08/6/3^14

—B WAVE GENETATOR(the principle for design technology)—

Nicola-Tesla(1856~1943) had invented marvelous electrical generator(scalar ϕ wave one or BWG) creating energy from nothing. Author happened to research on creating universe also from nothing. Those are common in following relation.

"0 =+E (available positive matter energy) − E (negative gravity field energy)".

Clasical Electro-Dynamics(CED) has two mode {longitudinal wave ϕ &transversal one $\mathbf{A}$}, the former is analyzed by Quantum Electro-Dynamics(QED). The report introduce the basis of QED for design technology and the fundamental structure of BWG. Now the difficulty in realizing pragmatical power output are summarized as follows.

(1)Dielectirc wave guide(DWG) needs bigger crystal which is higher cost to secure.
(2)Radio frequency energy is troublesome to convert commerecial frequency or DC.
(3)System design has another possibility of good performance ?,
(4)In this critical era, it's quite ridiculous that such marvelous energy technology has been neglecting due to political & military secret affairs?.

☞:Reader is asuumed to be familiar with clasical electro-dynamics(CED) and electronic circut theory.

-THE CONTENTS-

[1]:Overview on "B Wave Generator≡BWG" Creating Electrical Energy from Nothing:

①The historical view:

(1)BWG was first invented by **Nicola-Tesla**(1856~1943)also modern ac current generating system inventer and the fund-raiser of Westing House Co(USA).So he was far from fake,on the contrary,he had been confined due to his greatness[3]. Then note that he was scientist in era of clasical electro-magnetic theory. His way of invetion is not ordinary one !.

(2)Also author-himself had mistaken to consider it fake when he heard at first. Because it seems evidently break **energy conservation low**.However adviser[1][2] was persuading him earnestly,when he was engaged in research on Quantum Gravity Dynamics(QGD) which was to disclose creation process of univers.

(3)Universe is created from "nothing" in such very reasoable process as

0＝＋E(positive material energy)—E(negative gravity field energy).

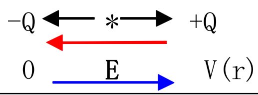
Above equation is officially admitted by international physical society. Astrophysicist Dr Stephen.W.Hawking also mentioned the same in his book[4]. <u>Gravity field is the biggest hearted bank without "repayment"</u>.

②Creating negative field energy by generating attraction force :

(1)Then note that $E=mc^2$ is Einstein relation between **positive energy**=E and mass=m which generate universal gravity field of **negative energy**.

(2)An **attraction force** has negative energy,which could become zero by positive energy input.Not only gravity field,also electric one can have attraction force by separating opposit sign ±charges(**dielectric polarization**).

(a) ＊(nothing)　　　　(b)spontaneous dielectric polarization:



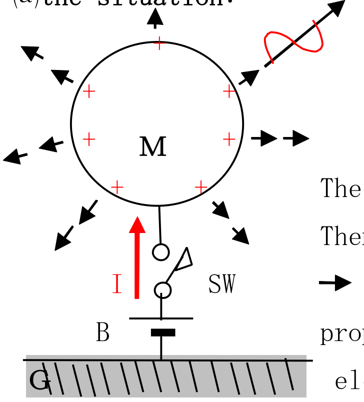
(3)Then charges{-Q,+Q}act as attraction of negative electro-static potential＝voltage $V(r)=-Q^2/4\pi\varepsilon r$ between +Q and -Q(Coulomb low).

(4)<u>After all,BWG is to generate positive and negative energy wave field simuletaneously with substantially nothing energy input</u>.Then very fortunately for us,negative energy never can be detected by reciver antenna,but positive one:$E=mc^2$. Then negative energy is to instantly be converted from electrical one to gravity one by QGD reaction.<u>QED is a derivative component of QGD family</u>.

(5)Also by experiments,such interpretation seems to have gained agreement.

③**Monopole capacitor and the propagation of polarization domino:**

(a)the situation:



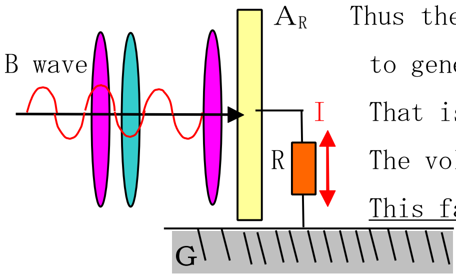
G is earth of voltage=0. B is battery connecting to monopole anttena M through switch SW. M is a sphere of conducting surface. Making SW on causes M equi-voltage of B by flowing charge(current) on M.
The collctive charge is to **induce polarization around M.** Then → means forming dipole (−〜+). Then outer side of → also are induced as →. Thus this induction is to propagate toward outer side of M. This is longitudinal electoro potential wave or charge density one or B wave.
In above situatio, only the positive charge density of paropagation head surface is to propagate with decreasing its intensity as propagate goes on, and following wave are nothing. Therefore accomplishing stationary propagation, DC battery should be exchange to ac gnenerator. <u>B wave has nothing magnetic one</u>.

(b)The propagation is described by QED (and also in clasical one(CED)).

④Monopole anntena M is capacitor consuming nothing energy and also the radiated **B wave** becomes so to say **"a flying ac battery with positive energy"**.

(1)As was mentioned in ③(a), the propagation head surface is charge density ρ, which has positive difeinite field energy density $\rho\phi>0$, where ϕ is the voltage (mesured from the earth V=0) formed by the charge density ρ themselve.

(2)As the consequence, B wave becomes **a flying ac battery with positive energy.**



Thus the **charge density** on the reciver electrode(A_R) is to generate voltage $V=\phi$ between the ground $V=0$. That is, attachment of flying ac battery on A_R. The voltage can generate power to heat up resistor R. <u>This fact was verified by experiments by authorhimself</u>.

☞:Note that the mesurement must be sufficient distance between M and A_R of so called "in wavenized distance", but not "in static one".

(3)From where the energy come ?!. <u>It comes from the biggest hearted Gravity Bank !.</u>
$E=mc^2$ is the famous Einstein's formula on energy and mass. The mass generates gravity field with the negative field energy −E cancelling +E in the universe.

By unifying general guage field theory<R.Utiyama,1956> and the quantization one <L.D.Faddeev-V.N.Popov,1967>had established quantum gravitational field theory (1995), which(QGD) is to disclose the deatils. Because a EM field is mere a derivative of QGD field.

[2]:Quantum Electro-Dynamics(QED) the introduction：

❶Essential difference between QED and CED<more detail is mentioned Appendix-1>.

Almost utilized EM wave in commercial usage such as portable phone is **transversal** electro-magnetic one stimulated by ac currrent **j**(t), which is also called "A wave" due to the equation $\Box \mathbf{A} = -\mu \mathbf{j}$. Then employed theory is CED,

while BWG utilize non-popular **longitudinal** electrical one stimulated by ac charge ρ(t), which is called also "B wave". $\Box \phi = -\rho/\varepsilon$, or $\Box B = (ic)^{-1}\partial_\mu j_\mu$. Both are superficially different, but essentially the same. Then the theory is QED.

CED suppose Lorentz condition (1) with "3" independent components, while QED (3) is with "4" independent components<<u>B is the new field variable</u>>. In CED, induced and polarized charge density ρ^B is not recognized. However, in BWG theory, those induced and polarized charge become "main caster".

(1)**The difference between ρ and ρ^B.**

$0 = \partial_\mu A_\mu = \mathrm{div}\mathbf{A} + \partial_t \phi / c^2$. <Lorentz gauage condition>.

(2) $0 = -\varepsilon\ \partial_t(1) = \varepsilon\,\mathrm{div}(-\partial_t \mathbf{A}) - \varepsilon\ \partial_t^2 \phi / c^2 = \mathrm{div}\mathbf{D}_t - \varepsilon\,\mathrm{divgrad}\,\phi - \rho = \rho^B$.

* $-\partial_t \mathbf{A} = \mathbf{E}_t$ (transversal), $-\mathrm{grad}\,\phi = \mathbf{E}_l$(longitudinal).

*$\mathrm{div}\mathbf{D}_t = \rho$. <physically genuine charge density>

*$-\varepsilon\,\mathrm{divgrad}\,\phi = \mathrm{div}\mathbf{D}_l = \rho^B$. <<u>induced and polarized charge density</u>>.

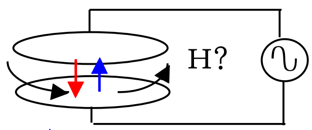
* $-\rho/\varepsilon = \Box \phi \equiv [\mathrm{divgrad} - c^2 \partial_t^2]\phi$.

(3) $(-\alpha/ic) B = \partial_\mu A_\mu$.

(4) $-\varepsilon\ \partial_t(3) = (\alpha\ \varepsilon / ic)\,\partial_t B = \rho^B$. <$\alpha\ \varepsilon = -1$>

(5)**Capacitor never generate mag-field** H, while clasical field equaqtion(5) do.

$\mathrm{curl}\mathbf{H} = \mathbf{j} + \partial_t \mathbf{D}$. (CED) ⟷ $\mathrm{curl}\mathbf{H} = \mathbf{j} + \mathbf{j}^B + \partial_t \mathbf{D}$. (QED)



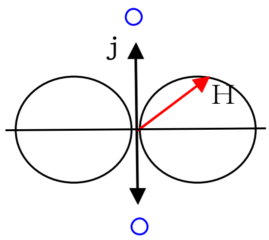
Established text state displacement current $\partial_t \mathbf{D}$ run through insulater in capacitor, if so, they could generate $\mathrm{curl}\mathbf{H} = \partial_t \mathbf{D}$. In capacitor, the actual is cacellation as $0 = \mathbf{j}^B\uparrow + \partial_t \mathbf{D}_l\downarrow$.

Then $\mathbf{j}^B$ is current concerned with ρ^B.

(6)**4 dimensional current conservation low:**

(a)CED：$0 = \partial_t \rho + \mathrm{div}\mathbf{j}_t \equiv \partial_\mu j_\mu$.

(b)QED：$0 = \partial_t(\rho + \rho^B) + \mathrm{div}(\mathbf{j}_t + \mathbf{j}^B_t)$. ⇔ $\Box B = (ic)^{-1}\partial_\mu j_\mu$.



In CED, B =0 due to <$\partial_\mu j_\mu = 0$>. Note that current $\mathbf{j} = \mathrm{curl}\mathbf{H}$ is detected by **H**. Then **H** never could be detected at direction toward(○) where j runs.

It breaks the low $\partial_\mu j_\mu \neq 0$.

❷The fundamental Equation of QED:

QED 4 dim current is $(j_\mu + j^B{}_\mu)$, while that of CED is j_μ only. Therefore QED Maxwell Equation become as follows by replacing $j_\mu \to (j_\mu + j^B{}_\mu)$.

①QED Maxwell Equation of the 1st order :

(1) $\mathrm{curl}\,\mathbf{H} = \mathbf{j} + \mathbf{j}^B + \partial_t \mathbf{D}$.

(2) $\mathrm{curl}\,\mathbf{E}_t = -\partial_t \mathbf{B}$.

(3) $\mathrm{div}\mathbf{D} = \mathrm{div}(\mathbf{D}_t + \mathbf{D}_l) = \rho + \rho^B$.

(4) $\mathrm{div}\mathbf{B} = 0$.

(5) $0 = ic\,\partial_\nu A_\nu + \alpha B$.

(6) $j^B{}_\mu \equiv -ic\,\partial_\mu B$. → $\langle \mathrm{curl}\,\mathbf{j}^B = \mathrm{curl}\,\mathrm{grad}(-icB) = 0 \rangle$.

(7) $\mathbf{B} \equiv \mu \mathbf{H}$.

(8) $\mathbf{D} \equiv \varepsilon \mathbf{E}$. $\langle$or $D_k \equiv [\varepsilon]_{kl} E_l$, tensor equation in non-isotropic medium$\rangle$.

(9) $\mathbf{B} \equiv \mathrm{curl}\,\mathbf{A}$.

(10) $\mathbf{E} \equiv \mathbf{E}_t + \mathbf{E}_l = -\partial_t \mathbf{A} - \mathrm{grad}\,\phi$.

②QED Maxwell Equation of the 2nd order :

(11) $\Box A_\mu = -\mu j_\mu$. $\{$(12) $\Box \phi = -\rho/\varepsilon$; (13) $\Box \mathbf{A} = -\mu \mathbf{j}\}$.

(14) $\Box B = (ic)^{-1} \partial_\mu j_\mu$.

③Deriving **the 2nd order eqns** from the 1st order ones :

(1) $\Box \mathbf{H} = -\mathrm{curl}\,\mathbf{j}$.

(1)→ $\mathrm{curl}\,\mathrm{curl}\,\mathbf{H} = \mathrm{curl}\,\mathbf{j} + \varepsilon\,\partial_t \mathrm{curl}\mathbf{E} = \mathrm{curl}\,\mathbf{j} - \varepsilon\mu\,\partial_t{}^2 \mathbf{H} = \mathrm{grad}\,\mathrm{div}\mathbf{H} - \nabla \mathbf{H}$.

(2) $\Box \mathbf{E}_t = \mu\,\partial_t \mathbf{j}$.

$\mathrm{curl}\,\mathrm{curl}\,\mathbf{E}_t = -\mu\,\partial_t \mathrm{curl}\,\mathbf{H} = -\mu\,\partial_t(\mathbf{j} + \mathbf{j}^B) - \varepsilon\mu\,\partial_t{}^2(\mathbf{E}_t + \mathbf{E}_l) = \mathrm{grad}\,\mathrm{div}\,\mathbf{E}_t - \nabla \mathbf{E}_t$.

$\Box \mathbf{E}_t = \mu\,\partial_t \mathbf{j} + \langle \mu\,\partial_t \mathbf{j}^B + \mathrm{grad}\,\mathrm{div}\,\mathbf{E}_t + \varepsilon\mu\,\partial_t{}^2 \mathbf{E}_l \rangle = \mu\,\partial_t \mathbf{j}$.

(5) $\to 0 = c^2 \varepsilon\mu\,\partial_t \mathrm{grad}\,\partial_\nu A_\nu - ic\mu\,\partial_t \mathrm{grad} B = \langle -c^{-2} \partial_t{}^2 \mathrm{grad}\,\phi - \partial_t \mathrm{grad}\,\mathrm{div}\,\mathbf{A} \rangle + \mu\,\partial_t \mathbf{j}^B$.

$\underline{\mu\,\partial_t \mathbf{j}^B} + \mathrm{grad}\,\mathrm{div}\,\mathbf{E}_t + c^{-2} \partial_t{}^2 \mathbf{E}_l = \underline{(c^{-2} \partial_t{}^2 \mathrm{grad}\,\phi + \partial_t \mathrm{grad}\,\mathrm{div}\,\mathbf{A})} + \mathrm{grad}\,\mathrm{div}\,\mathbf{E}_t + c^{-2} \partial_t{}^2 \mathbf{E}_l = 0$.

(3) $\Box B = (ic)^{-1} \partial_\mu j_\mu$.

(a) : (1)→ $0 = \mathrm{div}\,\mathrm{curl}\,\mathbf{H} = \mathrm{div}(\mathbf{j} + \mathbf{j}^B) + \partial_t(\rho + \rho^B) = -ic\,\partial_\mu{}^2 B + \partial_\mu j_\mu$.

(b) $\mathscr{L}_{CED}(A_\nu, \partial_\mu A_\nu, B; j_\nu)$ <see APPENDIX1:③(7)(c)>

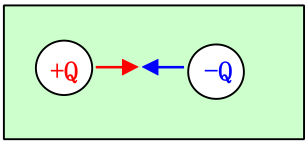
$= \Sigma_{\mu>\nu=0}{}^3 (-1/2\mu)[\partial_\mu A_\nu - \partial_\nu A_\mu]^2 - \Sigma_{\nu=0}{}^3 j_\nu A_\nu + ic\,\partial_\mu A_\mu B + ½\alpha BB$.

$0 = D_E \mathscr{L}_{QED} \to \Box A_\mu = -\mu(j_\mu - ic\,\partial_\mu B) + \partial_\mu \partial_\nu A_\nu \to$

$\Box \partial_\mu A_\mu = (-\alpha/ic)\Box B = (-\alpha/ic)(ic)^{-1} \partial_\mu j_\mu = -\mu\,\partial_\mu j_\mu + ic\mu(1 + \alpha\varepsilon)\Box B$.

→ $\alpha = -1/\varepsilon$, $\Box A_\mu = -\mu j_\mu$. ☞ : α had been undetermined in former QED.

❸Dielectric polarized B field：



Between opposit ±sign chareges called electric **dipole**, there is attraction force genarating **negative energy.**
A negative energy simuletaneously creat avaliable positive one when they created from nothing. Thus you shall know great role of dipole field$\{\phi, B\}$. Then $\{\phi, B\}$ field could be radiated by time dependent charge density $-\rho/\varepsilon=\Box\phi$.

①**Polarlized charge** in **longitudinal** electric field $\mathbf{E}_l=-\mathrm{grad}\,\phi$: $\mathrm{div}\mathbf{D}_l=\rho^B$.

$$\rho^B\equiv-\partial_0 B=(ic/\alpha)\partial_\nu\partial_0 A_\nu=-\varepsilon[c^{-2}\partial_t^2\phi+\partial_t\mathrm{div}\mathbf{A}]$$
$$=\varepsilon[\Box\phi-\mathrm{divgrad}\,\phi-\partial_t\mathrm{div}\mathbf{A}]=-\varepsilon\,\mathrm{divgrad}\,\phi=\mathrm{div}\mathbf{D}_l.$$

A polarlized charge never can be detected as a single one. ⇔ non-observable.

☞:Observability is the kernel for logical construction of Quantum Mechanics(QM).

②**Physical charge** belongs to **transversal** electric field $\mathbf{E}_t=-\partial_t\mathbf{A}$: $\mathrm{div}\mathbf{D}_t=\rho$.

A physical charge can be detected as a single one. ⇔ observable.

③$\mathbf{j}^B=c^2\int^t dt\,\mathrm{grad}\,\rho-\partial_t\mathbf{D}_l$.

(a)In complete **dielectric** medium, $\mathbf{j}^B=-\partial_t\mathbf{D}_l$.

☞:In pure scalar ϕ field, $\mathbf{j}=0=\mathrm{curl}\,\mathbf{H}=\mathbf{j}+\mathbf{j}^B+\partial_t\mathbf{D}=\mathbf{j}^B+\partial_t\mathbf{D}$.

(b)In complete **conductive** medium, $\mathbf{j}^B=c^2\int^t dt\,\mathrm{grad}\,\rho$.

☞These are related also initial current on conductive surface by potential drive. :Note $\mathrm{curl}\,\mathbf{j}^B=0$, although, the motion of $\mathbf{j}^B$ is inductive

"①"→ $-\partial_0 B=-\varepsilon\,\mathrm{divgrad}\,\phi$.

→$B=ic\varepsilon\int^t dt[\Box\phi+c^{-2}\partial_t^2\phi]=-ic\int^t dt\,\rho+i\varepsilon c^{-1}\partial_t\phi$.

→$\mathbf{j}^B\equiv-ic\,\mathrm{grad}\,B=c^2\int^t dt\,\mathrm{grad}\,\rho+\varepsilon\partial_t\mathrm{grad}\,\phi=c^2\int^t dt\,\mathrm{grad}\,\rho-\partial_t\mathbf{D}_l$.

❹Energy Equation in BWG <The Hamiltonian Formulation>:

①**As for the incompleteness of nothing field(vaccume and dielectirc medium) :**

In this section ,we disucuss such phenomena as 0*=+a−a. Then we could not help to encouter something contradictional(incompleteness). This might cause you something doubt on this theory. The following may be help for you.

(1)The incompleteness of real number zero≡0*.

N≡{1, 2, 3, . . , N, . . , M≡∞} is wellknown natural number set. Then you never could tell the maximum number≡M of N. It is called infinity≡∞. Then cosider series, Z≡{1, 1/2, 1/3, . . , 1/N, . . , 1/M≡1/∞=0*}. The minimum value is real number 0*. It is nothing. However it must be also indefinite due to M's indefiniteness. Hence it is contradictional due to nothing's definiteness and indefiniteness of M.

In 1931, Kurt Goedel had fortold as **the incompleteness theorem.**
"In any non-contradictional theory K cotaining natural number theory N is incomplete". That is, certain non-contradictional propostion X of K can not determine its turuth value in the closed theory of K. The actual aspect of X is generally **statistical phenomena** caused by **information lack** due to singularity(non-regularity). For example, QFT is probability theory due to mathematical singularity of reaction as $\mathcal{H}=e\bar{\phi}(x)\gamma^{\mu}A_{\mu}(x)\phi(x)$.
The product of field operator(hyper fuction) is mathematically non-regular.

(2)The contradictional nature of physicall vaccume field:

In Quantum Field Theory(QFT), **vaccume polarization reaction**(VP) has been officially admitted its validity both by theoretically and experimetally.
VP is creation of dipole as particle(+a) and anti-particle(-a) from nothing and the anihilation into nothing. Creation from nothing is evidently breaking down causalitical low in logic. It is contradiction, however, QFT the theoretical system itself never be contradictional due to VP's zero probability. That is, VP never be observable with finite probability. The fact is quite similar to non-observability of single charge in dielectiric dipole field.

(3)Also **dielectric polarization**(DP) in non-charged medium is analougous to VP, therefore, it is not curious that physics of DP has something incompelteness.

(4)As the fact, you will encounter certain kind of incompleteness in determining of Hamiltonian in QED scalar field. However it could be made reasonable to experimantal fact.

②**Reconsideration on CED Lagrangean :**

Our most concern is EM field energy density, which is represented by Hamiltonian derived from Lagrangean in canonical formulation.

(1)<see APPENDIX1:③(4)**CED Lagrangean density :** >

$\mathscr{L}_{CED}(A_\nu, \partial_\mu A_\nu; j_\nu) = \Sigma_{\mu>\nu=0}{}^3 (-1/2\mu)[\partial_\mu A_\nu - \partial_\nu A_\mu]^2 + \Sigma_{\nu=0}{}^3 j_\nu A_\nu$.

(2)canonical momentum variable :

$P_0 = 0$ in CED.

$P_k = (ic)^{-1}\partial\mathscr{L}/\partial(\partial_0 A_k) = (i/c\mu)[\partial_0 A_k - \partial_k A_0] = (1/c^2\mu)[\partial_t A_k + \partial_k \phi] = -D_k$.

(3)**The unfamiliar term in clasical Hamiltonian density :**

$\mathscr{H}_{CED} \equiv \Sigma_{\nu=0}{}^3 P_\nu \partial_t A_\nu - \mathscr{L}(A_\nu, \partial_\mu A_\nu; j_\nu) = \mathbf{E}_t\mathbf{D} - ½(\mathbf{E}\mathbf{D} - \mathbf{H}\mathbf{B}) - j_\nu A_\nu$

$= ½(\mathbf{E}\mathbf{D} + \mathbf{H}\mathbf{B}) - j_\nu A_\nu - \mathbf{E}_l\mathbf{D} = ½(\mathbf{E}\mathbf{D} + \mathbf{H}\mathbf{B}) - \mathbf{j}\mathbf{A} + \rho\phi - \mathbf{E}_l\mathbf{D}$.

We must ditinctly discriminate $\mathbf{E} \equiv \mathbf{E}_t + \mathbf{E}_l = -\partial_t \mathbf{A} - \mathrm{grad}\,\phi$. <[2]①❷⑽>, then the unfamiliar term $-\mathbf{E}_l\mathbf{D}$ become indispensable in the later.

③**QED Hamiltonian the representation of field energy density :**

(1)**QED Lagrangean:**<see APPENDIX1:③(7)(c)>.

The Hamiltonina difficulty is found in QED.

—QED Lagrangean—

$\mathscr{L}_{CED}(A_\nu, \partial_\mu A_\nu, B; j_\nu)$

$= \Sigma_{\mu>\nu=0}{}^3 (-1/2\mu)[\partial_\mu A_\nu - \partial_\nu A_\mu]^2 + \Sigma_{\nu=0}{}^3 j_\nu A_\nu + ic\,\partial_\mu A_\mu B + ½\alpha BB$.

(a)Necessity of term $½\alpha BB$ become evident by taking variation of $\{B\}$, which yields field equation $0 = ic\,\partial_\mu A_\mu + \alpha B$. If $\alpha = 0$, then $0 = \partial_\mu A_\mu$ is Lorentz condition of freedom degree 3 while QED must be 4.

(b)Definiteness of gauge constant $\alpha = -1/\varepsilon$.

In former QED theory, α had incorrectly been considered arbitary constant.

(c)The justice of (1) is not being proof, but their rational results. Above formulation had been generalized & gotten success also in **general gauge field theory.**

(2)canonical momentum variable :

$P_\nu \equiv \partial\mathscr{L}/\partial(\partial_t A_\nu) = (ic)^{-1}\partial\mathscr{L}/\partial(\partial_0 A_\nu)$.

$P_0 = B$.

$P_k = (i/c\mu)[\partial_0 A_k - \partial_k A_0] = (1/c^2\mu)[\partial_t A_k + \partial_k\phi] = -D_k$.

(3)Hamiltonian Density Ⅰ<Complete Canonical Formulation>:

$\mathscr{H} \equiv \Sigma_{\nu=0}{}^3 P_\nu\,\partial_t A_\nu - \mathscr{L}_{CED}(A_\nu, \partial_\mu A_\nu, B; j_\nu)$.

$= icB\,\partial_0 A_0 + \mathbf{E}_t\mathbf{D} - ½(\mathbf{E}\mathbf{D} - \mathbf{H}\mathbf{B}) - j_\nu A_\nu - icB\,\partial_\mu A_\mu - ½\alpha BB$.

$= -½\alpha BB + ½(\mathbf{E}\mathbf{D} + \mathbf{H}\mathbf{B}) - j_\nu A_\nu - (\mathbf{E}_l\mathbf{D} + icB\,\mathrm{div}\mathbf{A})$

$= -½\alpha BB + ½(\mathbf{E}\mathbf{D} + \mathbf{H}\mathbf{B}) - j_\nu A_\nu - \mathbf{E}_l\mathbf{D} - j^B\mathbf{A}$

$= -½\alpha BB + ½(\mathbf{E}\mathbf{D} + \mathbf{H}\mathbf{B}) - (j + j^B)\mathbf{A} - \mathbf{E}_l\mathbf{D}$.

☞: $∭dx^3\, icB\,\mathrm{div}\mathbf{A} = ∭dx^3\{\mathrm{div}[icB\mathbf{A}] - (ic\,\mathrm{grad}B)\mathbf{A} = ∭dx^3\{j^B\mathbf{A}\}$.

☞: $∭dx^3\,\mathrm{div}[icB\mathbf{A}] = ∯dS\cdot\{icB\mathbf{A}] = 0$. (S=boundary at infinity)

$-\mathbf{E}_l\mathbf{D}$ is not indispensable, of which role shall be seen in pure scalar field. It is curious that scalar interaction $(\rho + \rho^B)\phi$ is lost. As those have been such way, we could not help consider that the canonical formulation itself may not be allmighty.

(4)Hamiltonian Density Ⅱ<Semi-experimental Formulation>:

$\mathscr{H}_{CED} \equiv -½\alpha BB + ½(\mathbf{E}\mathbf{D} + \mathbf{H}\mathbf{B}) - (j + j^B)\mathbf{A} + (\rho + \rho^B)\phi - \mathbf{E}_l\mathbf{D}$.

″Author reccomend above formulation owing to semi-experimental reason″. After all, the experiment supported it. The scalar interaction $(\rho + \rho^B)\phi$ is indispensable !.

Canonical quntization itself never can determine mutual interaction between charge(ϕ) and EM field(A_μ), which is soley the task of **gauge principle** as decision on $\mathscr{H}_I = gc\hbar\bar{\phi}\gamma^\mu A_\mu\phi = \rho\phi - j\mathbf{A}$.

(5)Note that transversal $½\mathbf{E}_t\mathbf{D}_t$ is positive, while longitudinal $½\mathbf{E}_l\mathbf{D}_l$ should be negative caused by attraction force in dielectric field. The latter needs the unfamiliar term $-\mathbf{E}_l\mathbf{D}$. In longitudinal scalar field shall realize as follows,

$\{½(\mathbf{E}\mathbf{D} + \mathbf{H}\mathbf{B}) - \mathbf{E}_l\mathbf{D}\} \rightarrow -½\mathbf{E}_l\mathbf{D}_l$.

[3]:{B, ϕ} Wave Propagation in Pure Scalar Field:

❶Pure Scalar Field:

①Pure Scalar Field Hamiltonian debsity≡$\mathscr{H}_S$:

Pure scalar field is defined nothing transversal components{0= ρ =**j**=**A**=**H**}.

Then $\mathscr{H}_{QED}$ becomes $\mathscr{H}_S$ of scalar field.

$$\mathscr{H}_{CED}=-½\alpha BB+½(\mathbf{E}\mathbf{D}+\mathbf{H}B)-(\mathbf{j}+\mathbf{j}^B)\mathbf{A}+(\rho+\rho^B)\phi-\mathbf{E}_1\mathbf{D}.$$

(1) $B=ic\varepsilon\,\partial_0 A_0=(i\varepsilon/c)\partial_t\phi=-\varepsilon\,\partial_0\phi$. ← {0=**A**, $ic\partial_\nu A_\nu+\alpha B=0$}. <[2]❷①(5)>

Thus B become evident to be time derivative of scalar field ϕ. Then note that B satisfies $\Box B=(ic)^{-1}\partial_\mu j_\mu=\partial_0\rho$. This equation needs more discussion.

(2)Pure Scalar Field Hamiltonian≡$\mathscr{H}_S$:
$\mathscr{H}_S=-½\alpha BB+½\mathbf{E}\mathbf{D}+\rho^B\phi-\mathbf{E}_1\mathbf{D}_1$
$\quad=-(\varepsilon/2c^2)(\partial_t\phi)^2-½\mathbf{E}_1\mathbf{D}_1+\rho^B\phi$.

(3)Pure Scalar Field Lagrangean density≡$\mathscr{L}_S$:

$\mathscr{L}_{QED}(A_\nu,\partial_\mu A_\nu,B;j_\nu)$

$$=\Sigma_{\mu>\nu=0}{}^3(-1/2\mu)[\partial_\mu A_\nu-\partial_\nu A_\mu]^2+\Sigma_{\nu=0}{}^3 j_\nu A_\nu+ic\partial_\mu A_\mu B+½\alpha BB.$$

↓

$$\mathscr{L}_S=(-1/2\mu)[\partial_k A_0]^2+ic\partial_0 A_0 B+½\alpha BB=-(1/2\mu)[\partial_\mu A_0]^2=½\varepsilon\,\partial_\mu\phi\,\partial_\mu\phi.$$

↓

(4)Euler Equation : $0=D_E\mathscr{L}_S$.

$$0=-\partial_\mu[-(1/2\mu)\partial_\mu A_0\partial_\mu A_0]=\mu^{-1}\Box A_0.$$

(5) $P_0=(ic)^{-1}\partial\mathscr{L}/\partial(\partial_0 A_\mu)=-(ic)^{-1}\varepsilon c^2\partial_0 A_0=B$.

$$\mathscr{H}_S{}^*\equiv\partial_t A_0 B-\mathscr{L}_S=\partial_t A_0 B-½\varepsilon\,\partial_\mu\phi\,\partial_\mu\phi=\varepsilon\,\partial_0\phi\,\partial_0\phi-½\varepsilon\,\partial_\mu\phi\,\partial_\mu\phi$$

$$=½\varepsilon\,\partial_0\phi\,\partial_0\phi-½\varepsilon\,\partial_k\phi\,\partial_k\phi.$$ <☞:<u>$\rho^B\phi$ is lost in $\mathscr{H}_S{}^*$</u>>

(6)Lagrangean yielding $\Box A_0=-\mu j_0$. ⇔ $\Box\phi=-\rho/\varepsilon$.

$$\mathscr{L}_S{}^\#\equiv½\varepsilon\,\partial_\mu\phi\,\partial_\mu\rho-\rho\,\phi.\ \rightarrow\ 0=D_E\mathscr{L}_S=-\rho-\partial_\mu[½\varepsilon\,\partial_\mu\phi\,\partial_\mu\phi]=-\rho-\varepsilon\Box\phi.$$

↓

$$\mathscr{H}_S{}^\#=-(\varepsilon/2c^2)(\partial_t\phi)^2-½\mathbf{E}_1\mathbf{D}_1+\rho\,\phi.$$

☞:As has been seen, the QED scalar field is not reversible between Hamiltonian and Lagragean in canonical formulation. Certainly it is rather incovinient.

❷Energy Conservation in {B, ϕ} Longitudinal Wave Propagation :

①The Validity in Scalar Field :

(1)$\mathcal{H}_S = -\frac{1}{2}\alpha BB + \frac{1}{2}ED + \rho^B\phi - E_1D_1$

$= -(\varepsilon/2c^2)(\partial_t\phi)^2 - \frac{1}{2}E_1D_1 + \rho^B\phi$.

(2) $\rho^B\phi = -\varepsilon\ \phi\,\mathrm{div}\,\mathrm{grad}\,\phi = -\varepsilon\,\mathrm{div}(\phi\,\mathrm{grad}\,\phi) + \varepsilon\,(\mathrm{grad}\,\phi\,\mathrm{grad}\,\phi)$

$= \mathrm{div}(-\varepsilon\ \phi\,\mathrm{grad}\,\phi) + E_1D_1 = E_1D_1 > 0$.

☞:$\mathrm{div}(-\varepsilon\ \phi\,\mathrm{grad}\,\phi)$ can be vanished by surface integral.

(3)$(\varepsilon/2c^2)(\partial_t\phi)^2 = \frac{1}{2}E_1D_1 = \frac{1}{2}\varepsilon\,(\mathrm{grad}\,\phi\,\mathrm{grad}\,\phi)$.

(a)proof in plan wave:

Supposing $\phi \equiv \phi_0\exp i(\omega t - \mathbf{kx})$ yields $\mathrm{grad}\,\phi = i\mathbf{k}\phi$,

$(\mathrm{grad}\,\phi\,\mathrm{grad}\,\phi) = -\mathbf{k}^2\phi^2$

$(1/c^2)(\partial_t\phi)^2 = -(\omega/c)^2\phi^2$. Then $\mathbf{k}^2 = (\omega/c)^2$. Hence we derive (3).

(b)Therefore $\mathcal{H}_S = -(\varepsilon/2c^2)(\partial_t\phi)^2 - \frac{1}{2}E_1D_1 + \rho^B\phi = 0$.

—Energy conservation low in {B, ϕ} Longitudinal Wave Propagation—

$\mathcal{H}_S = \{-(\varepsilon/2c^2)(\partial_t\phi)^2 - \frac{1}{2}E_1D_1\} + \{\rho^B\phi\} = 0$.

$0 = -\mathbf{E} \qquad + \mathbf{E}$.

Negative energy density of attraction force generated in dielectric dipole field.	positive energy density generated by accumulating same charge in same points.

②Thus {B, ϕ} propagate with nothing energy.

(1)They are faithfully called **dipole gohst** in decent physics.

Hence its radiation from stimulating source needs also nothing energy.

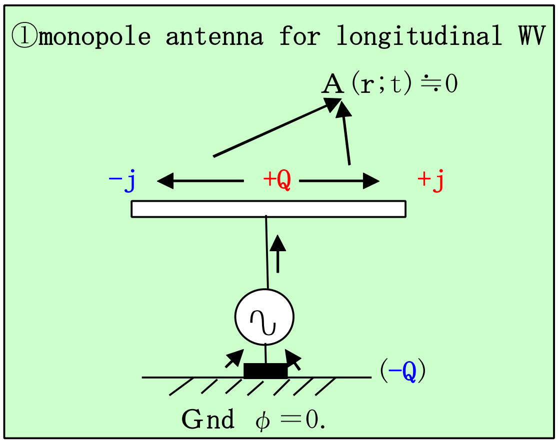
{B, ϕ} wave radiated(and recieved) by charge particle in **neuron cells** is deeply connected with so called tele-pathy in para-normal phenomena.

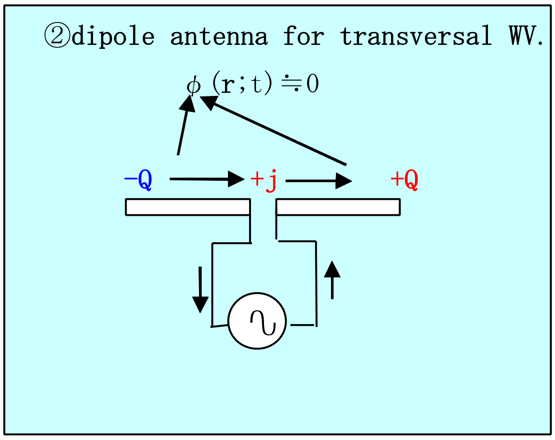
(2)Cat fish **can detect precedent underground current stimulated by earthquake kernel source. They are** "high sensitive foreteller" on earthquake:

Then the current is not necessary {B, ϕ},but normal one. They have electrically high sensitive organ called "side line neuron(?)" in their body. Then the source is a spot of ultr high pressure generating high voltage charge by **piezo effect**. Then note that, as the reversible process, charge density wave of {B, ϕ}has possibility of becoming **earthquake weapon** by effecting piezo stones in underground.

❸Monopole Antenna Rradiating {B, ϕ} Wave with Nothing Energy Consumption :

②Transversal A wave consumes electrical power(energy) for the radiation by dipole antenna(Z_{in}=resisitive),①while,as the principle,**longitudinal B wave consumes nothing energy for the radiation by monopole antenna(Z_{in}=reactive).**





③View from retarted potential solution : <☞:t' =t-|r−r' |/c>

<[2]❷②>⑿ $\Box\phi=-\rho/\varepsilon. \to \phi(\mathbf{r};t)=\iiint d\mathbf{r}^3 \rho(\mathbf{r}';t')/4\pi\varepsilon|\mathbf{r}-\mathbf{r}'|.$ ····(1)

<[2]❷②>⒀ $\Box\mathbf{A}=-\mu \mathbf{j}. \to \mathbf{A}(\mathbf{r};t)=\mu\iiint d\mathbf{r}^3 \mathbf{j}(\mathbf{r}';t')/4\varepsilon|\mathbf{r}-\mathbf{r}'|.$ ····(2)

On **monopole antenna**①,the currents are opposit sign of $\pm\mathbf{j}$,so they are cancellated with each other in the integral $\mathbf{A}$ of (2) at sufficiently far point from source.Hence it never radiate positive energy pointing flus $\mathbf{P}=\mathbf{E}\times\mathbf{H}$,
,$0=\oint dS\cdot[\mathbf{E}\times\mathbf{H}]$,
which is the reflection of **nothing energy consumption.** Then input impedance Z_{in} = reactive(substantially **capacitive**).In the other hand,on dipole antenna,the charges are opposit sign of ±Q,so they are cancellated with each other in the integral ϕ of (1) at sufficiently far point from source.Hence it never radiate ϕ at far point.Dipole antenna has resisitive input impedance reflecting positive energy consumption.

④Problem of common earthing(zero potentil $\phi=0$) in monopole radiation :

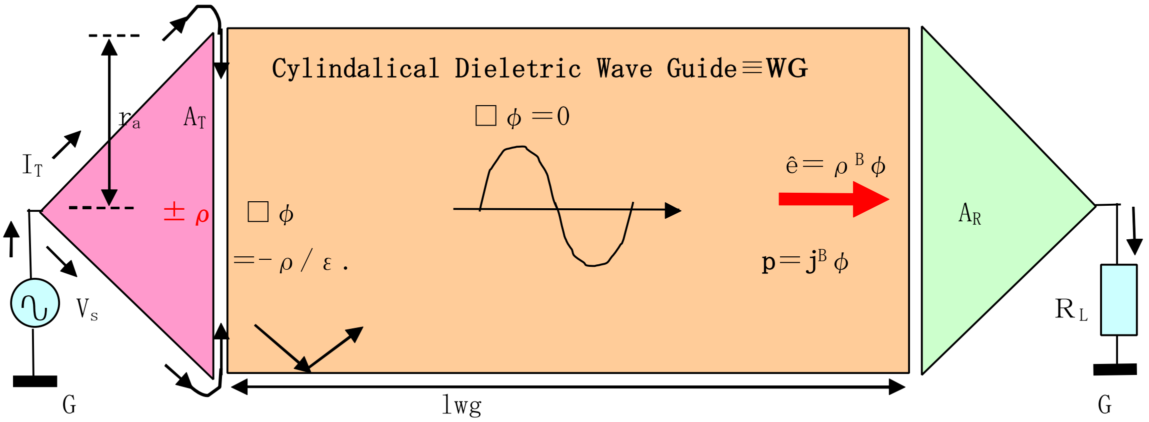
(1)As is seen in ②,dipole antenna does not need earthing(zero potentil $\phi=0$), while,in monopole radiation,securing zero potentil $\phi=0$ is essential.

(2)**Ideal earthing by infinitive capacitor:**

C=Q/V. ⇔ V=Q/C.

By any amount flow of charge Q,C=infinitive capacitance could secure stable zero voltage V=0.However its realization is impossible<see[4]>.

❹Dielectrical Longitudinal Wave Guide Characteristic Parameters :



①Overview on the Propagation of Longitudinal Plane Wave of ϕ with available positive energy density $ê = j^B ϕ$:

(1)V_s is high frequency potential soruce supplying A_T charging current I_T and the current forms charge distribution ±ρ on the disc surface of A_T.

(2)A_T is disc(radius r_a) monopole antenna radiating ϕ by $□ϕ = -ρ/ε$.

<The discone $A_T(A_R)$ is also current feeding surface. This shape is not good>.

Input impedance of ideal A_T is pure capacitive of nothing energy consumption.

(3)**WG** is Cylindalical Dieletric Wave Guide for realizing **ϕ plane wave** by its reflection side wall. WG also act to shield ϕ plane wave in it.

(4)Wave propagation velocity≡$c = \sqrt{(1/εμ)}$, wave shorten rate $ξ = \sqrt{(ε_0/ε)}$.

Example1) $ε_r$(H_2O, room temperature)≒80, ξ=0.11, f=200Mhz, λ=16.5cm

(5)Propagated wave become **charge density one** with +energy density $ê = ρ^B ϕ$.

BWG is so to say a **flying ac battery**(charge density wave), therefore, electrical contacting with charge density by reciever antenna A_R is to generate voltage between zero potential.

(6)Propagated ϕ is finally captured by A_R, which out put power P_0 into R_L.

The negative field energy could not be detected by anyhow, so it is nothing harmful and become non-localized gravity field of negative energy at last.

(7)Then cylinder length l_{wg} must secure at least few time of wave length=λ.

Insufficient l_{wg} would make **capacitive coupling** between A_T and A_R.
L_{wg} must be sufficient long for realizing **wave-nization length.**

②**Dielectrical Longitudinal Wave Guide Characteristic Parameters :**

(1)Assumption of one demensional plane wave propagation:

$\phi \equiv \phi_0 \exp i(\omega t - kx)$. ⇔ $\Box \phi = 0$.

(2)Longitudinal Electric Flux: $D = -\varepsilon \,\mathrm{grad}\,\phi = ik\varepsilon\phi$.

(3)B field charge density{ρ^B}: $\rho^B = \mathrm{div} D = k^2 \varepsilon \phi$.

(4)Field electrical power(energy) density $\hat{e} = \rho^B \phi$:

$\hat{e} = \rho^B \phi^* = k^2 \varepsilon \phi \phi^* = k^2 \varepsilon |\phi_0|^2$. ☞: ρ^B and ϕ have the same phase.

(5)B field current density {j^B}: ☞: j^B and ϕ have the same phase.

$j^B = -\partial_t D = \omega k \varepsilon \phi$.

(6) $I^B \equiv$ WG cross section total current $= \oint dS j^B = \pi r_a^2 \omega k \varepsilon \phi$.

(7)**Charasteristic impedance of WG $Z_c \equiv \phi / I^B$.**

$Z_c \equiv \phi / I^B = 1/\pi r_a^2 \omega k \varepsilon$.

Z_c is essential factor to gain **maximum output power** and to realized **minimum input power** for WG(**impedance matching**).Therefore Z_c becomes test for the validity of QED theory for BWG. We actually employed it.

(8)**Ideal Output Power≡P_0:** <MKSA unit>

(a)$P_0 = \phi^* I^B = \pi r_a^2 \omega k \varepsilon |\phi_0|^2 = S_a (\omega^2/c) \varepsilon |\phi_0|^2 = \pi r_a^2 (2\pi f)^2 |\phi_0|^2 \varepsilon_r^{3/2} (\varepsilon_0/c_0)$.

$= |\phi_0|^2 / Z_c$.

(b) $Z_c = 1/\pi r_a^2 \omega k \varepsilon = 1/\pi r_a^2 (2\pi f)^2 \varepsilon_r^{3/2} (\varepsilon_0/c_0)$.

(c) $S_a = \pi r_a^2$.

(d)$c = c_0/\sqrt{\varepsilon_r}$.

(e) $\omega = 2\pi f$. (f)$k = \omega/c$. $(\varepsilon_0/c_0) = 2.95\mathrm{X}10^{-20}$.

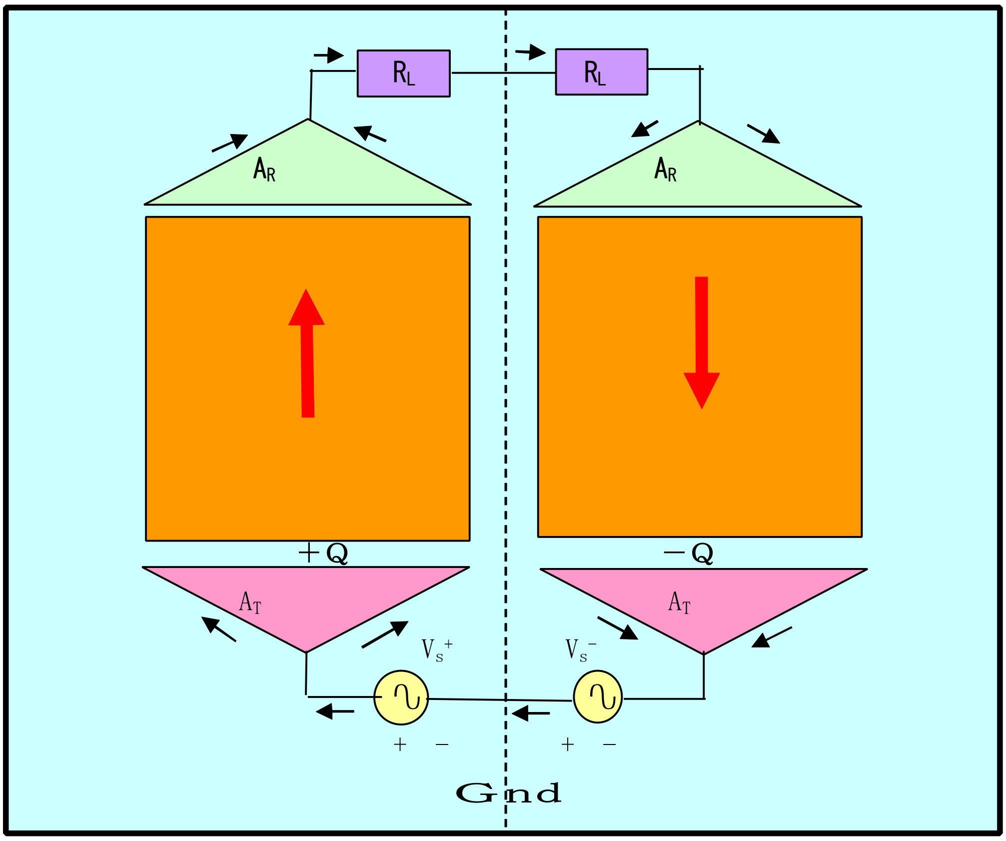
Example 2) ☞: $(2\pi f)^2 = 1/S_a Z_c \varepsilon_r^{3/2} (\varepsilon_0/c_0)$.

ε_r(material)	Z_c	S_a	$\lambda_0/\sqrt{\varepsilon}$	f	$\lvert\phi_0\rvert$	P_0
80(H_2O, RT)*author	6.0Ω	0.005m^2	0.167m	200Mhz	2.5v	1.W
	1.0				10v	100W
170(TiO_2, T=25'C)	1.25	0.0013m^2	0.046m	500Mhz	25	500W
2000($BaTiO_3$, T=120'C)	5.0	0.00077m^2	0.088m	50Mhz	50v	500W
11.7(Si)	0.31	0.0008m^2	0.089m	2.94Ghz	12.5v	500W

☞:These are entirely ideal output power without any loss energy.The some detail shall be mentioned in the later.

[4]:Pragmatical Implementation(Double Balanced Earthing System≡DBE):

❶Double Balanced Earthing System≡DBE:



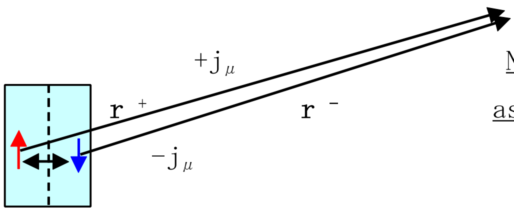
①Above figure is **Double Balanced Earthing BWG system** with the electro-magnetic field ± symmentry for center dot line(GND).

②The symmetry could realize **automatic earthing** at the center line.

③$\{V_s^+ ; V_s^-\}$must be opposit phase with same amplitde.

④Right and left circuit configuration also must be symmetric.

⑤The symmetry could accomplish also **automatic shielding** for harmful exterior oriented leakage of EM field. The principle is caused by that each symmetric configuration of $\{\pm j_\mu\}$ is to cancell with each other in potential integral at sufficeint far distance.



$*A(\mathbf{r};t)=\mu\iiint d\mathbf{r}^3 j_\mu(\mathbf{r}^\pm;t')/4\pi\varepsilon|\mathbf{r}-\mathbf{r}^\pm|$.

Note there is some incompleteness as for certain{position and direction}.

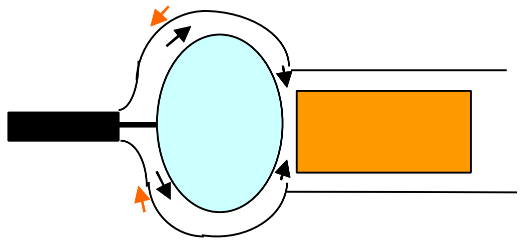
⑥Sky blue box is conceptual EM shielding one.

❷Design Problem on Monopole Antenna with Current Feader Circuit:

☞:This time report is far from satisfaction on its completeness. So author wish to rewrite the matters abribated here before long. For the time being, at first, the main principle and the overview shall be mentioned briefly. Now, author has many unsolved problems for pragmatical realization.

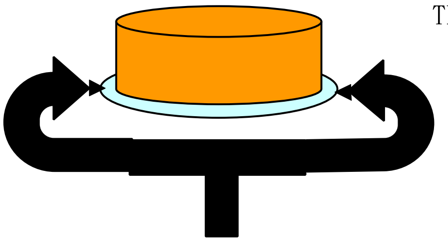
①Another method such as **spherical wave propagation** also may be possible, though it seemed not good. In order to form **plane wave**, chargeable antenna surface of finite area is necessary, then charging current must be diffused on the surface by feeder circuit. Then there may be many possibility of the realization. Though feeding on monopole anntena does not allow **explicit closed circuit**, because aim of current feeding is to stopp current at monopole antenna surface to make charge density. The fact made design rather difficult.

②**Spherical surface feeder with exterior shielding cover:**



A high frequency current dislike abrupt curvature surface.

③**Pararell cable feeder method.**



Then how to "terminate exterior shield line ?".

④**Shielding on whole system by conducting closed box.**

Naked feeding such as figure [3]❹ causes more input(&output) power loss by exterior oriented radiation from feeding circut. For realizing transmission line of feeding circuit, it may be better to make shielding on whole system by closed box such as figure [4]❶.

⑤Impedance matching is always indispensable in high frequency circuit design, then it is desirable that circuit parameters have been previously known.

❸How to convert high frequency big power into commercial one ? :
A high frequency(RF) EM field energy is rather troublesome for commercial usage. Solid state device is weak for RF power.The answer may be heat energy for steam turbine same as atomic power generator.Then you had better imagine small steam locomotive operated by ape in amusement park.

[5]:As for dielectic material problem:

(1)Author also has been engaged in experimental survey on BWG.Conclusionally to tell,<u>the result is scarcely said to satisfy critical condition</u>.That is,ouput power is scarcely over input power in order of less than 1W(2004/1/1). The detail shall be reported in next time.Frankly to tell,<u>he wish acutal demonstration with reexaminers in appropriate enviroment</u>.

(2)He acutually used **H_2O**($\varepsilon_r \fallingdotseq 80$, $Q \equiv 1/\omega cr \equiv 1/\tan\delta = 2 \sim 3$ at f=200MHz) for directric wave guide in plastic pipe.
(a)H_2O is non favourable for its quality factor as Q=2〜3 at f=200MHz,that is ,large resisitive loss of capacitor performance in input impedance.
(b)Above all,its plane wave transfer perfomance is bitter.It's almost attenuator. According to an expert,actual water is composed from **clusters** of morecule such as grape,which act as random oriented tiny crystal.As the consequence, ε_r is no more scalar,but is tensor acting for <u>random wave scattering</u>.Hence it may become attenuator in plane wave transfer characteristic.
(c)Author is weak for knowledge(and money fund)on solid state physics.As for dielectric material problem,he has no sufficient information and assists.

(2)If dielectric material must be crystal of uniform scalar ε_r, it is almost **jewel** of ultra high cost,at least in now era.

According to ferro-dielectric material experts,they could make dielectiric crystal,however it is too tiny fragment for experimental usage.For realizing dielectric Wave Guide pipe,it needs certain large scale of crystal.

[6]:As for the problem making international R & D team uion:

By political,economical,and technical reason,author wish not only domestic supporters,also international ones.

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*⑷～⒁ data are standard physics,but they are not that all is complete.

⒂private conversations on directric materials with few scientists,200?.

-ACKNOELEDGEMENT:

In reserch history of BWG,both **"devotion and deception"** has been struggling with each other by many the concerned.Author had been fortunately infulenced by both international engineer groupe and physicists one.If both of them had not been,this report never could be.Though it is now incomplete,but may be co-operation results of people in this planet.As was so,he never have experienced such bitter work than that of this time.

APPENDIXØ :

-Symbol Convention-

<$i\equiv\sqrt{-1}$, Greek: μ , $_{\mu}$, ν , $_{\nu}$=0,1,2,3 ; Latain:k,l=1,2,3(space index)>.

$x_{\mu}\equiv(x_0=ict, x_1, x_2, x_3)\equiv(x_0, \mathbf{x})\equiv(x_0, x_k)$.

$A_{\mu}\equiv(A_0=i\phi/c, A_1, A_2, A)\equiv(A_0, \mathbf{A})\equiv(A_0, A_k)$.

$j_{\mu}\equiv(j_0=ic\rho, j_1, j_2, j_3)\equiv(j_0, \mathbf{j})\equiv(j_0, j_k)$.

$\partial_{\mu}\equiv\partial/\partial x_{\mu}$; $\partial_{x}\equiv\partial/\partial x$; $\partial_{t}\equiv\partial/\partial t$; $\partial_{t}^{2}\equiv(\partial/\partial t)^{2}$.

$\partial_{k}^{2}\equiv\partial_{k}\partial_{k}\equiv\Sigma_{k=1}^{3}\partial_{k}^{2}\equiv\Sigma_{k=1}^{3}(\partial/\partial x_k)^{2}$. <sumation on double index" k">

$\Box\equiv\Sigma_{\mu=0}^{3}\partial_{\mu}\partial_{\mu}\equiv\partial_{\mu}\partial_{\mu}\equiv-c^{-2}\partial_{t}^{2}+\mathrm{divgrad}\equiv-c^{-2}\partial_{t}^{2}+\triangle$.

$\mathbf{r}\equiv(x_1, x_2, x_3)$.

$\oiiint dx_1dx_2dx_3\equiv\oiiint dx^3\equiv\oiiint d\mathbf{r}^3$.

<$c=1/\sqrt{(\varepsilon\mu)}$≡velocity of light, ε≡permittivity, μ≡permeability>

vaccume constant : $\varepsilon_0=8.85X10^{-12}$F/m; $\mu_0=4X10^{-7}$H/m. $c_0=2.998X10^{8}$m/s

—useful vector analysis formula—

(1) $\mathrm{grad}(\chi\phi)=\phi\,\mathrm{grad}\chi+\chi\,\mathrm{grad}\phi$.

(2) $\mathrm{div}(\phi\mathbf{A})=\mathbf{A}\mathrm{grad}\phi+\phi\,\mathrm{div}\mathbf{A}$.

(3) $\mathrm{curlcurl}\mathbf{A}=\mathrm{graddiv}\mathbf{A}-\nabla^2\mathbf{A}$.

(4) $\oiint d\mathbf{S}\cdot\mathrm{curl}\mathbf{A}=\oint d\mathbf{l}\cdot\mathbf{A}$.

(5) $\oiiint dv\cdot\mathrm{div}\mathbf{A}=\oiint d\mathbf{S}\cdot\mathbf{A}$.

(6) $\oiiint dv\cdot\mathrm{curl}\mathbf{A}=\oiint d\mathbf{S}\times\mathbf{A}$.

(7) $\oiiint dv\cdot\mathrm{grad}\phi=\oiint d\mathbf{S}\cdot\phi$.

(8) $\mathrm{curlgrad}\phi=0$.

(9) $\mathrm{divcurl}\mathbf{A}=0$.

APPENDIX1:Clasical Electro-Dynamics(CED) as Lagrangean and Canonical formulation.

①Variation Principle for Lagrange Function.

People would act to gain maximum benefit with minimum expenditure. A realizaion of extremum value action seems universal in every aspect of nature. Then clasical dynamics of generalized cooridinate $\{q_1, q_2, .., q_j, .., q_N\}$ system is described by variation principle. $\delta q_j(t) \equiv q'_j(t) - q_j(t)$ is arbiraty infinitesimal variation of orbit. The the principle demand time integral variation of L must be zero.

$$0 \equiv \delta \int_{ti}^{tf} dt\, L(q_j, \partial_t q_j) \equiv \delta \int_{ti}^{tf} dt [L(q_j + \delta q_j, \partial_t q_j + \delta \partial_t q_j) - L(q_j, \partial_t q_j)]$$
$$= \int_{ti}^{tf} dt [\delta q_j (\partial L/\partial q_j) + \delta \partial_t q_j (\partial L/\partial(\partial_t q_j))]$$
$$= \int_{ti}^{tf} dt\, \delta q_j [(\partial L/\partial q_j) - \partial_t (\partial L/\partial(\partial_t q_j))] + \int_{ti}^{tf} dt\, \partial_t [\delta q_j (\partial L/\partial(\partial_t q_j))]$$
$$= \int_{ti}^{tf} dt\, \delta q_j [(\partial L/\partial q_j) - \partial_t (\partial L/\partial(\partial_t q_j))].$$

The last term could be vanished at $\delta q_j(t_i) = \delta q_j(t_f) \equiv 0$. δq_j are arbitary, but not zero, so we derive "Lagrange Dynamics Equation"(1).

(1) $(\partial L/\partial q_j) - \partial_t (\partial L/\partial(\partial_t q_j)) = 0$. <j=1, 2, . . . , N>.

②Canonical Formulation by Legendre Tranform :

(1) $p_j \equiv \partial L/\partial(\partial_t q_j)$. <canonical momentum variable of q_j>.

(2) $H(q_j, p_j) \equiv \Sigma_{j=1}^{N} p_j \partial_t q_j - L(q_j, \partial_t q_j)$. <Hamiltonian of system energy=E>

$H = K$(kinetic Energy=$p_j v_j/2$) $+ V$(potential Energy) $= 2K - L$.

(3) $L = K - V$.

Hence, realizable dynamics acts as realizing extremum value of $S = \int_{ti}^{tf} dt\, L$.

As the fact, $K = V$ in time interval averaging(**equi energy distribution low**).

$$0 = \delta \int_{ti}^{tf} dt [\Sigma_{j=1}^{N} p_j \partial_t q_j - H(q_j, p_j)]$$
$$= \Sigma_{j=1}^{N} \int_{ti}^{tf} dt [\delta p_j \partial_t q_j - \delta q_j \partial_t p_j - \delta p_j (\partial H/\partial p_j) - \delta q_j (\partial H/\partial q_j) + \partial_t (p_j \delta q_j)]$$
$$= \Sigma_{j=1}^{N} \int_{ti}^{tf} dt\, \delta p_j [\partial_t q_j - (\partial H/\partial q_j)] + \Sigma_{j=1}^{N} \int_{ti}^{tf} dt\, \delta q_j [-\partial_t p_j - (\partial H/\partial q_j)].$$

$\partial_t q_j = +\partial H/\partial p_j = \partial(\Sigma_{j=1}^{N} p_j \partial_t q_j)/\partial p_j$.

$\partial_t p_j = -\partial H/\partial q_j = \partial L/\partial q_j$. <j=1, 2, . . . , N>. Canonical Eqiation

(4)Any dynamic system could be determined uniquely by once having determined **Lagrangean**. Or another word, "in the beggining is Lagrangean".

(5)Dimention of $[q_j p_j] = $[Energy][time]$\equiv$"**action dimension**" due to (2). It is related with "adiabatic invariance" such as variation principle, which are reflections of dynamical stability that reaction goes toward to reduce action. It is called negative feed back for dynamical stability.

③Canonical Formulation in Contineous EM Wave Field :

In contineous wave field, discrete suffix j of variable q_j becomes contineous space variable q(x), Field variable itself become space density one. Typical is electro-magnetic(EM) field of Lagrangean density $\mathscr{L}(A_\nu, \partial_\mu A_\nu; j_\nu)$.

(1)Euler Equation :

$0 = D_E\mathscr{L}(A_\nu, \partial_\mu A_\nu; j_\nu) \equiv \Sigma_{\mu=0}{}^3\{\partial\mathscr{L}/\partial A_\nu - \partial_\mu[\partial\mathscr{L}/\partial(\partial_\mu A_\nu)]\}$.

$0 = \delta\int_{ti}{}^{tf}dt\iiint dx^3\mathscr{L}(A_\nu(x), \partial_\mu A_\nu(x)) = \int_{ti}{}^{tf}dt\iiint dx^3\,\delta A_\nu[(\partial\mathscr{L}/\partial A_\nu)$

$-\partial_\mu(\partial\mathscr{L}/\partial(\partial_\mu A_\nu))] + \int_{ti}{}^{tf}dt\iiint dx^3\,\partial_\mu\langle\delta A_\nu(\partial\mathscr{L}/\partial(\partial_\mu A_\nu)\rangle$. (last term=0)

(2)Canonical Momentum Variable :

$P_\nu \equiv \partial\mathscr{L}/\partial(\partial_t A_\nu) = (ic)^{-1}\partial\mathscr{L}/\partial(\partial_0 A_\nu)$.

(3)Hamiltonian Density :

$\mathscr{H} \equiv \Sigma_{\nu=0}{}^3 P_\nu\,\partial_t A_\nu - \mathscr{L}(A_\nu, \partial_\mu A_\nu; j_\nu)$.

(4)CED Lagrangean density :

$\mathscr{L}_{CED}(A_\nu, \partial_\mu A_\nu; j_\nu) = \Sigma_{\mu>\nu=0}{}^3(-1/2\mu)[\partial_\mu A_\nu - \partial_\nu A_\mu]^2 - \Sigma_{\nu=0}{}^3 j_\nu A_\nu$.

(5)CED EM Field Equation : ⟨$\Sigma_{\mu=0}{}^3$ is abrivated by Einstein convention⟩

$0 = D_E\mathscr{L}(A_\nu, \partial_\mu A_\nu; j_\nu) = -j_\nu - (1/\mu)\partial_\mu[\partial_\mu A_\nu - \partial_\nu A_\mu]$. ⟨$D_E$≡Euler differetial⟩.

→ $\Box A_\nu - \partial_\mu(\partial_\nu A_\nu) = -\mu j_\nu$. Lorentz condition $\partial_\nu A_\nu = 0$ yeields the equation.

$\Box A_\nu = -\mu j_\nu$. ⟨ν=0, 1, 2, 3⟩. ☞:Experimentally, this equation(5) is valid.

(6)Imcompleteness of CED Lagarangean.

(a)Without Lorentz condition yields pseudo current$=-j^B{}_\nu$.

Supposing $B \equiv -(ic/\alpha)\partial_\nu A_\nu$; $j^B{}_\nu \equiv -ic\,\partial_\mu B$; $c^2 = 1/\varepsilon\mu$; $\alpha \equiv -1/\varepsilon$, then,

$\Rightarrow -\mu^{-1}\partial_\mu(\partial_\nu A_\nu) = -\alpha\mu^{-1}(1/ic)^2\partial_\mu(-icB) = -\alpha\mu^{-1}(1/ic)^2 j^B{}_\mu = -j^B{}_\mu$.

$\Box A_\nu = -\mu(j_\nu - \mu^{-1}\partial_\mu(\partial_\nu A_\nu)) = -\mu(j_\nu - j^B{}_\nu)$.

Thus we see that CED Lagrangean is incomplete due to $-j^B{}_\nu$. Therefore, QED Lagrangean is to have a term yielding $+j^B{}_\nu$ for cancelling $-j^B{}_\nu$.

(b)$P_0 \equiv \partial\mathscr{L}_{QED}/\partial(\partial_t A_0) = 0$. Nothing P_0 is invalid in QED, so correct $\mathscr{L}_{QED}$ has at least term as $P_0\partial_t A_0 = ic\,\partial_0 A_0 P_0$. From 4 dimensionaly symmetry view, it must be $ic\,\partial_\nu A_\nu P_0$. Now we denote $P_0 \equiv B$ in the follwing.

(7)The complete QED Lagarangean :

(a)$\mathscr{L}_{QED}(A_\nu, \partial_\mu A_\nu; j_\nu) = \mathscr{L}_{CED}(A_\nu, \partial_\mu A_\nu; j_\nu) + ic\,\partial_\mu A_\mu B + ½\alpha BB$.

(b)$0 = \partial\mathscr{L}/\partial B = ic\,\partial_\nu A_\nu + \alpha B$. ⇒ $B \equiv -(ic/\alpha)\partial_\nu A_\nu$.

(c)$D_E\mathscr{L}_{QED} = -j_\nu - (1/\mu)\partial_\mu[\partial_\mu A_\nu - \partial_\nu A_\mu] - \partial_\nu[\partial\mathscr{L}/\partial(\partial_\nu A_\nu)]$

$= -j_\nu - (1/\mu)\partial_\mu[\partial_\mu A_\nu - \partial_\nu A_\mu] - ic\,\partial_\nu B = -j_\nu - \mu^{-1}[\Box A_\nu - \partial_\nu\partial_\mu A_\mu] - \mu^{-1}\partial_\nu(\partial_\mu A_\mu)$

$= -j_\nu - \mu^{-1}\Box A_\nu$. ⇒ $\Box A_\nu = -\mu j_\nu$.

(d)Thus QED term$=(ic\,\partial_\mu A_\mu B + ½\alpha BB)$ is to generate B field current$\equiv +j^B{}_\mu$.

④**Qunatum Field Theory<the Origin Principles>:**

After all, for pragmatical implementation of BWG, the most necessary technology is **EM field design** and may be **dielectircal materials.** Details on "quantum field theory=QFT" is no concerned in design phase. The orthodox derivation employ so called "canonical quntization" which seems supeficially formal, but essential. Fortunately we need not operator algebra, but clasical number algebra in BWG.

(a) Matter (electron and charge particles) with (electro-magnetic field) interaction is described spinor field $\phi(x)$ with guage field $A_\mu(x)$.

Then $\mathscr{H}=e\bar{\phi}(x)\gamma^\mu A_\mu(x)\phi(x)$ describes elementary particle reactions.

(b) $\mathscr{L}(\phi, A_\mu, ..)$ is function of fucntion called Lagrangean. Then the pre-quantized $\mathscr{L}(\phi, A_\mu; \partial_\nu\phi, \partial_\nu A_\mu)$ is determined uniquely by **Lorentz and Guage Invariance.**

(c) Global Lorentz invariance (**GLI**) is special relativity theory for time & space in uniform inertia system. Physical equation is invariant by global rotational transform of 4 dimensional coordinate. Then localized Lorentz transform (**LLI**) invariance correspond to non-inertia system of **gravity field**[6]. The "localized" means "<u>dependency on time and space variable of each point</u>", the non-uniformity. <u>That is, by each diffrent transform on each point, physics must be invariant</u>.

(d) Localized gauage invariance is general interaction theory for matter (spinor field ϕ = inner coordinate representing physical state) with gauage field A_μ. Observable physical quantity must be invariant by localized rotational transform (**LGI**) of muliti-dimensional spinor field coordinate[6]. Then being of gauge field A_μ become spontaneously necessary (interaction theory such as $\mathscr{H}$).

(e) Both (c) & (d) are similar demand that physics must be invariant by any gauge for each point. Each language may be different at each regeon, though the essence is invariant. As you have felt the very similarity of LLI and LGI. That right, those had been unified as establishing unique Quntum Gravity Dynamics (**QGD**) as the supreme unified theory[13] of the matter world (1993^1995).

(f) **CQP** derives the complete $\mathscr{L}(\phi, A_\mu, B; \partial_\nu\phi, \partial_\nu A_\mu)$ where {B} has electric dipole dimension. Then **<u>all the information lies soley in "$\mathscr{L}$".</u>** CQP is an universal reflection of "reciprocal duality" between so called canonical conjugate variable $A_0(x)$ and $B(x)$ of those product A_0B has universal "action" dimension.

$[A_0(x_0, \mathbf{x}),\ B(x_0, \mathbf{y})] \equiv A_0B - BA_0 = i\hbar\,\delta(\mathbf{x}-\mathbf{y})$.

, where i=imaginary number unit, $\hbar$=Plank constant, $\delta(\mathbf{x}-\mathbf{y})$ is Dirac delta function. $(A_0B - BA_0)$ is operator algebra such as non-commutable matrix.

APPENDIX2: N machine creating DC power:

❶: N machine the fundamental structure :

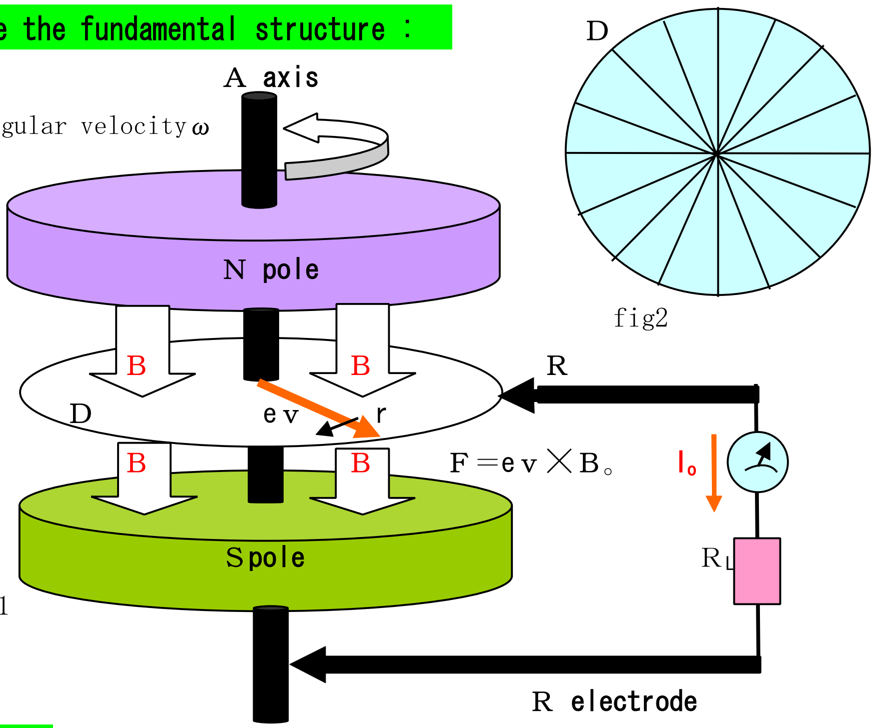

fig1

fig2

❷: the action.

(1)The idea of N machine is due to Lorentz force : $F = e v \times B$.
$-e$=charge of electron, B is magnetic flux penetrating conductive disc D from N to S-pole. {A-N-D-S-A} is one body rotating around center axis A with angular velocity=ω, then electron{-e} in D at position of radius=r from axis A (r=0) is to run thrugh B with velocity $v = r\omega$. It generate Lorentz force F, as the consequnece, voltatage V is generated between axis and the circular edge of D. Electrical intensity directing radius is $E_r = r \omega B$. As the principle, in this procces, there need nothing energy for rotating A of nothing reaction force.

(2) $V = \int_0^r dr E_r(r) = \int_0^r dr\, r \omega B = \frac{1}{2} r^2 \omega B$.

(3)The problem of incidental circular electrical intensity E_C.
By E_r, once radius current j_r had been generated, then also it shall generate circular oriented electrical force $F_C = j_r \times B$. Consequently, electron in D moves as "spriral trajectory" to act for reducing B. It is troublesome. For cutting F_C, D must be segmented into many radius directing conductive lines <see fig2>. Then could it be sufficient ?.