MATTER THEORY OF EXPANDED MAXWELL EQUATIONS

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

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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 unit 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

$$s \to Cs =: \kappa : m_e = 1$$

We always use it.

2. Self-consistent Electrical-magnetic Fields

Try so-called expanded Maxwell equation for the free E-M field in mass-center frame

$$\partial \cdot \partial' A = ie_{/\sigma} A^{\nu *} \cdot \partial A_\nu /2 + cc. = -J, \quad e = 1 \tag{2.1}$$

and

$$\partial \cdot \partial' A = iA^{\nu *} \cdot \partial A_\nu /2 + cc. = -J, \quad \sigma = 1$$
$$\partial_\nu \cdot A^\nu = 0$$

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

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

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

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

With invariant normalization for one particle, this condition is found:

$$1 = |e_{/\sigma} \int_{0}^{\infty} dt < A^{\nu}, \partial \cdot \partial' A_{\nu} > | \tag{2.3}$$

unless the particle is eternal. It's deduced by the non-homogeneous equation 2.1.

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.

The decay to a stable state is calculated in isolated system. It's a process the EM energy $\varepsilon_t = \varepsilon - \varepsilon_f$ transfer to mechanical (kinetic) energy $E_k = \varepsilon_0 - \varepsilon_t$. With the matter number invariant normalization in space-time (2.3)

$$1 = \int_{0}^{\infty} e_{/\sigma} dt < A^{\nu}, \partial \cdot \partial' A_{\nu} >$$

$$= -\int_{0}^{\infty} e_{/\sigma} dt < A^{\nu}, J_{\nu} > /2 = -\int_{0}^{\infty} dt e_{/\sigma} \varepsilon_0 e^{-Ct}$$

hence

$$C = e_{/\sigma}\varepsilon_0$$

$$\varepsilon_t/\varepsilon_0 = e^{-Ct}$$

$\varepsilon_0 - \varepsilon_t$ is of cause the decrease of the crossing energy of all the decayed blocks.

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

$$f = R\Theta\Phi = R_l Y_{lm}$$

$$\Theta = P_l^m(\cos\theta), \Phi = \cos(\alpha + m\varphi)$$

$$R_l = N j_l(kr)$$

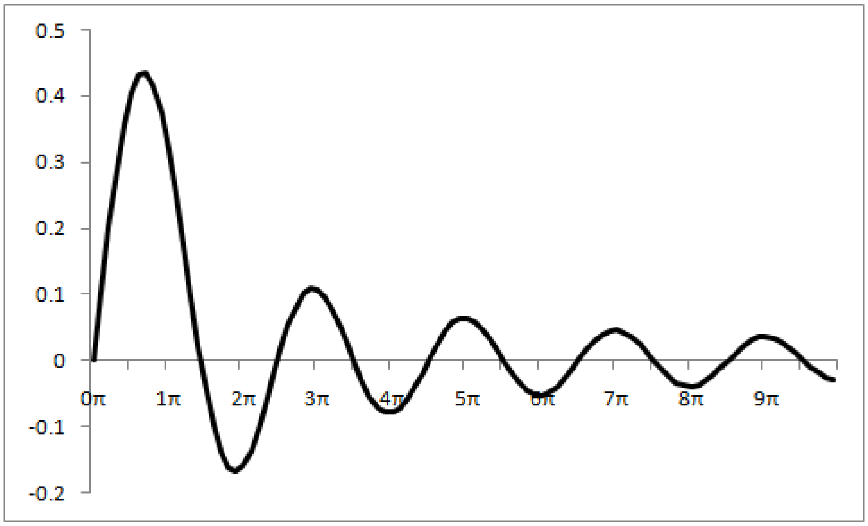

FIGURE 1. The function of j_1

$j_l(r)$ is spherical Bessel function.

$$j_1(r) = \frac{\sin(r)}{r^2} - \frac{\cos r}{r}$$

$$j_1(0) = 0$$

$$\int_0^\infty dr \cdot r^2 j_1(kr)|j_1(k'r) = Ck^{-2}\delta(k-k')$$

Define

$$F(x) := NR_1(r)Y_{1,1}(\theta, \varphi)$$

Use discrete coordinates to get more correct calculation:

$$< k^{3/2}F(kx), k^{3/2}F(kx) >= 1$$

$$k^{3/2}F(kx) * k^{3/2}F^*(kx) = \delta(kx) = \delta(x)/k^2$$

and

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

$$< F^n(x), F^n(x) >= 1$$

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

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

5. Electrons and Their Symmetries

Some states of electrical field A are defined as the core of the electron, which's the initial function $A_i = V$ that is electrical, for the re-substitution 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

$$e_{/\sigma} < e_c^\mu | i\partial_t | e_{\mu c} >= Q_c, e = 1$$
$$< \nabla e_\mu | \nabla e^\mu >= m_e$$

hence

$$< e_c^\mu | i\partial_t | e_{\mu c} >= Q_c, \sigma = 1$$
$$< e_\mu/\sigma \cdot \sigma | i\partial_t | e^\mu/\sigma \cdot \sigma >= \sigma e/Q_c$$

Then

$$|k_e| = m_e$$

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 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 $e_{/\sigma}\varepsilon$ on the coupling of e_r^+, e_r^- mainly between A_2 is

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

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 $e_{/\sigma}\varepsilon$ on the coupling of e_r^+, e_l^- mainly between A_4, is

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

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:

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

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

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 2.3 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 initial state

$$e_{xi} = NR_1(k_x x)Ye^{-ik_x t}$$

to get the dynamic state.

With the normalization conditions of charge

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

hence

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

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

and for the whole state

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

Then the MDM is

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

The harmonic wave behaves in Lorentz transform

$$e^{ipx} * e(x) = e^{ip'x'} * e(x')$$
$$p^\nu p_\nu = p'^\nu p'_\nu = 0$$

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 $\nabla e_\mu * \nabla e_\mu$,

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

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 is

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

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

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

The following particle is similar to π^0

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

11. Tau

The core of tauon maybe

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

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

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

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

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 $29 \times 64m_e$ [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)

$$m_\nu \omega^2 r \approx 3 \cdot 3 \cdot 2 \cdot (\varepsilon_e/2)m_e/(m_p r^2)$$
$$m_\nu = e_{/\sigma}^6 m_e$$

The EM energy emitted by neutrino is approximately

$$18^2 e_{/\sigma}^{6+4+2} m_e^3/(m_p^2 e_{/\sigma}^2) = \frac{1}{971s}/e_{/\sigma}$$

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
$emission-unit$	$-\varepsilon_e$	$-\varepsilon_e m_e/\|k_x\|$	$-\varepsilon_x$	$-\varepsilon_x m_e/\|k_x\|$	m_e

We analyze the mesons [1] as the following

$name$	$mass(MeV)$	$emission \cdot e_{/\sigma}$	$type$	$ratio$	$construction$
η	547	$7.9 \times 10^{-17}s$	L	2	$\pi^0 - class$
$K^\pm$	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	$-e_r^+ - e_r^-), (-ne_l^- - n'e_r^+))$
$D_S^\pm$	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	$54keV \cdot e_{/\sigma}$	$-$	$-$	$unclear$
J/φ	3096	$93keV \cdot e_{/\sigma}$	$-$	$-$	$unclear$
$others$	$-$	$-$	S	$-$	$-$

15. Great Unification

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 General Theory of Relativity is

$$R_{ij} - \frac{1}{2} R g_{ij} = 8\pi G T_{ij}/c^4 \tag{15.2}$$

Firstly we redefine the unit second as S to simplify the equation 15.2

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

We observe that the co-variant curvature is

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

16. 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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