium of hyper moment around 0_1 upon infinitesimal surface element of dxdu near the origin of x-u plane as in Fig. 38 which leads us to

Fig. 38
(See the right leaf.)

Equilibrium of Internal Bending Moment around the center of infinitesimal plane element of dxdu.

$$f^{14}\,dy\,dz\,du\cdot\frac{dx}{2}+\left(f^{14}+\frac{\partial f^{14}}{\partial x}dx\right)dy\,dz\,du\cdot\frac{dx}{2}-f^{41}\,dx\,dy\,dz\times\frac{du}{2}-\left(f^{41}+\frac{\partial f^{41}}{\partial u}du\right)dx\,dy\,dz\cdot\frac{du}{2}=0. \qquad (A-9-2)$$

Neglecting higher order of infinitesimal terms we obtain

$$f^{41}=f^{14}. \qquad (A-9-3)$$

The remaining five planes give

$$f^{23}=f^{32},\ f^{12}=f^{21},\ f^{42}=f^{24}\quad\text{and}\quad f^{43}=f^{34},\ f^{31}=f^{13} \qquad (A-9-4)$$

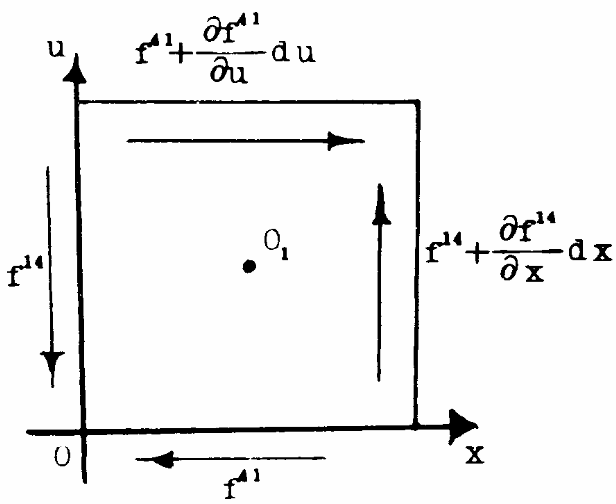
第　4　表

応力の作用体積	応力の作用方向			
	x 方 向	y 方 向	z 方 向	u 方 向
dy dz du	$f^{11}+\frac{\partial f^{11}}{\partial x}dx$ $-f^{11}$	$f^{12}+\frac{\partial f^{12}}{\partial y}dx$ $-f^{12}$	$f^{13}+\frac{\partial f^{13}}{\partial z}dx$ $-f^{13}$	$f^{14}+\frac{\partial f^{14}}{\partial u}dx$ $-f^{14}$
dz du dx	$f^{21}+\frac{\partial f^{21}}{\partial x}dy$ $-f^{21}$	$f^{22}+\frac{\partial f^{22}}{\partial y}dy$ $-f^{22}$	$f^{23}+\frac{\partial f^{23}}{\partial z}dy$ $-f^{23}$	$f^{24}+\frac{\partial f^{24}}{\partial u}dy$ $-f^{24}$
du dx dy	$f^{31}+\frac{\partial f^{31}}{\partial x}dz$ $-f^{31}$	$f^{32}+\frac{\partial f^{32}}{\partial y}dz$ $-f^{32}$	$f^{33}+\frac{\partial f^{33}}{\partial z}dz$ $-f^{33}$	$f^{34}+\frac{\partial f^{34}}{\partial u}dz$ $-f^{34}$
dx dy dz	$f^{41}+\frac{\partial f^{41}}{\partial x}du$ $-f^{41}$	$f^{42}+\frac{\partial f^{42}}{\partial y}du$ $-f^{42}$	$f^{43}+\frac{\partial f^{43}}{\partial z}du$ $-f^{43}$	$f^{44}+\frac{\partial f^{44}}{\partial u}du$ $-f^{44}$

dF^1 の法線はｘ軸，dF^2 の法線はｙ軸，dF^3 の法線はｚ軸で，最後に dF^4 の法線は時間軸である事を考えると，第４表を容易に理解する事が出来ます。第４表の最後の列に就いて考えたのが，（Ａ－９－１）でした。

次に，ｘ－ｕ平面の原点近くで，第３８図の如く，超応力の，微小平面 $dx\,dy$ の中心 0_1 の周りの超モウメントが０である事から，

第３８図



（超モウメントの平衡）

$$f^{14}\,dy\,dz\,du\cdot\frac{dx}{2}+\left(f^{14}+\frac{\partial f^{14}}{\partial x}\times dx\right)\times dy\,dz\,du\cdot\frac{dx}{2}-f^{41}\times dx\,dy\,dz\cdot\frac{du}{2}-\left(f^{41}+\frac{\partial f^{41}}{\partial u}\times du\right)dx\,dy\,dz\cdot\frac{du}{2}=0, \qquad (A-9-2)$$

を得ます。高次の微小項を省略して，

$$f^{41}=f^{14} \qquad (A-9-3)$$

を得ます。

残りの５枚の平面に就いて，

$$f^{23}=f^{32},\quad f^{31}=f^{13},\quad f^{12}=f^{21},\quad f^{42}=f^{24},\quad f^{43}=f^{34}, \qquad (A-9-4)$$

which finally leads to

$$f^{jk}=f^{kj}\ . \qquad (A-9-5)$$

(A−9−1) can be rearranged in

$$\partial_k f^{4k}=f^4\ . \qquad (A-9-6)$$

The remaining three directions give

$$\partial_k f^{1k}=f^1\ , \qquad \partial_k f^{2k}=f^2\ , \qquad \text{and} \qquad \partial_k f^{3k}=f^3\ .$$

We namely obtain equilibrium equation of hyper stresses of,

$$\partial_k f^{jk}=f^j \qquad (A-9-7)$$

(contracted over k).

If no volumetric force is present, (A−9−7) reduces to

$$\partial_k f^{jk}=0\ , \qquad (A-9-8)$$

for which we can take potentials of φ^{jk} such that

$$\begin{aligned} f^{jk}&=\partial_j\,\partial_k\,\varphi^{mn}\ ,\\ f^{jj}&=-\left(\partial_k^2\varphi^{mn}+\partial_m^2\varphi^{nk}+\partial_n^2\varphi^{mk}\right)\ ,\\ &(\varphi^{jk}=\varphi^{kj})\ , \end{aligned} \qquad (A-9-9)$$

so that (A−9−8) may identically be satisfied.

We also know the other conservation Eqn. of energy momentum tensor of,

$$\partial_k T^{jk}=0\ , \qquad (A-9-10)$$

which can be satisfied by taking potentials of,

$$\begin{aligned} T^{jk}&=\partial_j\,\partial_k\,\Psi^{mn}\ ,\\ T^{jj}&=-\left(\partial_k^2\Psi^{mn}+\partial_m^2\Psi^{nk}+\partial_n^2\Psi^{km}\right)\ . \end{aligned} \qquad (A-9-11)$$

If $\qquad \Box^4\varphi^{jk}(X)=0\ , \qquad (A-9-12)$

we obtain $\qquad \Box^4\Psi^{jk}(X)=0\ , \qquad (A-9-13)$

where we have taken the boundary conditions of,

$$\lim_{x\to\infty} f^{jk}(X)=\lim_{y\to\infty} f^{jk}(X)=\lim_{z\to\infty} f^{jk}(X)=\lim_{u\to\infty} f^{jk}(X)=0\ ,$$

for time-dependent solutions, while those of,

$$\lim_{x\to\infty} f^{jk}(X)=\lim_{y\to\infty} f^{jk}(X)=\lim_{z\to\infty} f^{jk}(X)=0\ ,$$

for static field, by which we have annhilated degrees of freedom that arbitrary functions are trailed when integrating (A−9−8) and (A−9−10).

(A-10) Kageyama Model

Kageyama Model which is educational one of rotating electric field on spherical condensers is displayed on the following Fig.

(See the right)
Fig. 64

Clock-wise rotation appears only when

$$R = 10\,M\Omega.$$

Otherwise it enjoys upwards counter clock-wise rotation.
This twinkling rotation is that of a morning-glory or any vine.

It continues to enjoy counter clock-wise rotation if one decreases variable resister and vice versa.

Namely, if the initial condition is clock-wise one it leads so and vice versa. Twinkling rotation, of course, becomes rapid when one increases electric potential across delta Ne-ons. This model is called Kageyama One since the inventor is Akira KAGEYAMA.

(A-11) Reversing Reflection upon Mirror

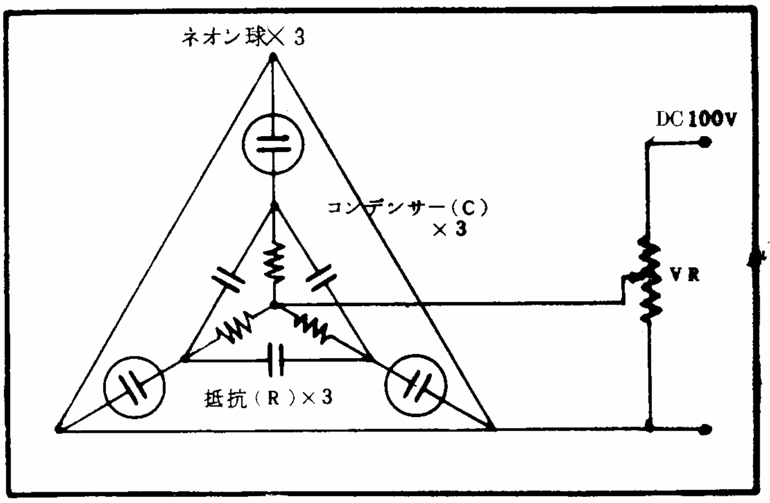
Image upon mirror reverses itself later-ally, while it enjoys ordinary orientation longitudinally. It seems quite natural to enjoy longitudinal inversion if laterally so.

(See the right)
Fig. 65

Why? <Above> and <Below> are present because g-field is so. For instance, mirror of EARTH also reverses itself, namely,

(A-10) 影 山 模 型

3相電源を，球型コンデンサーに充放電した時の電場の回転を教育模型的に示すには，次図の回路で示した影山モデルと称されるものがある。



(第64図)

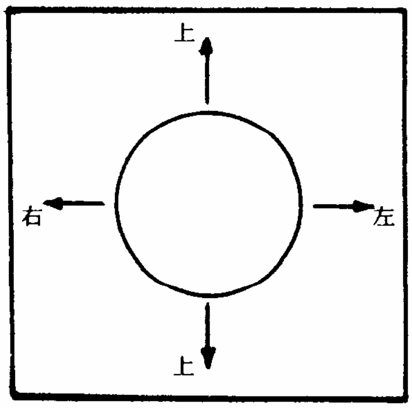
Rに10 MΩの値をとった時にのみ，上から見て時計方向の回転が現われる。他のRの値の時は．反時計方向の回転となる。上方へ向けてz軸をとった時に，朝顔のつるの巻方の回転である(10 MΩを使用した時)。

可変抵抗器を減じていく時，初期条件として時計方向の回転から出発すれば，この回転が連続し，逆ならば逆である。勿論．ネオン球にかかる電圧を上げると，回転速度は大きくなる。影山氏に依って考案されたので，影山モデルと称している。

(A-11) 鏡 の 反 転 性

鏡に映る像は，左右が反転している。一方，上下は反転していない。左右が反転しているならば，上下もそうであってよさそうなものである。

この理由は，何であろうか？上，下があるのは重力場があるからである。そこで，重力場全体からみると――例えば．地球の南極と北極を上，下方向に置いて考えて，南極での上下と，



(第65図)

when we treat a whole g-field-we think giant mirror of EARTH.

This conception also holds when we think of microscopic g-field —— for instance, that of electron.

(A-12) Multiplication Theorem and Frequency Modulation

Multiplication Theorem may appear corresponding with addition theorem in trigonometory. In recourse to generalized theorem of De moivre's we have

$$(\cos\beta+i\sin\beta)^{\alpha}=\cos\alpha\beta+i\sin\alpha\beta\,, \qquad (A-12-1)$$

the right hand side of which leads to

$$=(\cos\beta)^{\alpha}(1+i\tan\beta)^{\alpha}. \qquad (A-12-2)$$

If

$$\alpha\beta=\theta\,,$$

takes all the real value, there is no restriction to α, because of which we put

$$0<\beta<\pi/4\ . \qquad (A-12-3)$$

Then,

$$|\,i\tan\beta\,|<1\,, \qquad (A-12-4)$$

holds. With reference to extended binomial theorem we obtain,

$$(1+i\tan\beta)^{\alpha}=1+\alpha\,i\tan\beta-\frac{\alpha(\alpha-1)}{2\,!}\tan^2\beta$$

$$-\frac{\alpha(\alpha-1)(\alpha-2)}{3\,!}(i\tan^3\beta)+\cdots\cdots$$

$$+\frac{\alpha(\alpha-1)\cdots(\alpha-n+1)}{n\,!}(i\tan\beta)^{n}+\cdots\cdots$$

$$=1-\frac{\alpha(\alpha-1)}{2\,!}\tan^2\beta+\frac{\alpha(\alpha-1)(\alpha-2)(\alpha-3)}{4\,!}\tan^4\beta\ \cdots\cdots$$

$$\cdots+i\left[\alpha\tan\beta-\frac{\alpha(\alpha-1)(\alpha-2)}{3\,!}\tan^3\beta\right.$$

$$\left.+\frac{\alpha(\alpha-1)(\alpha-2)(\alpha-3)}{5\,!}\tan^5\beta-\cdots\cdots\right] \qquad (A-12-5)$$

Then, the left hand side is easily found to be,

$$= (\cos\beta)^{\alpha} - \frac{\alpha(\alpha-1)}{2\,!}\sin^2\beta(\cos\beta)^{\alpha-2}$$

$$+\frac{\alpha(\alpha-1)(\alpha-2)(\alpha-3)}{4\,!}\sin^4\beta(\cos\beta)^{\alpha-4} - \cdots\cdots$$

$$+ i\left[\alpha\sin\beta(\cos\beta)^{\alpha-1} - \frac{\alpha(\alpha-1)(\alpha-2)}{3\,!}\sin^3\beta(\cos\beta)^{\alpha-3} + \cdots\right].$$

We finally obtain,

$$\cos\alpha\beta = (\cos\beta)^{\alpha} - \frac{\alpha(\alpha-1)}{2\,!}\sin^2\beta(\cos\beta)^{\alpha-2}$$

$$+\frac{\alpha(\alpha-1)(\alpha-2)(\alpha-3)}{4\,!}\sin^4\beta(\cos\beta)^{\alpha-4} - \cdots\cdots$$

$$\sin\alpha\beta = \alpha\sin\beta(\cos\beta)^{\alpha-1} - \frac{\alpha(\alpha-1)(\alpha-2)}{3\,!}\sin^3\beta$$

$$\times(\cos\beta)^{\alpha-3} + \cdots\cdots, \qquad \text{(A-12-6)}$$

comparing real part and imaginary of the left hand side with those of the right hand side, respectively, which is multiplication theorem.

This theorem is applied to frequency modulation expression of,

$$\Psi = \Psi_0\sin(\Omega\sin\omega t)\,t$$

$$= \Psi_0\sin(\sin\omega t)\,\Omega t \qquad \text{(A-12-7)}$$

If we put,

$$\alpha = \sin\omega t, \qquad \beta = \Omega t\ , \qquad \text{(A-12-8)}$$

(A-12-7) leads us to,

$$\sin(\Omega\sin\omega t)\,t = (\sin\omega t)\sin\Omega t\,(\cos\Omega t)^{\sin\omega t-1}$$

$$-\frac{\sin\omega t(\sin\omega t-1)(\sin\omega t-2)}{3\,!}\sin^3\Omega t\,(\cos\Omega t)^{\sin\omega t-3}$$

$$+\cdots\cdots]. \qquad \text{(A-12-9)}$$

Physical Constants associated with the present title

Signal Velocity $c = 2.9979 \times 10^{10}$ cm/sec.

Newtonian Gravitation Constant

$k = 6.670 \times 10^{-8}$ dyn · cm^2/g^2,

Unit Year $Y = 365.242$ days

Mass of the Moon $m = 0.0123$ A.U.

Mass of the Earth $M = 1.00$ A.U. $= 5.977 \times 10^{27}$ gr

Mass of the Sun $M' = 332,958$ A.U. $= 1.991 \times 10^{33}$ gr

Distance between the Earth and the Sun

$l = 1.00$ A.U. $= 1.49600 \times 10^8$ Km

Light Year $l' = 9.46 \times 10^{12}$ Km

Mass of our Galaxy $M'' = 2 \times 10^{11} M'$

Rotation Velocity of our Galaxy at the Solar System $v = 250$ Km/sec.

Mass Density of the Universe (near the Solar System)

$\rho = 1.0 \times 10^{-23}$ gr/cm^3

Stress Energy of Gravitation upon the Surface of the Earth

$$w = -\frac{g^2}{8\pi k} = -5.4 \times 10^{11} \text{ gr}/cm^3$$

Horizontal Component of Geomagnetic Field (at Hamamatsu) $H = 30942\ \gamma$

g-Acceleration

Helsinki	981.9152	cm/sec^2.
Roma	980.3617	〃
Johanesburg	978.5495	〃
Shohwa Base	982.5401	〃

Resistivity of Cupper $\rho = 1.72 \times 10^{-6}\ \Omega \cdot cm$ ($T = 293°K$)

Density of Cupper $\rho = 8.93$ gr/cm^3

Density of Barium Strontium Titanate

$\rho = 6.05$ gr/cm^3

[Unit cell is $(4 A°)^3$.]

Density of Ferroxcube 2 $\rho = 4.4$ gr/cm^3

Coupling Constant of Electron

$$\alpha = -\frac{e}{2mc} = -9.41 \times 10^6 / \text{gauss} \cdot \text{sec}$$

Physical Constants associated with the present title

(Coupling constant of Frenker-Kramers Equation is twice this constant to most of materials.)

Unit Charge $-e = -4.803 \times 10^{-10}$ esu

Mass of Electron $m = 9.1083 \times 10^{-28}$ gr

Mass of Proton $M = 1836m = 1.00759$ amu $= 1.6729 \times 10^{-24}$ gr

Mass of Neutron $M' = 1839m = 1.00898$ amu

Classical Radius of Electron

$$r_0 = \frac{e^2}{mc^2} = 2.818 \times 10^{-13} \text{ cm}$$

Bohr Radius $a_0 = \dfrac{\hbar^2}{me^2} = 5.292 \times 10^{-9}$ cm

Wave Length of Visible Ray

$$\lambda = (3 \sim 7) \times 10^{-5} \text{ cm}$$

Period of Electron in Hydrogen Atom

$$\frac{2\pi\hbar^3}{me^4} = 1.520 \times 10^{-16} \text{ sec.}$$

Period of Other Planets

Mercury	0.2409	year
(Earth	1.0000	year)
Mars	1.8809	year
Saturn	29.350	year
Pluto	250.431	year
(The Tenth Planet $\approx$ 775.0)		
Uranus	84.598	year

(The first 21 years are nights of Winter in Northern Hemisphere, while days of Summer in Southern. The following 21 years are periodically days and nights. The third 21 years are days of Summer in Northern Hemisphere, while nights of Winter in Southern. The last 21 years are also periodically days and nights.)

Planck's Constant

$$\hbar = \frac{h}{2\pi} = 1.054 \times 10^{-27} \text{ ergs} \cdot \text{sec.}$$

Boltzmannean Constant $k = 1.380 \times 10^{-16}$ ergs/degree

Unit Electron Volt $1 \text{ eV} = 1.602 \times 10^{-12}$ erg

$1 \text{ coulomb} = 2.9979 \times 10^{9}$ esu

Physical Constants associated with the present title

Time Reversing Machine (Past Observing Machine) and Geologic Scales

Beginning of Quaternary Period of Cenozoic Era	$t = -10^6$ years
Tertiary Period of Cenozoic Era	$t = -63 \times 10^6$ years
Cretacious Period of Mesozoic Era	$t = -135 \times 10^6$ years
Jurassic Period of Mesozoic Era	$t = -181 \times 10^6$ years
Triassic Period of Mesozoic Era	$t = -230 \times 10^6$ years
Permian Period of Paleozoic Era	$t = -280 \times 10^6$ years
Carboniferous Period of Paleozoic Era	$t = -345 \times 10^6$ years
Devonian Period of Paleozoic Era	$t = -405 \times 10^6$ years
Silurian Period of Paleozoic Era	$t = -425 \times 10^6$ years
Ordovician Period of Paleozoic Era	$t = -500 \times 10^6$ years
Cambrian Period of Paleozoic Era	$t = -600 \times 10^6$ years

(Dreams of Earth vanish far at $t = -600 \times 10^6$ years. Yet time reversing machine owns the possibility in which further past will be searched for.)

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The Principles of Ultra Relativity

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