THEORY OF ELECTRON

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ABSTRACT. This article try to unified the four basic forces by Maxwell equations, the only experimental theory. Self-consistent Maxwell equation with the e-current from matter current is proposed, and is solved to four kinds of electrons and the structures of particles. The static properties and decay are reasoned, all meet experimental data. The equation of general relativity sheerly with electromagnetic field is discussed as the base of this theory. In the end the conformation elementarily between this theory and QED and weak theory is discussed.

CONTENTS

1. UNIT DIMENSION OF *sch*

A rebuilding of units and physical dimensions is needed. Time s is fundamental.
We can define:
The unit of time: s (second)
The unit of length: cs (c is the velocity of light)

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The unit of energy: $\hbar/s$ (h is Plank constant)

The unit dielectric constant ϵ is

$$[\epsilon] = \frac{[Q]^2}{[E][L]} = \frac{[Q]^2}{\hbar c}$$

The unit of magnetic permeability μ is

$$[\mu] = \frac{[E][T]^2}{[Q]^2[L]} = \frac{\hbar}{c[Q]^2}$$

We can define the unit of Q (charge) as

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

then

$$[Q] = \sqrt{\hbar}$$
$$[H] = [Q]/[L]^2 = [cD] = [E]$$

Then

$$\sqrt{\hbar} : C = (1.0546 \times 10^{-34})^{1/2}$$

C is charge SI unit Coulomb.

For convenience we can define new base units by unit-free constants

$$c = 1, \hbar = 1, [Q] = \sqrt{\hbar}$$

then all physical units are power of second s^n, the units are reduced.

Define

$$UnitiveElectricalCharge : \sigma = \sqrt{\hbar}$$
$$\sigma = 1.03 \times 10^{-17} C \approx 64e$$
$$e_{/\sigma} = e/\sigma = 1.57 \times 10^{-2} \approx 1/64$$

Define and rebuild the system:

$$s \to Cs =: 1 = m_e/e_{/\sigma} =: \beta$$

$s \to Cs$ means the value of the redefined second becomes c seconds. We always use this units system.

2. Self-consistent Electrical-magnetic Fields

Try so-called expanded Maxwell equation for the free E-M field in the previously defined units

$$\partial \cdot \partial' A = iA^{\nu *} \cdot \partial A_\nu/2 + cc. = -J \tag{2.1}$$
$$\partial_\nu \cdot A^\nu = 0$$

with definition

$$(A^i) := (V, \mathbf{A}), (J^i) = (\rho, \mathbf{J}), (J_i) = (-\rho, \mathbf{J})$$
$$\partial := (\partial_i) := (\partial_t, \partial_{x_1}, \partial_{x_2}, \partial_{x_3})$$
$$\partial' := (\partial^i) := (-\partial_t, \partial_{x_1}, \partial_{x_2}, \partial_{x_3})$$

It's deduced by using momentum to express e-current in a electron: the mass and charge have the same movement in electron. The equation 2.1 have symmetry

$$CPT, cc.PT$$

The energy (reference to the section 15) of the field A under Lorentz gauge are

$$\varepsilon :=< \nabla A^\nu, \nabla A_\nu >=< E, E > /2+ < H, H > /2 \tag{2.2}$$

$$\varepsilon|_{\infty}^{t} = - < A^{\nu}, J_{\nu} > |_{\infty}^{t} = < \rho, V > |_{\infty}^{t} \tag{2.3}$$

The previous presumption is used again. As a convention the time-variant part is neglected.

3. Calculation of Recursive Re-substitution

We can calculates the solution by recursive re-substitution (RRS) for the two sides of the equation. For the equation

$$\hat{P}' B = \hat{P} B$$

make the algorithm (It's approximate, the exact solution needs a rate in the re-substitution)

$$\hat{P}'(\sum_{k \le n} B_k + B_{n+1}) = \hat{P} \sum_{k \le n} B_k$$

One can write down a function initially and correct it by re-substitution. Here is the initial state

$$V = V_i e^{-ikt}, A_i = V, \partial_\mu \partial^\mu A_i = 0$$

Substituting into equation 2.1. We call the fields' correction A_n with n degrees of A_i the n degrees correction.

4. Solution

Firstly

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

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

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

Its solution is

$$f = R\Theta\Phi = R_l Y_{lm}$$
$$\Theta = P_l^m(\cos\theta), \Phi = \cos(\alpha + m\varphi)$$
$$R_l = N j_l(kr)$$

$j_l(r)$ is spherical Bessel function.

$$j_1(r) = \frac{\sin(r)}{r^2} - \frac{\cos r}{r}$$
$$j_1(0) = 0$$
$$\int_0^\infty dr \cdot r^2 j_1(kr) | j_1(k'r) = C k^{-2} \delta(k - k')$$

Define

$$F(x) := N R_1(r) Y_{1,1}(\theta, \varphi)$$
$$< k^{3/2} F(kx), k^{3/2} F(kx) >= 1$$

then by unitary discrete coordinates

$$k^{3/2} F(kx) * k^{3/2} F^*(kx) = k^3 \delta(kr) / (\frac{4}{3}\pi)$$

and

$$F^n(x) F^{*n'}(x) e^{-ict} * \delta(t - r)/(4\pi r) = F^n(x) F^{*n'}(x) e^{-ict}$$
$$< F^n(x), F^n(x) >= 1$$

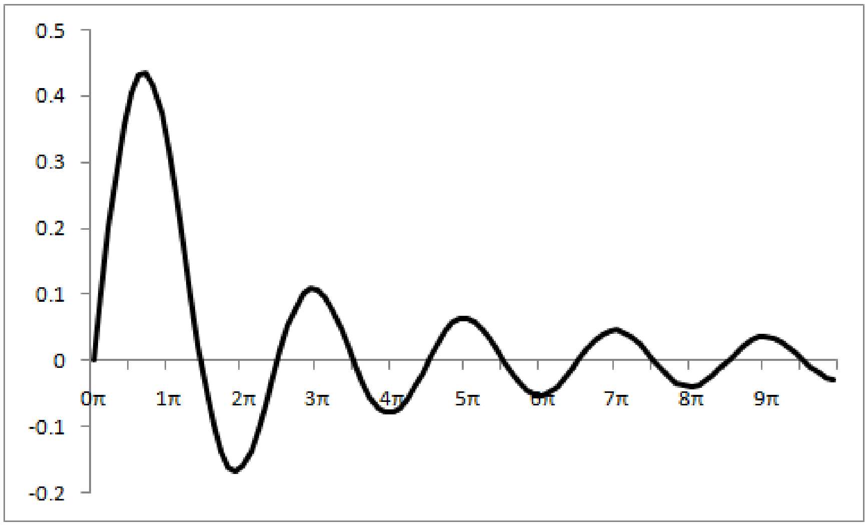

FIGURE 1. The function of j_1

The solution of $l = 1, m = 1, Q = e_{/\sigma}$ is calculated or tested for electron,

$$V = NR_1(k_e r)Y_{1,-1}e^{-ik_e t}$$

5. Electrons and Their Symmetries

Some states of electrical field A are defined as the core of the electron, which's the start function $A_i = V$ that is electrical, for the RRS to get the whole electron function e:

$$e_r^+ : NR_1(k_e r)Y_{1,1}e^{-ik_e t},$$
$$e_l^+ : NR_1(k_e r)Y_{1,-1}e^{-ik_e t}$$
$$e_r^- : NR_1(-k_e r)Y_{1,-1}e^{ik_e t}$$
$$e_l^- : NR_1(-k_e r)Y_{1,1}e^{ik_e t}$$

r, l is the direction of the spin.

Normalize the electron function with charge and mass, using the equation 2.1

$$< e_c^\mu | i\partial_t | e_{\mu c} >= Q_c$$
$$< \nabla e_\mu | \nabla e^\mu >= m_e$$

Then

$$k_{ec} = m_e/Q_c$$
$$< e_{c\mu} | e_c^\mu >= Q_c$$

The magnetic dipole moment of electron is calculated as the first rank of proximation

$$-\mathbf{r} \times \partial \cdot \partial' A/4 + cc.$$
$$\mu_z =< A_i | - i\partial_\phi | A_i > /4 + cc.$$
$$= \frac{Q_e}{2k_e}$$

By the discussion in the section 2 the spin is

$$S_z = \mu_z k_e / e = 1/2$$

The correction in RRS of the equation 2.1 is

$$A_n = A_{n-1} i\partial(A_i - A_i^*)/2 * u \tag{5.1}$$

$$= (A_i^*(i\partial_t A_i))((i\partial_t(A_i - A_i^*)/2)^{n-3}((i\partial(A_i - A_i^*)/2)$$

$$u = \delta(t-r)/(4\pi r)$$

The convolution is made in 4-d space. Generally

$$\partial_x \cdot \partial_x - \partial_t^2 = \partial_{x'} \cdot \partial_{x'}$$

$$(x', t') := (x, t-r)$$

In fact

$$e = u * e$$

then for the electron

$$\int d^3x e^{\nu *} \partial' \cdot \partial e_\nu = 0 \tag{5.2}$$

$$\partial_\nu \cdot J_e^\nu = 0$$

$$\partial_\nu \cdot e^\nu = 0$$

These are Lorentz gauge and current constraint.

The function of e_r^+ is decoupled with e_l^+

$$2 < \nabla(e_r^+)^\nu, \nabla(e_l^+)_\nu >= 0$$

The increment of field energy ε on the coupling of e_r^+, e_r^- mainly between A_2 is

$$\varepsilon_e = 2 < \nabla(e_r^+)^\nu, \nabla(e_r^-)_\nu > \approx -2e^3_{/\sigma} m_e = -\frac{1}{1.66 \times 10^{-16} s}$$

Use the condition 2.2. This value of increments on the coupling of electrons are

ε_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	$-$	$+$

The increment of field energy ε on the coupling of e_r^+, e_l^- mainly between A_4, is

$$\varepsilon_x = 2 < \nabla(e_r^+)^\nu, \nabla(e_l^-)_\nu > \approx -\frac{1}{2} e^7_{/\sigma} m_e = -\frac{1}{1.09 \times 10^{-8} s}$$

This value of increments on the coupling of electrons are

ε_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	$+$

6. Propagation and Movement

The propagation:

$$A := f * \sum_i e_i,$$

$$f * e := \int d^3 y f(y) e(x-y)$$

The following are stable propagation:

particle	*electron*	*photon*	*neutino*
notation	e_r^+	γ_r	ν_r
structure	e_r^+	$(e_r^+ + e_r^-)$	$(e_r^+ + e_l^-)$

By the condition of **??** or 5.2, their static mass except the couplings is zero.

The movement of the propagation is called *Movement*, ie. the third level wave:

$$f * \sum f_i * e_{ij}$$

Calculating the following coupling system of particle x

$$A := e_x * \sum_c n_c e_c, < e_x | e_x >= 1$$

c differ in charge, spin and being negative or not. Make RRS with the start state on e_x

$$NR_1(k_x x) Y e^{-ik_x t} =: E_x e^{-ik_x}$$

and define the e_x after the first degree correction

$$e_x : \partial \cdot \partial' A = 0$$

to get the dynamic state by succeeding corrections.

With the normalization conditions of initial charge

$$< e_x * (\sum_i e_i)^\nu | i\partial_t | e_x * (\sum_i e_i)_\nu >= Q_x \tag{6.1}$$

hence

$$k_x \approx m_e \sum_c n_c^2 / Q_x$$

By notice the normalization of charge and mass of electrons,

$$\varepsilon =< \nabla e_x * (\sum_i e_i)^\nu | \nabla e_x * (\sum_i e_i)_\nu > \approx m_e \sum_c n_c^2 / e_{/\sigma} \tag{6.2}$$

The initial state J is

$$-J \approx \sum_c < e_x * n_c e_c^\mu | i\partial | e_x * n_c e_{c\mu} > /2 + cc.$$

Then the initial MDM is

$$\mu_z \approx \sum_c < e_x * n_c e_c^\mu | -i\phi | e_x * n_c e_{c\mu} > /4 + cc. \approx \frac{m_e}{2k_x} \sum_c Q_c n_c^2$$

7. Conservation Law and Balance Formula

The reaction

$$A_{1i} - A_{2i} \to A_{1f} - A_{2f}$$

is equivalent of the same energy emission to

$$A_{1i} + A_{2f}(x,-t) \to A_{1f} + A_{2i}(x,-t)$$

by the 4-d fourier form. This means we can shift electron to the other side, with the same emission of EM energy.

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 negative terms is shifted to the other side of the reaction formula. Balance formula is suitable for the analysis of the energy transition of decay. The *invariance of electron itself* in reaction is also a conservation law.

8. Muon

The core of muon is

$$\mu_l^- : e_\mu * (e_r^- - e_r^+ - e_l^-)$$

From the equation 15.1, μ is approximately with mass $3m_e/e_{/\sigma} = 3 \times 64 m_e$ [3.2][1] (The data in bracket is experimental by the referenced lab), spin S_e (electron spin), MDM $\mu_B k_e/k_\mu$.

The main channel of decay

$$\mu_l^- \to e_r^- - \nu_r, \quad e_r^- \to -e_r^- + \nu_l$$

with balance formula

$$e_\mu * e_r^- + \delta^{1/2}(x + v_2 t) * \nu_r$$
$$\to \delta^{1/2}(x - v_1 t) * e_r^- + e_\mu(-t) * \nu_r$$

The main EM effect is

$$2 < \nabla e_\mu(-t) * (e_r^+)^\nu | \nabla e_\mu(-t) * (e_l^-)_\nu > -2 < \nabla (e_r^+)^\nu | \nabla (e_l^-)_\nu >$$

Use the equation 6.1 and the equation after the first degree correction in RRS, and calculate the correction of $\nabla e_\mu * \nabla e_\mu$,

$$\approx \frac{\varepsilon_x m_e}{k_\mu} = -\frac{1}{2.18 \times 10^{-6} s} \quad [2.1970 \times 10^{-6} s][1]$$

9. Pion

The core of pion is

$$\pi_l^+ : e_\pi(\varphi) * (e_r^+ \pm e_l^+) + e_\pi(-\varphi) * e_l^-$$

It's approximately with mass $3 \times 64 m_e$ [4.2][1], spin S_e and MDM $\mu_B k_e/k_{\pi^+}$.

Decay Channels:

$$\pi_l^+ \to e_l^+ + \nu_r, \quad e_l^+ \to -e_l^+ + \nu_l$$

The mean life approximately is

$$-\varepsilon_x/2 = \frac{1}{2.2 \times 10^{-8} s} \quad [(2.603 \times 10^{-8} s][1]$$

10. Pion Neutral

The core of pion neutral is like a atom

$$\pi^0 : ((e_r^+ + e_l^+), (e_r^- + e_l^-))$$

It has mass approximately $4 \times 64 m_e$ [4.2][1], zero spin, and zero MDM. Its decay modes are

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

The loss of energy is

$$-2\varepsilon_e = \frac{1}{8.3 \times 10^{-17} s} \quad [8.4 \times 10^{-17} s][1]$$

The following particle is similar to π^0

$$(e_x(-\varphi) * (ne_r^+ - n' e_l^-) + e_x * (e_r^+ + e_l^+), e_x(-\varphi) * (-ne_l^- + n' e_r^+) + e_x * (e_r^- + e_l^-))$$

11. Tauon

The core of tauon maybe

$$\tau_r^- : e_\tau(-\varphi) * (ne_r^+ - ne_l^-) + e_\tau(\varphi) * (-e_l^- + e_r^- - e_l^+)$$

Its mass approximately $53 \times 64 m_e$ [54][1] $(n = 5)$, spin S_e and MDM $\mu_B m_e / k_\tau$. It has decay mode with a couple of neutrinos counteracted

$$(-e_l^- + e_r^- - e_l^+) \to e_r^- - \gamma_r$$

$$e_\tau * e_r^- + \delta^{1/2}(x + v_2 t) * \gamma_l \to \delta^{1/2}(x - v_1 t) * e_r^- + e_\tau(-t) * \gamma_l$$

The main EM effect is

$$2 < \nabla e_\tau(-t) * (e_l^+)^\nu | \nabla e_\tau(-t) * (e_l^-)_\nu > -2 < \nabla (e_l^+)^\nu | \nabla (e_l^-)_\nu >$$

$$\approx \frac{\varepsilon_e m_e}{k_\tau} = -\frac{1}{5.5 \times 10^{-13} s} \quad [2.91 \times 10^{-13} s; BR. \quad 0.17][1]$$

Perhaps, it's a mixture with distinct coefficients n. The following particle is similar to τ

$$e_\tau(-\varphi) * (-ne_r^+ + e_l^+ - e_l^+ - e_l^-) + e_\tau * (ne_l^- - e_r^+ - e_r^- - e_l^+ - e_l^-)$$

12. Proton

The core of proton may be like

$$p_r^- : e_p * (-4e_r^+ - 3e_r^- - 2e_l^-)$$

The mass is $29 \times 64 m_e$ [29][1] that's very close to the real mass. The MDM is calculated as $3\mu_N$, spin is S_e. The proton thus designed is eternal.

13. Neutron

Neutron is the atom of a proton and a electron and a neutrino,

$$n = (p_r^+, -\nu_l, e_l^-)$$

Neutrino circles around proton with

$$m_\nu \omega r^2 = 1$$

The effect is between their (proton and neutrino) magnetic fields of A_2 (gross current)

$$m_\nu \omega^2 r \approx 3 \cdot 3 \cdot 2 \cdot (\varepsilon_e/2) k_e/(m_p r^2)$$
$$m_\nu = e_{/\sigma}^7 m_e$$

The EM energy emitted by neutrino is approximately

$$18^2 e_{/\sigma}^{7+3\cdot 2} m_e^3/(m_p^2 e_{/\sigma}^2) = \frac{1}{971s}$$

14. Mesons

We can define kinds of energy decreases of decays

interaction	EM	side EM	weak	side weak	strong
abbrevation	L	LS	W	WS	S
emission unit	$-\varepsilon_e$	$-\varepsilon_e m_e/\lvert k_x\rvert$	$-\varepsilon_x$	$-\varepsilon_x m_e/\lvert k_x\rvert$	m_e

We analyze the mesons [1] as the following

name	mass(MeV)	emission	type	ratio	construction
η	547	$1.3keV$	L	–	$\pi^0 - class$, perhaps
$K^\pm$	493	$1.24 \times 10^{-8}s$	W	0.88	$e_x(\varphi) * (ne_r^- + e_l^- - e_l^+)$
					$+e_x(-\varphi) * (-ne_l^+ + e_r^+)$
K_S^0	–	$10^{-10}s$	–	–	unclear
K_L^0	–	$5 \times 10^{-8}s$	–	–	unclear
D^0	1865	$4100 \times 10^{-16}s$	LS	1.5	$((-ne_r^+ + n'e_l^- - e_l^+ - e_l^-)$
B^0	5279	$1.52 \times 10^{-12}s$	LS	1	$,(ne_l^- - n'e_r^+ - e_l^+ - e_l^-))$
$D_S^\pm$	1968	$5000 \times 10^{-16}s$	LS	1.3	$\tau - class$
$D^\pm$	1869	$10400 \times 10^{-16}s$	LS	0.6	τ
$B_S^\pm$	5279	$1.6 \times 10^{-12}s$	LS	1	$\tau - class$
Υ	9460	$54keV$	–	–	unclear
J/φ	3096	$93keV$	–	–	unclear
others	–	–	S	–	–

15. Mechanical Quantification

The mechanic feature of the electromagnet fields is

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

T is stress-energy tensor,

$$T_{ij} = \sum m u_i u_j, u = dx/ds$$

T_{00} is quantum expression of the energy, by Lorentz transform it's easy to get the quantum expression of momentum. The observed mass in mass-center frame is

$$M = \int dV T_{00}$$

$$M = \varepsilon \tag{15.1}$$

The physicals have operators as the following

$-<A^\nu\|\partial_t^2\|A_\nu>$	mechaincal energy (it's conserved)	E
$-<A^\nu\|\nabla^2\|A_\nu>$	EM energy or analytic kenitic energy	ε
$-<A^\nu\|\partial_t^2-\nabla^2\|A_\nu>$	analytic static mass	m
$<A^\nu\|J_\nu>$	interaction potential	F,Γ

Use the equation 2.1 and its mechanical explanations, the partial field A_n of n independent particles decaying to stable state

$$F =< A_n^\nu|\partial\cdot\partial'|A_{\nu n} >= n\Gamma e^{-C\Gamma t} =< A_n^\mu|iA_n^{\nu *}\partial_\mu A_{\nu n}/2 + cc. >$$

For some number n and charge Q

$$1 = \int_0^\infty dt < A_1^\nu|\partial\cdot\partial'|A_{\nu 1} >= \frac{Q}{\sigma}\int_0^\infty dt < A_1^\mu|iA_1^{\nu *}\partial_\mu A_{\nu 1}/2 + cc. >, Q = 1 \tag{15.2}$$

$$1 = \int_0^\infty dt < A_n^\nu|\partial\cdot\partial'|A_{\nu n} >= \int_0^\infty dt < A_n^\mu|iA_n^{\nu *}\partial_\mu A_{\nu n}/2 + cc. >, \sigma = 1$$

then

$$1 = (< A_n^\nu|\partial\cdot\partial'|A_{\nu n} > |_0^t)^3 = (\int_0^\infty dt < A_n^\mu|iA_n^{\nu *}\partial_\mu A_{\nu n}/2 + cc. >)^2$$

$$1 = n^3(< A_1^\nu|\partial\cdot\partial'|A_{\nu 1} > |_0^t)^3 = n^2(\int_0^\infty dt < A_1^\mu|iA_1^{\nu *}\partial_\mu A_{\nu 1}/2 + cc. >)^2$$

$$(\int_0^\infty dt < A_1^\nu|\partial\cdot\partial'|A_{\nu 1} >)^3 = (\frac{Q}{\sigma}\int_0^\infty dt < A_1^\mu|iA_1^{\nu *}\partial_\mu A_{\nu 1}/2 + cc.|_0^t >)^2$$

$$\frac{Q}{\sigma} = n^{-1/2}$$

Substitute it into the equation 15.2 to find

$$n = 1$$

hence

$$1 = \int_0^\infty dt < A^\nu|\partial\cdot\partial'|A_\nu >$$

It's the normalization of one decaying particle, and it leads to the result between decay life and EM emission (also an interaction potential):

$$C = 1$$

The distribution shape of decay can be explain as

$$e^{-\Gamma t/2}e_x * \sum_i e_i = E_x * \sum_i e_i\cdot e^{-\Gamma t/2 - ik_x t}, 0 < t < \Delta$$

is the real wave of the particle x near the initial time. Expand it in that time span

$$\approx E_x * \sum_i e_i\cdot\int_{-\infty}^\infty dk\frac{Ce^{ikt}}{k - k_x + i\Gamma/2}$$

With calculation, we find the emission of each branch wave is the same.

16. Great Unification

The General Theory of Relativity is

$$R_{ij} - \frac{1}{2}Rg_{ij} = 8\pi GT_{ij}/c^4 \tag{16.1}$$

Firstly we redefine the unit second as S to simplify the equation 16.1

$$R_{ij} - \frac{1}{2}Rg_{ij} = T_{ij}$$

We observe that the co-variant curvature is

$$R_{ij} = F^*_{ik}F_j{}^k + g_{ij}F^*_{\mu\nu}F^{\mu\nu}/8$$

17. Conclusion

Fortunately, this model explained all the effects in the known world: strong, weak and electromagnetic effects, and even subclassify them further if not being to add new ones. In this model the only field is electromagnetic field, and this stands for the philosophical with the point of that unified world is from an unique source, all depend on a simple hypothesis: the current of matter in a system can be devised to analysis the e-charge current.

Except electron function my description of particles in fact is compatible with QED elementarily, but my theory isn't compatible to the theory of quarks. In fact, The electron function is a good promotion for the experimental model of proton that went up very early.

Underlining my calculations a fact is that the electron has the same phase (electron resonance), which the BIG BANG theory would explain, all electrons are generated in the same time and place, the same source.

References

[1] K. Nakamura et al. (Particle Data Group), JPG 37, 075021 (2010) (URL: http://pdg.lbl.gov)

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