

# QUANTUM THEORY DEPENDING ON MAXWELL EQUATIONS

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ABSTRACT. This article try to unified the three basic forces by Maxwell equations, the only experimental theory. Self-consistent Maxwell equation with the current from electromagnetic field is proposed. and is solved to four kinds of electrons and the structures of particles. The static properties and decay and scattering are reasoned, all meet experimental data. The momentum-energy tensor of the electromagnetic field coming to the equation of general relativity is discussed. In the end that the conformation elementarily between this theory and QED and weak theory is discussed compatible, except some bias in some analysis.

## CONTENTS

1. Unit Dimension of $sch$	2
2. Quantization	2
3. Self-consistent Electrical-magnetic Fields	3
4. Stable Particle	3
5. Radium Function	4
6. Solution	5
7. Electrons and Their Symmetries	6
8. Mechanic Feature	7
9. Propagation and Movement	8
10. Antiparticle and Radiation	10
11. Conservation Law and Balance Formula	11
12. Muon	11
13. Pion Positive	12
14. Pion Neutral	12
15. tau	12
16. Proton	13
17. Magic Numbers	13
18. Scattering and decay life	14
19. $\eta$	15
20. Conclusion	16
References	16

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1. UNIT DIMENSION OF  $sch$ 

A rebuilding of units and physical dimensions is needed. Time  $s$  is fundamental. The velocity of light is set to 1

$$Velocity : c = 1$$

Hence the dimension of length is

$$L : c(s)$$

The  $\hbar$  is set to 1

$$Energy : \hbar(s^{-1})$$

In Maxwell equations the following is set

$$c\epsilon = 1, c\mu = 1$$

One can have

$$\epsilon : \frac{Q^2}{\varepsilon L};$$

$$\mu : \frac{\varepsilon L}{c^2 Q^2}$$

$$UnitiveElectricalCharge : \sigma = \sqrt{\hbar}$$

It's very strange that the charge is analyzed as space and mass. Charge  $Q$  is then defined as  $Q/\sigma$  here, without unit.

$$\sigma = 1.03 \times 10^{-17} C = 64e, e/\sigma = e/\sigma = 1/64 = 1.56 \times 10^{-2}$$

$$H : Q/(LT) : \sqrt{\hbar}/c(s^{-2})$$

$$E : \varepsilon/(LQ) : \sqrt{\hbar}/c(s^{-2})$$

If  $\hbar, c$  is taken as a number instead of unit, then all physical units is described as the powers of the second:  $s^n$ .

The unit of charge can be reset by *linear variation of charge-unit*

$$Q \rightarrow CQ, Q : \sigma/C$$

We will use it without detailed explanation.

## 2. QUANTIZATION

All discussion base on a explanation of quantization, or *real* probability explanation for quantum theory, which bases on a Transfer Probability Matrix (TPM)

$$P_i(x)M = P_f(x)$$

As a fact, that a particle appears in a point at rate 1 is independent with appearing at anther point at rate 1. There still another pairs of independent states

$$S_1 = e^{ipx}, S_2 = e^{ip'x}$$

because

$$\langle s_1, s_2 \rangle_4 = \int dV s_1 s_2^* = N\delta(p - p')$$

$\langle s_1, s_2 \rangle_4$  means make product integrated in time-space. Similarly the symbol

$$\langle s_1, s_2 \rangle$$

is the product integrated in space and *always means its branch of zero frequency*. In fact in the TPM formulation, it's been accepted for granted that the Hermitian

inner-product is the measure of the dependence of two states, and it is also implied by the formula

$$P_1 M P_2^*$$

Depending on this view point one can constructs a wave

$$e^{ipx}$$

and gifts it with the momentum explanation  $p$ , Then all quantum theory is set up.

### 3. SELF-CONSISTENT ELECTRICAL-MAGNETIC FIELDS

The Maxwell equations are

$$\frac{\partial H}{\partial t} + \nabla \times E = 0$$

$$\frac{\partial E}{\partial t} - \nabla \times H + \mathbf{j} = 0$$

Try equation for the free E-M field

$$(3.1) \quad A_{,j}^{i,j} - A_{,j}^{j,i} = \frac{1}{4}(-iA_{\nu}^* \cdot \partial^i A^{\nu} + iA^{\nu} \cdot \partial^i A_{\nu}^*) = J, Q_e = 1$$

$$(A^i) := (V, \mathbf{A}), (j^i) = (\rho, J)$$

$$\partial := (\partial_i) := (\partial_t, \partial_{x_1}, \partial_{x_2}, \partial_{x_3})$$

$$\partial' := (\partial^i) := (-\partial_t, \partial_{x_1}, \partial_{x_2}, \partial_{x_3})$$

The equation 3.1 have symmetries

$$CPT, cc.PT$$

If the gauge is

$$\partial_{\mu} A^{\mu} = 0$$

the continuous charge current meets

$$\partial_{\mu} \cdot j^{\mu} = 0$$

The gross energy of field is

$$\varepsilon = \langle F^{ij}, F^{ij} \rangle / 4 = \langle \partial A, \partial A \rangle / 2$$

### 4. STABLE PARTICLE

All particles are elementarily E-M fields is presumed. It's trying to find stable solution of the Maxwell equations *in complex domain*. One can write down a function initially and correct it by re-substitution. Here is the initial state

$$V = V_i e^{ikt}, A_i = V$$

Substituting into equation 3.1

$$\partial_{\mu} \partial^{\mu} A^{\nu} = J_x, \partial_{\mu} \partial^{\mu} A_i^{\nu} - \partial^{\nu} \partial_{\mu} A_i^{\mu} = J_i$$

$$J_x = \frac{1}{2}(-iA_{\nu}^* \cdot \partial^i A^{\nu} - cc.)$$

$$J_i = -\partial^{\nu} \partial_{\mu} A_i^{\mu} = \partial^{\nu} \partial_i V$$

It has the properties

$$\partial \cdot J_i = 0$$

$J_i$  causes the initial fields  $V$ , so that it is the real seed of recursive algorithm.

The static fields  $E_0, H_0$

$$(4.1) \quad \begin{aligned} \nabla \cdot E_0 &= (iA_{1\nu}^* \cdot \partial_t A_1^\nu + cc.) / 4 = \rho_0 \\ \nabla \times H_0 &= -(iA_{1\nu}^* \cdot \nabla A_1^\nu + cc.) / 4 = J_0 \end{aligned}$$

In the first round of substitution

$$4J_1 = -i(A_{0\nu} \cdot \partial' A_1^\nu) + i(\partial' A_{0\nu} \cdot A_1^{\nu*}) + cc.$$

We calls the fields' correction with frequency  $nk$  the n-th order correction, calls the n-th re-substitution in same order the n-th rank correction.

The energy of field  $A$  is  $\varepsilon = \int dV(E^2 + H^2)/2$

$$\begin{aligned} & (A_{,j}^i - A_{,i}^j)^* (A_{,j}^i - A_{,i}^j) \\ &= 2A_{,j}^{i*} A_{,j}^i - A_{,j}^{i*} A_{,i}^j - A_{,i}^{j*} A_{,j}^i \\ &= 2A_{,j}^{i*} A_{,j}^i - (A_{,j}^{i*} A^j)_{,i} + A_{,ji}^{i*} A^j - (A^{j*} A_{,j}^i)_{,i} + A^{j*} A_{,ij}^i \end{aligned}$$

under integration

$$\int dV (A_{,j}^i - A_{,i}^j)^* (A_{,j}^i - A_{,i}^j) = 4\varepsilon = 2 \langle A_{,j}^i | A_{,j}^i \rangle$$

$\varepsilon$  is energy of the field.

Here is a analysis of decay to light. For some simple electrical field

$$(4.2) \quad \varepsilon = W + C$$

It's Lorentz-covariant.  $W$  is the potential of effect  $\int dV \cdot j^\mu \cdot A^\mu$ . setting

$$A = UC(t)e^{i\mathbf{p}\mathbf{r}+ikt} \rightarrow_t Ue^{i\mathbf{p}\mathbf{r}+ikt}, \mathbf{p}^2 = k^2$$

we have

$$\begin{aligned} \frac{1}{2} A^* \partial_t^2 A - A \partial \cdot \partial' A / 2 &= \frac{3}{2} A^* \nabla^2 A \\ C_{tt} + 2kC_t - 3k^2 &= 0 \\ C &= e^{kt} \end{aligned}$$

This means virtue particle can decay to real particle.

## 5. RADIUM FUNCTION

Firstly

$$\nabla^2 A = -k^2 A$$

is solved. Exactly, it's solved in spherical coordinate

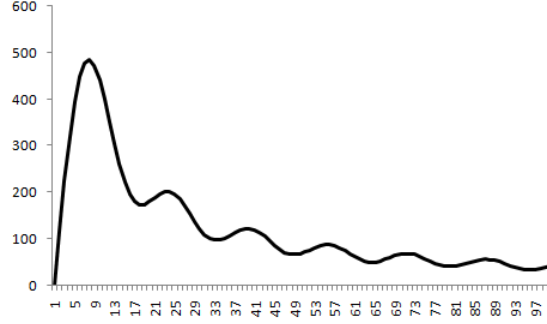
$$0 = r^2 \nabla^2 f + k^2 f = (r^2 f_r)_r + k^2 r^2 f + \frac{1}{\sin \theta} (\sin \theta f_\theta)_\theta + \frac{1}{\sin^2 \theta} (f_\phi)_\phi$$

Its solution is

$$\begin{aligned} f &= R\Theta\Phi = R_l Y_{lm} \\ \Theta &= P_l^m(\cos \theta), \Phi = \cos(\alpha + m\phi) \\ R_l &= N \eta_l(kr), \eta_l(r) = r^l \int_0^\infty \frac{(1-\lambda)^l}{(1+\lambda)^{l+2}} \cos(\lambda r) d\lambda \\ &\int_0^\infty dr \cdot r^2 R^2 = 1 \end{aligned}$$

$R$  is solved like

$$\begin{aligned} (r^2 R_r)_r &= -k^2 r^2 R + l(l+1)R, l \geq 0 \\ R &\rightarrow rR' \end{aligned}$$


 FIGURE 1. the shape of radium function  $R_1$  by DFT

$$(r^2 R')_{rr} = -k^2 r^2 R' + l(l+1)R'$$

$$R' \rightarrow r^{l-1} R'$$

$$r R'_{rr} + 2(l+1)R'_r + k^2 r R' = 0$$

$$r \rightarrow r/k$$

$$(s^2 F)' + 2(l+1)F + F' = 0, F = F(R')$$

$F()$  is the Fourier transform

$$R' = \int_0^\infty \frac{(1-\lambda)^l}{(1+\lambda)^{l+2}} \cos(\lambda r) d\lambda$$

The function  $R_1$  has zero derivative at  $r = 0$  and is zero as  $r \rightarrow \infty$ .

## 6. SOLUTION

The derivatives of the function of electron has a strange breaking point in coordinate origin hence without normal convenience of Fourier transform. The following are some proximation of the first rank. The solution of  $l = 1, m = 1, Q = e/\sigma$  is calculated or tested for electron.

$$A_1 = N R_1(kr) Y_{1,1},$$

The curve of  $R_1$  is like the one in the figure 1.

The magnetic dipole moment  $\mu_z$  is calculated as the first rank of proximation

$$\mu_z = \langle A_\nu | -i \partial_\phi | A^\nu \rangle / 2$$

$$= 1/2, k_e = 1$$

The power of unit of charge is not equal, but it's valid for unit  $Q = e$ .

$$\frac{Q}{2k} = \mu_B$$

## 7. ELECTRONS AND THEIR SYMMETRIES

Some states of electrical field  $A$  are defined as the core of the electron, it's the initial function  $A_1 = V$  for the re-substitution to get the whole electron function.

$$\begin{aligned} e_r^+ &: NR_1(kr)Y_{1,1}e^{-ikt}, \\ e_r^- &: NR_1(-kr)Y_{1,1}e^{ikt}, (CPT) \\ e_l^+ &= NR_{-z}(e_r^+) : R_1(kr)Y_{1,-1}e^{-ikt} \\ e_l^- &= NR_{-z}(e_l^-) : R_1(-kr)Y_{1,-1}e^{ikt} \\ R_{-z} &: \text{Rotation} : z \rightarrow -z, x \rightarrow x, y \rightarrow -y \end{aligned}$$

$r, l$  is the direction of the magnetic dipole moment. We use these symbols  $e$  to express the complete potential field  $A$  or the abstract particle.

Energy of static E-field crossing is discussed. In the zero rank of correction ie. the static field is

$$(e(-i\partial')e + cc.)/4 = J_e, Q_e = 1$$

The equation of charge

$$4\rho_0 = (e(i\partial_t)e + cc.), Q_e = 1$$

is used to normalize electron function that's the same with the normalization of electron to energy

$$\langle \partial e | \partial e \rangle / 2 = Q_e k_e$$

The static energy of electric field is

$$\varepsilon_e = - \int dV DV' \rho(\mathbf{r})\rho(\mathbf{r}')/|8\pi(\mathbf{r} - \mathbf{r}')|$$

Using spherical function expansion of  $1/|\mathbf{r} - \mathbf{r}'|$ ,

$$= -2 \int_{r' < r} dV DV' \rho(\mathbf{r})\rho(\mathbf{r}') \sum_n (r'/r)^n P_n(\cos(\theta)) / (8\pi)$$

Calculating the first term

$$\approx -\frac{\pi}{4} e/\sigma \int dV \rho(\mathbf{r}) / (8\pi r) = -\frac{1}{7.53 \times 10^{-16} s}$$

Energy of the static M-field crossing

$$\varepsilon'_m = \varepsilon_e$$

It's easy to prove

$$4\varepsilon_m - 4\varepsilon_e = \int dV (A_\mu^*(\mathbf{r}_1)\partial' A^\mu(\mathbf{r}_1) - cc.)^* \cdot (A_\mu^*(\mathbf{r}_1 - \mathbf{r}_2)\partial A^\mu(\mathbf{r}_1 - \mathbf{r}_2) - cc.) / |\mathbf{r}_1 - \mathbf{r}_2| = 0$$

Hence the gross energy is  $2\varepsilon_e$ . The value of crossing term generated by static fields between electrons are

$2\varepsilon_e$	$e_r^+$	$e_r^-$	$e_l^+$	$e_l^-$
$e_r^+$	+	0	0	-
$e_r^-$	0	+	-	0
$e_l^+$	0	-	+	0
$e_l^-$	-	0	0	+

Calculating the crossing part between  $e_r^+, e_r^-$ . In a electron  $e_r^+$  has two parts of first rank correction

$$J_1 = -i(-V_0 \cdot \partial' V + V_0 \cdot \partial' V^*)/4 \rightarrow A_1$$

$$J_1' = -i(-V^* \cdot \partial' V_0 + V \cdot \partial' V_0)/4 \rightarrow A_1'$$

Between  $e_r^+, e_r^-$  the crossing part is zero in this rank. They coupling with  $V$

$$J_2 = -i((-V_1 \cdot \partial' V + V_1 \cdot \partial' V^* - V^* \cdot \partial' V_1 + V \cdot \partial' V_1))/4$$

Its electrical part is

$$= -(G(V_0 \cdot V_t^*) \cdot V_t + G(V_0 V_t) \cdot V_t^*)/8$$

$G(J)$  is the potential caused by current  $J$ .

$$J_2' = -i(-V_1' \cdot \partial' V + V_1' \cdot \partial' V^* - V^* \cdot \partial' V_1' + V \cdot \partial' V_1')/4 = 0$$

As the magnetic part interaction with static fields their crossing part is zero.  $J_1 + J_2'$  interacts. By violent computation and sampling the radium function at 10 points with clear shape of it, the results of crossing between  $e_r^+, e_r^-$  approaches

$$2\varepsilon_x \approx -\frac{1}{1.6 \times 10^{-8}s}$$

The value of this crossing term generated between electrons are

$2\varepsilon_x$	$e_r^+$	$e_r^-$	$e_l^+$	$e_l^-$
$e_r^+$	+	-	0	0
$e_r^-$	-	+	0	0
$e_l^+$	0	0	+	-
$e_l^-$	0	0	-	+

The crossing term between  $J_1$  of  $e_r^+, e_r^-$  is

$$2\varepsilon_d = \varepsilon_e$$

The full crossing between  $e_r^+, e_r^-$  is

$$2\varepsilon_E = 3\varepsilon_e = -\frac{1}{3.2 \times 10^{-16}s}$$

## 8. MECHANIC FEATURE

If the equation that connects space and E-M fields is written down for cosmos of electrons, it's the following:

$$(8.1) \quad R_{ij} - \frac{1}{2} R g_{ij} = 8\pi G T_{ij}$$

$$e_{/\sigma}^2 T_{ij} = F_i^{k*} F_{kj} - g_{ij} F_{\mu\nu} F^{\mu\nu*} / 4$$

$F$  is the electromagnetic tensor. This equation give mass because the space is decided by E-M fields instantly. the factor  $e_{/\sigma}^2$  is to balances the physical unit.

Because fields  $F$  is additive, the group of electrons are express by:

$$\sum_i f_i * \nabla e_i, \langle f_i | f_i \rangle = 1$$

The convolution is made only in space:

$$f * g = \int dV f(t, y - x) g(t, x)$$

It's called *propagation*. Each  $f_i$  is normalized to 1. We always use

$$\sum_i f_i * e_i, \sum_i f_i * \nabla e_i$$

to express its abstract construction and the field. The reason is that

$$f_i * (\partial e_i - (e_i \partial))$$

is the potential field  $F$  Its potential and strength fields is

$$A = \int dx \sum_i f_i * \nabla e_i, , \partial A - A \partial$$

When the mechanical physical is discussed, we presume the field  $A$  also describes mechanical wave, then the dense of matter (mass) deduced from harmonic wave of charge current is

$$(\sqrt{|Q_e|/2} A_\nu^* \cdot i \partial_t \sqrt{|Q_e|/2} A^\nu + cc.) / 2$$

For electron the sum of the matter's dense in mass-center frame is

$$\langle \sqrt{|Q_e|/2} e | i \partial_t | \sqrt{|Q_e|/2} e \rangle = 1$$

In general frame it's

$$\langle \sqrt{|Q_e|/2} e | i \partial_\tau | \sqrt{|Q_e|/2} e \rangle = 1$$

The current of matter (or momentum) is calculated by mechanical wave:

$$(8.2) \quad p^\mu = -(\sqrt{|Q_e|/2} A_\nu^* \cdot \partial^\mu \partial_\tau \sqrt{|Q_e|/2} A^\nu + cc.) / 2$$

The field energy equal to the quantum energy

$$p^0 = \langle \partial A | \partial A \rangle / 2$$

By this equation we can get the natural frequency of the coupling electron system  $e_x * \sum e_i$  and natural frequency of electron.

The spin of electron is calculated as

$$S_e = \int dV \frac{1}{4} (\sqrt{|Q_e|/2} A_\nu^* \cdot \partial_\phi \cdot \partial_t \sqrt{|Q_e|/2} A^\nu + \sqrt{|Q_e|/2} A^\nu \cdot \partial_\phi \cdot \partial_t \sqrt{|Q_e|/2} A_\nu^*) / 2 = 1/2$$

## 9. PROPAGATION AND MOVEMENT

Define symbols

$$\begin{aligned} e_{xr} &:= N \cdot R_1(k_x r) Y(1, 1) e^{-ik_x t}, \\ e_{xx} &:= (e_{xl} + e_{xr}) / \sqrt{2} \\ \langle e_x | e^x \rangle &= 1 \end{aligned}$$

The following are also (stable) classical propagations.

<i>particle</i>	<i>electron</i>	<i>photon</i>	<i>neutino</i>
<i>notation</i>	$e_r^\pm$	$\gamma_r$	$\nu_r$
<i>structure</i>	$e_r^\pm$	$(e_r^+ + e_r^-)$	$(e_r^+ + e_r^-)$

In the propagation  $f * \sum_i e_i$  the probability  $f$  is normalized as

$$\langle f | f \rangle = \int dV \cdot f^* f = 1$$

By mathematic

$$\varsigma_{k,l,m}(x) := R_l(kr) Y_{l,m}, \varsigma_k(x) := \varsigma_{k,1,\pm 1}(x)$$

meets the following results



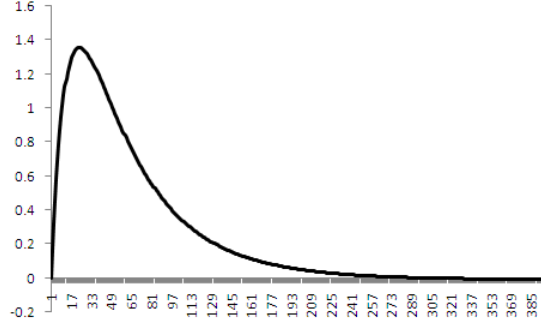


FIGURE 2. the shape of distribution of radioactive momenta of electron fields in one direction:  $k/(1+k)^4 - 4k/(1+k)^5$ , calculated through spherical Bessel functions

**Theorem 9.1.**  $C_A$  is a global area with its center in  $A$  and its diameter is  $r_A$

$$\lim_{r_o=r_y \rightarrow 0} \int_{I-\sum C_i} dV_{\varsigma_k}(x) \varsigma_k^*(x-y) = 0, y \neq O$$

*Proof.* Use the limit

$$\lim_{k' \rightarrow k} \lim_{r_o=r_y \rightarrow 0} \left( \int_{I-\sum C_i} dV_{\varsigma_k}(x) \varsigma_{k'}^*(x-y) \right)$$

□

**Theorem 9.2.** if  $e^{i\mathbf{p}\mathbf{r}}, \varsigma_k$  is normalized to 1,

$$e^{i\mathbf{p}\mathbf{r}} * \varsigma_k = \omega e^{i\mathbf{p}\mathbf{r}}, |\omega| = 1$$

**Theorem 9.3.**

$$\nabla(\varsigma_k * \varsigma_{k'}) = (\nabla \varsigma_k) * \varsigma_{k'} + \varsigma_k * \nabla(\varsigma_{k'})$$

Calculating

$$\int dV_x dV_y dV_{y'} \delta'(x) \varsigma_k(x-y) \varsigma_{k'}(y) \varsigma_k^*(y') \varsigma_{k'}^*(x-y')$$

and using the theorem 9.1

$$\int dV_x dV_y dV_{y'} \delta'(x) \varsigma_k(x-y) \varsigma_{k'}(x-y') \varsigma_k^*(x-y) \varsigma_{k'}^*(x-y')$$

**Theorem 9.4.**

$$(\nabla \varsigma_k) * \varsigma_1 = k \varsigma_k * \nabla \varsigma_1$$

The figure 2 is the shape of distribution of momenta of electron function  $e_x$ .

The movement of the propagation is called *Movement*, ie. the third level wave, harmonic wave. The moment and field is determined by the grid shift. The harmonic wave for static particle  $x$  is

$$e^{i\mathbf{p}\mathbf{r}} * e_x * \left( \sum_i e_i \right)$$

The general fields is obtained by the shift of grid in which real electron is

$$\int dx \cdot e^{i\mathbf{pr}+ikt+ik_e t} * \partial e, \mathbf{p}^2 = k^2$$

The static MDM (magnetic dipole moment) for coupling system is

$$\begin{aligned} \mu &= \langle \sum_i \int dx_i \cdot e_x * \nabla e_i(x) | -i\mathbf{r} \times \nabla | \sum_i \int dx_i \cdot e_x * \nabla e_i(x) \rangle / 4, Q_e = 1 \\ &= \langle \sum_i e_x * e_i(x) | -i\mathbf{r} \times | \sum_i e_x * \nabla e_i(x) \rangle > \frac{k_e}{4k_x} \\ \mu_z &= \langle \sum_i e_x * e_i(x) | \sum_i e_x * (-i\partial_\phi e_i(x)) \rangle > \frac{k_e}{4k_x} \end{aligned}$$

The MDM couples between electrons. Its spin (decoupled) is

$$\begin{aligned} S_z &= \langle \sum_i \int dx \cdot e_x * \nabla e_i(x_i) | -\partial_\phi \partial_t | \sum_i \int dx \cdot e_x * \nabla e_i(x_i) \rangle / 4, Q_e = 1 \\ &= \langle \sum_i e_x * e_i(x_i) | \sum_i e_x * (-i\partial_\phi e_i(x_i)) \rangle > k_e / 4 \end{aligned}$$

Mechanical spin decouples between electrons.

Calculating the following for coupling system for the initial fields:

$$A = \int dx \cdot e_x * \sum_i \partial e_i$$

we find  $e_x * e$  meets the wave equation

$$\partial \cdot \partial' A \approx 0$$

## 10. ANTIPARTICLE AND RADIATION

The radiation of photon is derive from this reaction

$$e^{ip_1x} * e_r^+ + e^{ip_2x} * e_l^- \rightarrow e^{ip_3x} * \gamma_r$$

The emission (of E-M fields), that's the reason to react forward but is not the all energy variation related, is

$$3\varepsilon_e = \frac{1}{3.2 \times 10^{-16} s}$$

this energy marks the strength of electromagnet effect.

The wave of photon is

$$e^{i\mathbf{pr}+ikt} * (e_r^+ + e_l^-)$$

The equivalent reaction for E-M effect is like

$$e^{ip_1x} * e_r^+ \rightarrow e^{-ip_2x} * \overline{e_l^-} + e^{ip_3x} * \gamma_r$$

$\overline{e_l^-}$  is just the equivalent for the equilibrium after the particle  $e_l^-$  is shifted to the other side of the reaction. In fact the shift is a transform of conjugation

$$\overline{e_r^-} = (e_r^-)^*$$

The normal matter is called positive matter and this kind above is called antiparticle (this term is different from the one derived by *CPT*) conventionally.

Antimatter happens by reversing the world's line, with the same map of the event.

The radiation of neutrino depends the reaction

$$e_r^+ + e_r^- \rightarrow \nu_r$$

This reaction is with emission of an energy

$$2\varepsilon_x = \frac{1}{1.6 \times 10^{-8} s}$$

this energy marks the strength of weak effect (of this kind). As a testifying one can have

$$3\varepsilon_e : 2\varepsilon_x = 0.65 \times 10^8$$

This is the difference of the strength between electromagnetic effect and weak effect.

The antiparticle is the particles under the operation  $PT$ , comes from the inner-product probabilities. It meets

$$(10.1) \quad A_{,j}^{i,j} - A_{,j}^{j,i} = -\frac{1}{4}(-iA_\nu^* \cdot \partial^i A^\nu + iA^\nu \cdot \partial^i A_\nu^*), Q_e = 1$$

With the current becomes negative. For example  $A$  is antimatter

$$A + P_1 \rightarrow P_2$$

The arrow " $\rightarrow$ " is the time direction.

$$P_1 \rightarrow P_2 + A^*$$

This two formula have the same scene of events. If the movement of particles is drawn the anti-operator is to reverse the world line.

## 11. CONSERVATION LAW AND BALANCE FORMULA

No matter in E-M fields level or in movement (the third) level, the conservation law is *conservation of momentum and conservation of angular momentum*. A *balance formula* for a reaction is the equivalent formula in positive matter, ie. after all anti-matter is shifted to the other side of the reaction formula. Balance formula is suitable for the analysis of the energy transition of E-M fields in the reaction. The *invariance of electron itself* in reaction is also a conservation law.

## 12. MUON

$\mu^+$  is composed of

$$\mu_r^+ : e_{\mu x} * (e_r^+) + e_{\mu y} * \overline{\gamma_r}$$

$\mu$  is with mass  $3k_e/e/\sigma = 3 \times 64k_e$ , spin  $1/2$ , MDM  $\mu_B k_e/k_\mu$ .

The main channel of decay

$$\mu_r^+ \rightarrow e_l^- + \overline{\nu_r} + \nu_r$$

$$e_{\mu x} * e_r^+ + e^{-ip_1 x} * e_l^- + e^{-ip_2 x} * \nu_r \rightarrow e_{\mu y}^* * \gamma_r + e^{-ip_3 x} * \nu_r$$

It balances approximately unless

$$e_{\mu x} * e_r^+ + e^{-ip_1 x} * e_l^- \rightarrow e_{\mu y}^* * \gamma_r$$

This interaction is between  $E = J'_1 + J_1$  and between the order  $-1$  and  $1$

$$\begin{aligned} & - \langle e_\mu * \partial E_r^+ | (e^{i\mathbf{p}_1 \mathbf{r} + ik_\mu t - \pm 2ikt} * \partial E_r^- \rangle / 2, p_1^2 = (k_\mu t - k_e)^2 \\ & + \langle e_\mu^* * \partial E_r^+ | e_\mu^* * \partial E_l^- \rangle > / 2 + cc. \\ & \approx \left( \frac{k_\mu + k_e}{k_\mu - k_e} - 1 \right) \langle e_\mu * E_r^+ | (e^{i\mathbf{p}_1 \mathbf{r} + ik_\mu t - \pm 2ikt} * \nabla^2 E_r^- \rangle / 2 + cc. \end{aligned}$$

sum up in spectrum of  $p_1$

$$= -\frac{4k_e \varepsilon_x}{k_\mu}$$

The emission of decay is

$$= \frac{1}{2.4 \times 10^{-6} s} [2.1970 \times 10^{-6} s][1]$$

The data in square bracket is experimental data of the full width.

### 13. PION POSITIVE

Pion positive is

$$\pi_r^- : e_{\pi x} * e_r^+ + e_{\pi y} * \bar{\gamma}_r$$

It's with mass  $3 \times 64k_e$ , spin 1/2 and MDM  $\mu_B k_e / k_{\pi^+}$ .

Decay Channels:

$$\pi^- \rightarrow \mu_r^- + \bar{\nu}_r$$

It's with balance formula

$$e^{-ip_1 x} * e_{\mu y} * \gamma_r + e^{-ip_3 x} * \nu_r \rightarrow e_{\pi x}^* * e_r^+ + e^{ip_1 x} * e_{\mu x} * e_r^- + e_{\pi y}^* * \gamma_r$$

The emission of energy is weak interaction

$$2\varepsilon_x = \frac{1}{1.6 \times 10^{-8} s} [(2.603 \times 10^{-8} s)[1]$$

The referenced data is the full width.

### 14. PION NEUTRAL

Pion neutral is atom-like particle

$$\pi^0 : e_{\pi^0 x} + \nu_r + e_{\pi^0 y} * \nu_l$$

It has mass  $4 \times 64k_e$ , zero spin and zero MDM. Its decay modes are

$$\pi^0 \rightarrow \gamma_r + \gamma_l$$

The loss of energy is from static field

$$12\varepsilon_e = \frac{1}{8 \times 10^{-17} s} [8.4 \times 10^{-17} s][1]$$

Half of it is the gap of energy, half is the cross interaction. (see the section 18.)

### 15. TAU

$\tau$  maybe that

$$\tau^+ : e_{\tau x} * (5e_r^+ + 4\bar{e}_r^+) + e_{\tau y} (*e_l^- + \bar{e}_l^-)$$

Its mass  $43 \times 64k_e$ , spin 1/2, MDM  $9\mu_B / k_\mu$ . It has decay mode

$$\tau^+ \rightarrow \bar{\mu}_l^- + \nu_l + \bar{\nu}_l$$

$$e_{\tau x} * 5e_r^+ + e_{\tau y} * e_l^- + e^{-ip_1 x} * e_{\mu x}^* * e_l^- + e^{-ip_2 x} * \nu_l \rightarrow e_{\tau x}^* * 4e_r^+ + e_{\tau y}^* * e_l^- + e^{ip_1 x} * e_{\mu x}^* * \gamma_r + e^{ip_3 x} * \nu_l$$

The energy gap is from

$$4e_{\tau x} * e_r^+ + e_{\tau x} * e_r^+ \rightarrow 4e_{\tau x}^* * e_r^+ + e^{ip_1 x} * e_r^+$$

The gap of energy is from  $E = A_i, J'_1 + J_1$  and between the order  $-1$  and  $1$

$$\begin{aligned}
 & 4 < e_\tau * \partial E_r^+ | e_{\tau x} * \partial E_r^+ > / 2 \\
 & -4 < e_\tau^* * \partial E_r^+ | e^{i\mathbf{p}_1 \mathbf{r} - ik_\tau t} * \partial E_r^+ > / 2 + cc., p_1^2 = (k_\mu t + k_e)^2 \\
 & = 4 \cdot 2 \cdot \left(1 - \frac{k_\tau + k_e}{k_\tau - k_e}\right) < e^{ik_\tau t} e_\tau^* * A_i | \nabla^2 e^{i\mathbf{p}_1 \mathbf{r} + ik_\mu t} * (A_1 + A'_1) > / 2 + cc. \\
 & = -\frac{4\varepsilon_e}{k_\tau/k_e} \\
 & = \frac{1}{4.4 \times 10^{-13} s} [2.9 \times 10^{-13} s, BR.0.17][1]
 \end{aligned}$$

## 16. PROTON

Proton may be like

$$p^+ : e_{px} * (4\overline{e_l^-} + 3e_l^- + e_l^+ + \overline{e_l^+})$$

The mass is  $27 \times 64k_e$  that's very close to the real mass. The MDM is calculated as  $3\mu_N$ , spin is  $1/2$ . The proton thus designed is eternal because even if decay to the finest small parts the emission is negative.

## 17. MAGIC NUMBERS

We define an unit: Mass-number Unite

$$m := m_e \sigma / e \approx 64k_e$$

And we presume the Mass-number (in fact relates theoretical electron number) in a particle for the four kinds of electrons are

$$e_r^+ : i, e_r^- : j, e_l^+ : k, e_l^- : l$$

The the designation of a particle is an equation

$$\begin{cases}
 i^2 + j^2 + k^2 + l^2 = M/m \\
 i - j + k - l = Q \\
 \pm i \pm j \pm k \pm l = 2S
 \end{cases}$$

According to Lagrange's four Square theorem, Any integer can be sum of some four square of integers. But after adding the constraints of charge number or spin number the conditions are not so simple as the Lagrange's theorem.

If consider more complicated design like

$$i' e_r^+, \overline{i' e_l^-}, i' + \overline{i} = i$$

The equations for mass, charge and spin are

$$\begin{cases}
 i^2 + j^2 + k^2 + l^2 = M/m \\
 i - j + k - l = Q \\
 i + j - k - l = 2S
 \end{cases}$$

## 18. SCATTERING AND DECAY LIFE

The scattering can be calculated as dynamic electromagnetic mechanical theory, ie. the magnitude scattered is

$$-ie \int dV_4 \hat{j}^\mu \hat{A}_\mu$$

The reaction is like

$$\sum_i f_i * e_i \rightarrow \sum_i f'_i * e_i$$

$e_i$  are positive matter all. The interaction between electrons

$$I(, e_i, ) = I(, J(e_i), )$$

is the *cross interaction*. At little scale of interaction it's

$$I(j_1, j_2) = \int dV_4 A_1 J_2^*$$

For example the scattering

$$e^{ip_1x} * e_r^+ + e^{ip_2x} * e_r^- \rightarrow e^{ip_3x} * e_r^+ + e^{ip_4x} * e_r^-$$

the rate of transfer is

$$W \approx \frac{C(p'_1 + p'_3)^\nu (p'_2 + p'_4)^\nu}{(p'_1 - p'_3)^2}$$

$p'_i$  is the *cap movement* relating to  $p_i$ .

$$\int \prod_i dV_{4,i} I(, J(e_i), ) = 2\varepsilon_E$$

$$k_e = \frac{1}{1.46 \times 10^{-21} s}, 2\varepsilon_E = \frac{1}{3.2 \times 10^{-16}}$$

this calculation must conform to classical theory

$$C = e^2 \approx C = \frac{2\varepsilon_E}{ek_e}$$

The  $ek_e$  is the factor shifting from energy normalization to normalization of particle number.  $p'_i$  is the cap momentum of the relevant terms of the i-th electron. The interaction is between  $J_0, J_2$ . For electromagnetic interaction between  $e_r^+, e_l^-$

$$I(, J(e_i), ) \approx \frac{C(p'_1 + p'_3)^\nu (p'_2 + p'_4)^\nu}{(p'_1 - p'_3)^2}$$

$$\int \prod_i dV_{4,i} I(, J(e_i), ) = 2\varepsilon_x$$

The interaction is between  $A_0$ . Its property of covariance conforms to that of energy.

The scattering cause by energy gap is discussed. For example

$$\pi^+ \rightarrow \mu_r^- + \bar{\nu}_r$$

It's with balance formula

$$e^{-ip_1x} * e_{\mu y} * \gamma_r + e^{-ip_3x} * \nu_r \rightarrow e_{\pi x}^* * e_r^+ + e^{ip_1x} * e_{\mu x} * e_r^- + e_{\pi y}^* * \gamma_r$$

When  $e_{\pi x}^* * e_r^+$  and  $e^{ip_1x} * e_{\mu x} * e_r^-$  couples the transfer of particles acts. Hence the gross wave of  $e_{\mu x} * e_r^-$  is

$$e_{\pi x}^* * e_r^- : e_{\pi x}^* * A_2, e_{\pi x}^* * A_0$$

The branches of radiation are

$$\langle j_1(kr)Y_{1,\pm 1}(\theta, \phi)e^{ik't}|e_{\pi x}^* \rangle$$

$j_1$  is spherical Bessel function. Its distribution of momentum is like the figure 2. The momenta of the rest particles can be solved by conservation law. This is the data in static grid, the case for the moving grid can be obtained easily from this.

The scattering mixed with gap of energy and crossing interaction has the example of the reaction of decay of  $\pi^0$

$$\pi^0 \rightarrow \gamma_r + \gamma_l$$

The crossing interaction between  $e_r^+, e_l^-$  and between  $e_r^-, e_l^+$  acts because of their coupled values of cap waves.

The energy gap in fact is part of interaction for example

$$e^{p_1 x} * e + e^{p_2 x} * e \rightarrow e^{p_3 x} * e + e^{p_4 x} * e$$

$e$  is the same electron of the four kind and of the same polarization. In fact the final state includes

$$s := e_s * (e + e)$$

The interaction in the reaction is

$$I = I(j_{13}, j_{24}) = \int dV_4 A_{13} J_{24}^* \delta(x - G)$$

The domain  $G$  is the domain meeting Clain-Golden equation and conservation of momentum, for all emitted matter. Taking the mass center system, the part generating  $s$  is

$$e + e \rightarrow s = e^{i\mathbf{p}\mathbf{r}} * e_{ik_s t} \zeta_{k_s} * (e + e)$$

this value is

$$I(j_{13}, j_{24}) = C \frac{\mathbf{p}_1^2}{(k_s - |\mathbf{p}_1|)^2 - (\mathbf{p} - \mathbf{p}_1)^2}$$

### 19. $\eta$

Eta is in fact different particles that have mass number  $10m$ . Their decay or scattering modes are

- $2\gamma$  (mass  $8m$ )

$$(\nu_r + \nu_l) + (\nu_l + \bar{\nu}_l) \rightarrow \gamma_r + \gamma_l$$

- $3\pi^0$

$$(\overline{\gamma_r + \gamma_l} + e + \bar{e}) \rightarrow 2\overline{\pi^0} + \pi^0$$

- $\pi^+ + \pi^- + \pi^0$

$$(\overline{\gamma_r + \gamma_l} + e + \bar{e}) \rightarrow \pi^+ + \overline{\pi^+} + \overline{\pi^0}$$

- $\pi^+ + \pi^- + \gamma$  (mass  $8m$ )

$$(\overline{\gamma_r + \gamma_l}) + (\gamma_l + \overline{\gamma_r})$$

$$\rightarrow \pi_r^+ + \pi_l^- + \gamma_l$$

All have decay width at the range of times of  $\varepsilon_e$ . The decay channel of leptons with width of range  $\varepsilon_x$  is like

$$(2e + 2\bar{e} + \overline{e_r^+ + e_r^-}) \rightarrow \overline{e_r^+} + \overline{e_r^-}$$

Its mass is  $14m$ . This is a weak particle participating weak interaction. Another example is

$$(\overline{2\gamma_r + \nu_r}) \rightarrow \overline{\mu_r^+} + \overline{\mu_r^-}$$

Its mass  $10m$ .

## 20. CONCLUSION

The relative theory is applied to electromagnetic wave to give the looking mass of the fields which does expresses mass, for example the solved electron function in this article. In my view point the sum-up of the grains (as electrons) of electromagnetic field is a mechanic movement with diverse effect. Fortunately this model will explain all the effects in the known world: strong, weak and electromagnetic effects, and even subclassify them further if not add new ones. In this model the only field is electromagnetic field except space, this stands for the philosophical with the point of that unified world from unique source. All depend on a simple fact: the current of matter in a system is time-invariant zero in mass-center frame, and we can devise current of matter to analysis the E-M current. So that all effects is explained with diffusion process.

The inertial mass is deduced by mechanical operator  $i\partial_t$ . But the gravitational mass ( by the equation of 8.1) of the naked electron is 64 time of the inertial and mechanical mass, the photon and neutrino has zero mechanical mass but their gravitational mass is not zero obviously. this is hard problem unsettled by this article. For atom the inertial mass less then gravitational mass by 1/50 approximately.

The energy of matter would happen in this process, the hot matter distilled to protons as got cold with their wave functions dependent each others. the harmony between bent space and electromagnetic fields explain them all.

Except electron function my description of particles in fact has the same form with Quantum Electromagnetic Mechanics, and they two should reach the same result except for precision. But my theory isn't compatible to the theory of quarks, the upper part of standard model, if not it is calculated in the style of Quantum Electromagnetic Mechanics. In fact, The electron function is a good promotion for the experimental model of proton that went up very early.

I found these presumptions on some days of 1994-1995 and soon I grossly testify this theory the year. At that time a few people studied in HUST China knew of it. But in the following teen years I nearly forgot of it except now and several years ago a round of submission of it.

## REFERENCES

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