Mass Model of Elementary Particles (viXra:2010.0252v2)

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Dedicated to Prof. Albert Sun-Chi Chan on the occasion of his 70th birthday

Abstract

In light of Chen's formulas of the fine-structure constant[2,3], we construct similar formulas to calculate proton and neutron to electron mass ratios, H, He and Li atoms to electron mass ratios and elementary particles to electron mass ratios. It was found that the formulas of elementary particles to electron mass ratios had two types, accordingly elementary particles were supposed to have two genders, i.e., Yang (convex) or Yin (concave), and the Yang/Yin ratio of all quarks and leptons is 1/2. Consequently, a hypothetical model called Mass Model of Elementary Particle was established. In the model, a formula of an elementary particle to electron mass ratio is consist of a Time Factor (TF) times a Space Factor (SF). A Time Factor is a single integer, a Space Factor has an integer plus or minus at least one modified sub-factor (called Sub-space Factor (SSF)), which decides the particle's gender is Yang or Yin. Based on the model, all elementary particles (including neutrinos and the particle of dark matter) to electron mass ratios were calculated, the mystery why quarks and leptons have three generations could be explained, and the mystery of matter and antimatter imbalance in the universe could be explained.

Keywords: elementary particles; mass, model; neutrino; matter and antimatter

1. Introduction

In physics, a dimensionless physical constant, sometimes called a fundamental physical constant, is a physical constant that is dimensionless[1]. It has no units attached and has a numerical value that is independent on the system of units used, cannot be derived from any more fundamental theory and are determined only from measurement. Standard Model of Physics requires 25 fundamental physical constants including the fine-structure constant α, 15 elementary particles to electron mass ratios and the others. The desire for a theory that would allow the calculation of particle mass is a core motivation to the search for "physics beyond Standard Model".

In our previous papers[2,3], we reported two series of formulas of the fine-structure constant giving two values of it. With them, we accurately calculated the ratio of Bohr radius to electron classic radius and hypothetically predicted the ratio of Bohr radius to proton charge radius as follows.

$$\frac{a_0}{r_e}=\frac{1}{\alpha_c^2}=\frac{1}{\alpha_1\alpha_2}=112\times(168-\frac{1}{3}+\frac{1}{12\cdot 47}-\frac{1}{14\cdot 112\cdot(2\cdot 173+1)})$$
$$=18788.865042381$$

$$\frac{a_0}{r_p}=\frac{1}{\alpha_{p/c}^2}=\frac{1}{\alpha_{p/1}\alpha_{p/2}}=225\cdot(282+\frac{1}{3}-\frac{1}{12\cdot 47}+\frac{1}{14\cdot 112\cdot(2\cdot 173+1)})$$
$$=63524.60147736$$

We here report the similar calculation of proton and neutron to electron mass ratios, H, He and Li atoms to electron mass ratios and elementary particles to electron mass ratios and establishing of a mass model of elementary particles.

2. Proton and Neutron to Electron Mass Ratio $\beta_{p/e}$ and $\beta_{n/e}$

CODATA[4]: $\beta_{p/e}=m_p/m_e=1836.15267343(11)$

$$\beta_{p/e-1}=m_p/m_e=\frac{1}{\alpha_{p/e}'^{\,2}}=\frac{1}{\alpha_{p/e,\theta}'\cdot\alpha_{p/e,\varphi}'}=\frac{1}{(\alpha_{p/e,1}\cdot\alpha_{p/e,2})^2}$$
$$=\{8\cdot[\frac{2}{3}(8+\frac{1}{29}-\frac{1}{4\cdot 53\cdot 113-\frac{19}{3\cdot 5\cdot 7}})]\}^2=1836.15267343002$$

$^{31}_{15}P_{16}$ $^{53}_{24}Cr_{29}$ $^{63,65}_{29}Cu_{34,36}$ $^{79,81}_{35}Br_{44,46}$ $^{95}_{42}Mo_{53}$ $^{106,112,113,116}_{48}Cd_{58,64,65,68}$ $^{113,115}_{49}In_{64,66}$ $^{127}_{53}I_{74}$
$^{138,139}_{57}La_{81,82}$ $^{223}_{87}Fr^*_{136}$ $^{226}_{88}Ra^*_{138}$ $^{268}_{105}Db^*_{163}$ $^{6\cdot 53,320}_{127}Ch^{ie}_{191,193}$ $^{12\cdot 29}_{138}Fy^{ie}_{210}$ $^{252}_{140}Ch^{ie}_{4\cdot 53}$ $^{374}_{148}Ch^{ie}_{226}$

$$\beta_{p/e-2}=m_p/m_e=[6\cdot(7+\frac{1}{7}-\frac{1}{2\cdot 9\cdot 49}+\frac{1}{2\cdot 19\cdot(6\cdot(4\cdot 19\cdot 29-1))})]^2=1836.15267343001$$

$^{12,13}_{6}C_{6,7}$ $^{14,15}_{7}N_{7,8}$ $^{19}_{9}F_{10}$ $^{28,29,30}_{14}Si_{14,15,16}$ $^{36,38,40}_{18}Ar_{18,20,22}$ $^{53}_{24}Cr_{29}$ $^{63,65}_{29}Cu_{34,36}$ $^{76}_{32}Se_{42}$ $^{87}_{38}Sr_{49}$
$^{95,98,100}_{42}Mo_{53,56,58}$ $^{113,115}_{49}In_{64,66}$ $^{188,189,190,192}_{76}Os_{112,113,114,116}$

CODATA[4]: $\beta_{n/e} = m_n / m_e = 1838.68366173(89)$

$$\beta_{n/e-1} = m_n / m_e = \frac{1}{(\alpha'_{n/e})^2} = \frac{1}{\alpha'_{n/e,\theta}\alpha'_{n/e,\varphi}}$$

$$= 8\cdot[\frac{2}{3}(8+\frac{1}{29}-\frac{1}{4\cdot 53\cdot 113-\frac{19}{105}})]\cdot 8\cdot[\frac{2}{3}(8+\frac{1}{21}-\frac{1}{25\cdot 19}+\frac{1}{74\cdot(34\cdot 193+1)+\frac{9}{13}})]$$

$$= 1838.68366167487$$

${}^{19}_{9}F_{10}$ ${}^{31}_{15}P_{16}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{39}_{19}K_{20}$ ${}^{53}_{24}Cr_{29}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{74,76,77,79,80,82}_{34}Se_{40,42,43,44,46,48}$ ${}^{85,87}_{37}Rb_{48,50}$

${}^{95}_{42}Mo_{53}$ ${}^{127}_{53}I_{74}$ ${}^{112,113}_{48}Cd_{64,65}$ ${}^{113,115}_{49}In_{64,66}$ ${}^{127}_{53}I_{74}$ ${}^{182}_{74}W_{108}$ ${}^{187,188,189,190,192}_{76}Os_{111,112,113,114,116}$

$$\beta_{n/e-2} = m_n / m_e = \frac{1}{(\alpha'_{n/e})^2} = \frac{1}{\alpha'_{n/e,\theta}\alpha'_{n/e,\varphi}}$$

$$= \{8\cdot[\frac{2}{3}(8+\frac{1}{25}-\frac{1}{191\cdot 223+\frac{23}{29}})]\}^2 = 1838.68366167487$$

${}^{50,51}_{23}V_{27,28}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{190,192}_{76}Os_{114,116}$ ${}^{191,193}_{77}Ir_{114,116}$ ${}^{223}_{87}Fr^{*}_{136}$ ${}^{289}_{115}Mc^{ie}_{174}$ ${}^{318-320}_{127}Ch^{ie}_{191-193}$ ${}^{16\cdot 23}_{145}Ch^{ie}_{223}$

$$\beta_{n/e-3} = m_n / m_e = \frac{1}{(\alpha'_{n/e})^2} = \frac{1}{\alpha'_{n/e,\theta}\alpha'_{n/e,\varphi}}$$

$$= [6\cdot(7+\frac{1}{6}-\frac{1}{49}+\frac{1}{2\cdot(4\cdot 17\cdot 19-1)+\frac{1}{9\cdot 7}})]^2 = 1838.68366167489$$

${}^{12,13}_{6}C_{6,7}$ ${}^{19}_{9}F_{10}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{64,68}_{30}Zn_{34,38}$ ${}^{113,115}_{49}In_{64,66}$ ${}^{151,153}_{63}Eu_{88,90}$ ${}^{166,170}_{68}Er_{98,102}$

3. H Atom to Electron Mass Ratio $\beta_{\text{H-atom/e}}$

$$\beta_{{}^1\mathrm{H}/e-1} = m_{{}^1H} / m_e = \frac{1.007825032241(94)\ u}{5.48579909070(16)\ u} = 1837.15264737(23)$$

$$\beta_{{}^1\mathrm{H}/e-1} = m_{{}^1H} / m_e = \frac{1}{\alpha'^{2}_{{}^1\mathrm{H}/e}} = \frac{1}{\alpha'_{{}^1\mathrm{H}/e,\theta}\cdot\alpha'_{{}^1\mathrm{H}/e,\varphi}} = \frac{1}{(\alpha_{{}^1\mathrm{H}/e,1}\cdot\alpha_{{}^1\mathrm{H}/e,2})^2}$$

$$= \{8\cdot[\frac{2}{3}(8+\frac{1}{27}-\frac{1}{16\cdot 9\cdot 17-\frac{1}{5}})]\}^2 = 1837.15264734930$$

${}^{19}_{9}F_{10}$ ${}^{32,33,34,36}_{16}S_{16,17,18,20}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{59}_{27}Co_{32}$ ${}^{63,65}_{19}Cu_{34,36}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{64,66,68}_{30}Zn_{34,36,38}$

${}^{80,82}_{34}Se_{46,48}$ ${}^{84}_{36}Kr_{48}$ ${}^{112}_{48}Cd_{64}$ ${}^{118}_{50}Sn_{68}$ ${}^{121,123}_{51}Sb_{70,72}$ ${}^{135,136,137,138}_{56}Ba_{79,80,81,82}$

${}^{151,153}_{63}Eu_{88,90}$ ${}^{168}_{68}Er_{100}$ ${}^{251}_{98}Cf^{*}_{153}$ ${}^{252}_{99}Es^{*}_{153}$ ${}^{6\cdot 64}_{153}Ch^{*}_{231}$

$$\beta_{{}^1\mathrm{H}/e-2} = m_{{}^1\mathrm{H}} / m_e = \frac{1}{\alpha'^2_{{}^1\mathrm{H}/e}} = \frac{1}{\alpha'_{{}^1\mathrm{H}/e,\theta} \cdot \alpha'_{{}^1\mathrm{H}/e,\varphi}} = \frac{1}{(\alpha_{{}^1\mathrm{H}/e,1} \cdot \alpha_{{}^1\mathrm{H}/e,2})^2}$$

$$= [6 \cdot (7 + \frac{1}{6} - \frac{1}{43} + \frac{1}{2 \cdot (4 \cdot 3 \cdot 7 \cdot 23 - 1) + \frac{1}{2 \cdot 17}})]^2 = 1837.15264734937$$

$${}^{42,43,46,48}_{20}Ca_{22,23,26,28} \quad {}^{50,51}_{23}V_{27,28} \quad {}^{76,77,80}_{34}Se_{42,43,46} \quad {}^{84,86}_{36}Kr_{48,50} \quad {}^{92,98}_{42}Mo_{52,56} \quad {}^{99}_{43}Tc^{*}_{56} \quad {}^{7\cdot 17}_{50}Sn_{69}$$

$${}^{136,137,138}_{56}Ba_{80,81,82} \quad {}^{144,146}_{60}Nd_{84,86} \quad {}^{168}_{68}Er_{100} \quad {}^{209}_{84}Po^{*}_{126} \quad {}^{222}_{86}Rn^{*}_{136} \quad {}^{14\cdot 17}_{92}U^{*}_{146} \quad {}^{8\cdot 43,346}_{136,137}Fy^{ie}_{208,209}$$

$$\beta_{{}^2\mathrm{H}/e} = m_{{}^2H} / m_e = \frac{2.01410177811(12)\ u}{5.48579909070(16)\ u} = 3671.48294134(32)$$

$$\beta_{{}^2\mathrm{H}/e-1} = m_{{}^2H} / m_e = 2 \cdot \{8 \cdot [\frac{2}{3}(8 + \frac{1}{30} + \frac{1}{23 \cdot (11 \cdot 19 + \frac{1}{21})})]\}^2 = 3671.482941116$$

$$\beta_{{}^2\mathrm{H}/e-2} = m_{{}^2H} / m_e = 2 \cdot \{6 \cdot [7 + \frac{1}{7} - \frac{1}{11 \cdot 47 + \frac{50}{69}}]\}^2 = 3671.482941131$$

$$\beta_{{}^3\mathrm{H}/e} = m_{{}^3H} / m_e = \frac{3.01604928199(23)\ u}{5.48579909070(16)\ u} = 5497.92150993(58)$$

$$\beta_{{}^3\mathrm{H}/e-1} = m_{{}^3H} / m_e = 3 \cdot \{8 \cdot [\frac{2}{3}(8 + \frac{1}{37} - \frac{1}{44 \cdot (83 + \frac{13}{12 \cdot 83})})]\}^2$$

$$= 5497.92151010397$$

$$\beta_{{}^3\mathrm{H}/e-2} = m_{{}^3H} / m_e = 2 \cdot \{6 \cdot [7 + \frac{1}{7} - \frac{1}{125} + \frac{1}{21 \cdot 25 \cdot 55 - \frac{30}{53}}]\}^2$$

$$= 5497.92151010346$$

4. He Atom to Electron Mass Ratio $\beta_{\mathrm{He/e}}$

$$\beta_{{}^3\mathrm{He}/e} = m_{{}^3He} / m_e = \frac{3.0160293191(26)\ u}{5.48579909070(16)\ u} = 5497.8851198(49)$$

$$\beta_{{}^3\mathrm{He}/e-1} = m_{{}^3He} / m_e = 3 \cdot \{8 \cdot [\frac{2}{3}(8 + \frac{1}{37} - \frac{1}{45 \cdot 74 - \frac{29}{59}}]\}^2 = 5497.88511862$$

$$\beta_{{}^3\mathrm{He}/e-2} = m_{{}^3He} / m_e = 3 \cdot \{6 \cdot [7 + \frac{1}{7} - \frac{1}{125} + \frac{1}{22 \cdot 33 \cdot 125}]\}^2 = 5497.88511864$$

$$\beta_{^4\mathrm{He}/e} = m_{^4He} / m_e = \frac{4.00260325415(16)\ u}{5.48579909070(16)\ u} = 7296.29938678(33)$$

$$\beta_{^4\mathrm{He}/e-1} = m_{^4He} / m_e = 4\cdot\{8\cdot[\frac{2}{3}(8+\frac{1}{125}-\frac{1}{56\cdot(15\cdot 44+1)+\frac{2\cdot 26}{5\cdot 21}}]\}^2$$

$$= 7296.29938673864$$

$$\beta_{^4\mathrm{He}/e-2} = m_{^4He} / m_e = 4\cdot[6\cdot(7+\frac{1}{8}-\frac{1}{3\cdot 49+\frac{1}{49\cdot(1+1/65)}}]^2$$

$$= 7296.29938673862$$

5. Li Atom to Electron Mass Ratio $\beta_{Li/e}$

$$\beta_{^6\mathrm{Li}/e} = m_{^6Li} / m_e = \frac{6.015122795(16)\ u}{5.48579909070(16)\ u} = 10964.898086(29)$$

$$\beta_{^6\mathrm{Li}/e-1} = 6\cdot\{8\cdot[\frac{2}{3}(8+\frac{1}{64}-\frac{1}{24\cdot(238+\frac{30}{29})}]\}^2 = 10964.8980865475$$

$$\beta_{^6\mathrm{Li}/e-2} = 6\cdot[6\cdot(7+\frac{1}{8}-\frac{1}{27\cdot(238+\frac{30}{29})})]^2 = 10964.8980865475$$

$$\beta_{^7\mathrm{Li}/e} = m_{^7Li} / m_e = \frac{7.0160034366(45)\ u}{5.48579909070(16)\ u} = 12789.3918837(86)$$

$$\beta_{^7\mathrm{Li}/e-1} = 7\cdot\{8\cdot[\frac{2}{3}(8+\frac{1}{68}-\frac{1}{35\cdot(4\cdot 37+\frac{99}{98})}]\}^2 = 12789.39188353$$

$$\beta_{^7\mathrm{Li}/e-2} = 7\cdot\{6\cdot[7+\frac{1}{8}-\frac{1}{4\cdot 11\cdot 23+\frac{27}{37}}]\}^2 = 12789.39188357$$

6. Formulas and Values of Elementary Particles to Electron Mass Ratios

Table 1. Formulas and Values of Elementary Particles to Electron Mass Ratios

Particles	**Meassured Mass(MeV/c^2)**	**Measured m/m$_e$**	**Formulas**	**Calculated m/m$_e$**
τ	1776.82	3.47715×10^3	$\beta_{\tau/e}=\{8[8-1+1/2-1/7+1/(72+14/39)]\}^2$	3477.19
μ	105.6583746	206.7682828	$\beta_{\mu/e}=\{4[4-1/2+1/10-1/(5\times39+14/31)]\}^2$	206.7682821
e	0.5109989461	1	$\beta_e=1+(\alpha_1\alpha_2)^2$	$1+2.8357\times10^{-9}$
t	$172.44(13)\times10^3$	3.3746×10^5	$\beta_{t/e}=[24(24+1/4-1/(22+3/25/11)]^2$	337456
b	$4.18(3)\times10^3$	8.18×10^3	$\beta_{b/e}=[10(10-1+1/(22+3/11)]^2$	8181
c	$1.29(+5,-11)\times10^3$	2.52×10^3	$\beta_{c/e}=[7(7+1/5-1/(44-9/22)]^2$	2524
s	95(5)	186	$\beta_{s/e}=[4(4-1+1/2-1/11)]^2$	186
u	2.01(14)	3.93	$\beta_{u/e}=2(2-1/32)$	3.94
d	4.79(16)	9.37	$\beta_{d/e}=3(3+1/8)$	9.38
ν_1			$\beta_{\nu_1/e}=1/\{55[55-1/2/(1-1/56)]\}^2$	1.11334×10^{-7}
ν_2	$\sum\leq1.20\times10^{-7}$	$\sum\leq2.35\times10^{-7}$	$\beta_{\nu_2/e}=1/[66(66-1/6)]^2$	5.2969×10^{-8}
ν_3	$\sum\geq0.60\times10^{-7}$	$\sum\geq1.17\times10^{-7}$	$\beta_{\nu_3/e}=1/\{66[68-1/3/(1-1/12)]\}^2$	5.0182×10^{-8}
ν_e	$m_1^2-m_2^2=2.51\pm0.50\times10^{-3}(eV/c^2)^2$		$\beta_{\nu_e/e}=1/[55(64-1/2+1/8-1/3/34+1/136/137)]^2$	8.1687×10^{-8}
ν_μ	$m_2^2-m_3^2=7.53\pm0.18\times10^{-5}(eV/c^2)^2$		$\beta_{\nu_\mu/e}=1/[66(57-1/6+1/2/29-1/29/181)]^2$	7.1031×10^{-8}
ν_τ			$\beta_{\nu_\tau/e}=1/[66[61-1/28+1/3/61/71)]^2$	6.1768×10^{-8}
H	$125.09(21)\times10^3$	2.4479×10^5	$\beta_{H/e}=[22(22+1/2-1/(94+33/49)]^2$	244795
Z	$91.1876(21)\times10^3$	1.78450×10^5	$\beta_{Z/e}=[20(22-1+1/8-1/2/9/17)]^2$	178451
W	$80.385(15)\times10^3$	1.5731×10^5	$\beta_{W/e}=[20(20-1/5+1/(33+1/40)]^2$	157296
D			$\beta_{D/e}=\{33[34+1/2-1/(26+5/21)]\}^2$	1293320

Notes: 1. $1/c_{au}^4=(\alpha_1\alpha_2)^2=[(1/137.035999037435)(1/137.035999111818)]^2=2.836\times10^{-9}$, c_{au} is the speed of light in atomic unites[2,3]; 2. In Measured Mass column, values for u and d are Lattice QCD calculated values; 3. D stands for the particle of dark matter.

7. General Formulas of Elementary Particles to Electron Mass Ratios

$$\beta_{ep/e} = m_{ep} / m_e = [TF(SF + \sum 1/SSF)]^{1,2,-2}$$

TF : Time Factor (Wheel Factor)

SF : Space Factor (Gear Factor)

SSF : Sub-space Factor (Cog Factor)

Table 2. Factors of Formulas of Elementary Particles to Electron Mass Ratios

Particles	TF	SF	1/SSF-1st	1/SSF-2nd	1/SSF-3rd	1/SSF-4th
t	24=3×7+3	24	4	22+3/25/11		
c	7=2×3+1	7	5	44-9/22		
d	3=2×1+1	3	32			
e	1	1	$1/(\alpha_1\alpha_2)^2$			
b	10=2×4+2	10	1	22+3/11		
τ	8=2×4	8	1	2	7	8×9
s	4=2×2	4	1	2	11	
μ	4=2×2	4	2	2×5	2×97	
u	2	2	8			
ν_1	55	55	2(1-1/56)			
ν_2	66	66	6			
ν_3	66	68	3(1-1/12)			
ν_e	55	64	2	8	3×34	136×137
ν_μ	66	57	6	2×29	29×181	
ν_τ	66	61	28	3×61×71		
D	33	34	2	26+5/21		
H	22=2×10+2	22	2	94+33/49		
Z	20=2×10	22	1	8	2×9×17	
W	20=2×10	20	5	33+1/40		

Notes: Azure indicates Yang particle and positive SSF;
Orange indicates Yin particle and negative SSF.

8. Mass Model of Elementary Particle

(1) A Formula of an elementary particle to electron mass ratio is basically consist of a Time Factor (TF) times a Space Factor (SF), and the later is modified by some Sub-space Factors (SSF). For example, the formula of Higgs Boson to electron mass ratio is: $\beta_{H/e}=\{22[22+1/2-1/(94+33/49)]\}^2=2244795$， in which TF=SF=22, SSF-1st=+1/2 and SSF-2nd=-1/(94+33/49). Time Factor is like a wheel, Space Factor is like a gear, Sub-space Factors (especially SSF-1st) are like cogs (convex and concave) in the gear.

(2) According to the positive or negative features of SSF-1st, elementary particles with mass can be classified into two types: Yang (+, Convex, azure), Yin (-, Concave, orange). And elementary particles without mass are Neutral (0, Smooth, white).

(3). As shown in **Table 2**, **Fig. 3** and **Fig. 4**, for elementary particles, fermion's ratio of Yang to Yin is 1/2, and boson's ratio of Yang to Yin to Neutral is 1/1/1. This can explain why quarks and leptons have three generations, because these 12 fermions (6 quarks plus 6 leptons) maintain Yang to Yin ratio to be 1/2 (4 Yang to 8 Yin) and also maintain ratio of positive to negative total amount of electric charges to be 1/2 (2 positive charges to 4 negative charges for quarks and leptons totally).

(4) If elementary particle switch to their anti-particles, the Yang feature of electron changes to Yin feature of positron, the Yin features of neutrinos change to Yang features of anti-neutrinos, and those of other particles do not change.

(5) A proton is consist of a u quark and two d quarks, the ratio of Yang to Yin in a proton is 1/2, the same as that for quarks and leptons, so proton is stable. A neutron is consist of two d quarks and a u quark, the ratio of Yang to Yin in a proton is 2/1, the opposite to that for quarks and leptons, so neutron is not stable.

(6) There should be a relationship between Higgs boson to electron mass ratio and the particle of dark matter to electron mass ratio as follows (**Fig. 1**). And hence, the particle of dark matter to electron mass ratio could be calculated out accordingly. In the following calculation, there are some integer factors which are assumed to relate to nuclides.

$$\frac{\beta_{H/e}+\beta_{D/e}}{\beta_{H/e}}=\frac{1293320+244795}{244795}=\frac{4\times5\times7\times31\times149+5\times173\times(6\times47+1)}{5\times173\times(6\times47+1)}$$

$$=\frac{1538115}{244795}=\frac{3\times5\times41^2\times61}{5\times173\times(6\times47+1)}\approx 6.2832778447\approx(2\pi)_{11315}$$

$$(2\pi)_{11315}=e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{11316}{11315})^{22631}}=e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{4\cdot3\cdot23\cdot41}{5\cdot31\cdot73})^{7\cdot53\cdot61}}$$

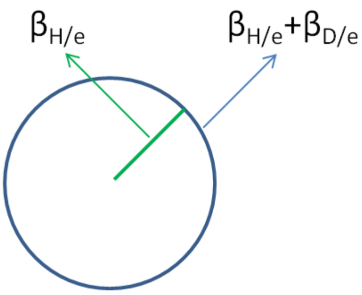
$${}^{50,51}_{23}V_{27,28}\quad {}^{61}_{28}Ni_{33}\quad {}^{3\cdot23,71}_{31}Ga_{38,40}\quad {}^{73}_{32}Ge_{41}\quad {}^{82,83}_{36}Kr_{46,47}\quad {}^{89}_{39}Y_{50}\quad {}^{90,92,94}_{40}Zr_{50,52,54}\quad {}^{3\cdot31}_{41}Nb_{52}\quad {}^{92,94,95,98}_{42}Mo_{50,52,53,56}$$

$${}^{100}_{44}Ru_{56}\quad {}^{107,109}_{47}Ag_{60,62}\quad {}^{112,115,119,120,122,124}_{50}Sn_{62,65,69,70,72,74}\quad {}^{125,126}_{52}Te_{73,74}\quad {}^{127}_{53}I_{74}\quad {}^{136,137,138}_{56}Ba_{80,81,82}\quad {}^{3\cdot47}_{59}\mathrm{Pr}_{2\cdot41}$$

$${}^{2\cdot73}_{61}Pm^{*}_{85}\quad {}^{149}_{62}Sm_{87}\quad {}^{155,156,157,158}_{64}Gd_{91,92,93,94}\quad {}^{169}_{69}Tm_{100}\quad {}^{173}_{70}Yb_{103}\quad {}^{180,181}_{73}Ta_{107,108}\quad {}^{185,187}_{75}\mathrm{Re}_{110,112}\quad {}^{4\cdot47}_{76}Os_{112}$$

$${}^{204,206,9\cdot23,208}_{82}Pb_{122,124,125,126}\quad {}^{209}_{83}Bi^{*}_{126}\quad {}^{227}_{89}Ac^{*}_{138}\quad {}^{5\cdot47,14\cdot17}_{92}U^{*}_{143,2\cdot73}\quad {}^{4\cdot61}_{94}Pu^{*}_{150}\quad {}^{257}_{100}Fm^{*}_{157}\quad {}^{262}_{103}Lr^{*}_{3\cdot53}\quad {}^{285}_{112}Cn^{*}_{173}$$

$${}^{312}_{125}Ch^{ie}_{187}\quad {}^{314}_{126}Ch^{ie}_{4\cdot47}\quad {}^{344,2\cdot173,348}_{136,137,138}Fy^{ie}_{208,209,210}\quad {}^{4\cdot89}_{141}Ch^{ie}_{215}\quad {}^{370}_{146}Ch^{ie}_{224}\quad {}^{4\cdot47}_{149}Ch^{ie}_{227}\quad {}^{400}_{157}Ch^{ie}_{243}\quad {}^{14\cdot31,435}_{173}Ch^{ie}_{261,262}$$



$\beta_{H/e}$: Higgs Boson to electron mass ratio

$\beta_{D/e}$: the particle of dark matter to electron mass ratio

$(\beta_{H/e}+\beta_{D/e})/\ \beta_{H/e}\approx 2\pi$

Mass Relationship of

Higgs Boson and the Particle of Dark Matter

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2020/10/28

Fig. 1

(7) Elementary particles except neutrinos to electron mass ratios should relate to Higgs boson to electron mass ratio, and neutrinos to electron mass ratios should relate to the particle of dark matter (D) to electron mass ratio as shown in **Table 2**.

(8) The relative mass of an electron could be defined as $1+(\alpha_1\alpha_2)^2$, and the relative mass of positron could be defined as $1-(\alpha_1\alpha_2)^2$. So electron is Yang particle and positron is Yin particle. The reactions at the Big Bang of the universe and the subsequent annihilation could be express as follows.

$$2\gamma_0 \longrightarrow e + e^+$$

$$e + e^+ \longrightarrow (m_r+m_d) + 2\,\gamma_1$$

In the above second equation, m_r corresponds to the mass of regular matter in the universe, and m_d corresponds to the mass of dark matter in the universe.

$$m_r+m_d=2(\alpha_1\alpha_2)^2\approx 5.6714\times 10^{-9}\approx(0.9026+4.7688)\times 10^{-9}$$

So in the universe after the Big Bang and subsequent annihilation of electron and positron, 0.90×10^{-9} of regular matter and 4.77×10^{-9} of dark matter survived.

$$(m_r+m_d)/m_r \approx (2\pi)_{11315}=6.2832778447$$

$$m_r/m_d \approx 0.9026/4.7688\approx 5.0659/26.7646$$

This can explain the mystery of matter and antimatter imbalance in the universe, and explain the composition of regular matter and dark matter in the universe (**Fig. 2**). And our results are consistent with the latest and most accurate measurements[5-10].

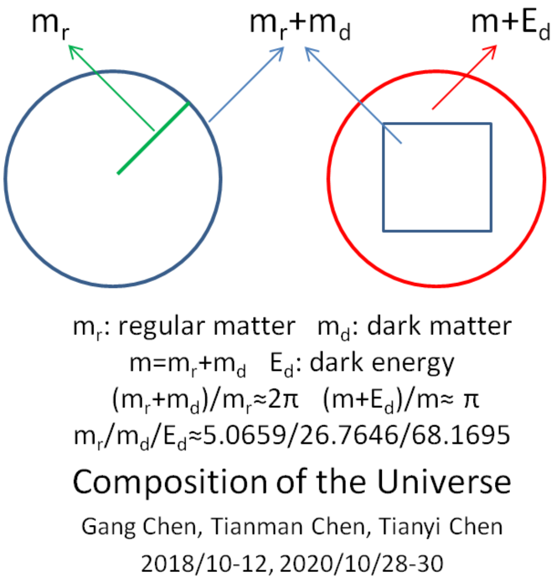

Fig. 2

(9) Calculation of neutrinos to electron mass ratios:

$$\beta_{\nu_1/e}=\frac{m_{\nu_1}}{m_e}=\frac{1}{[55(55-\frac{1}{2(1-\frac{1}{56})})]^2}=\frac{1}{(81\cdot 37)^2}=1.11334\times 10^{-7}$$

$$m_{\nu_1}=1.11334\times 10^{-7}m_e=5.6891\times 10^{-2}eV/c^2$$

$$\beta_{\nu_2/e}=\frac{m_{\nu_2}}{m_e}=\frac{1}{[66(66-\frac{1}{6}]^2}=\frac{1}{(55\cdot 79)^2}=5.2969\times 10^{-8}$$

$$m_{\nu_2}=5.2969\times 10^{-8}m_e=2.7067\times 10^{-2}eV/c^2$$

$$\beta_{\nu_3/e}=\frac{m_{\nu_3}}{m_e}=\frac{1}{[66(68-\frac{1}{3(1-\frac{1}{12})})]^2}=\frac{1}{(36\cdot 124)^2}=5.0182\times 10^{-8}$$

$$m_{\nu_3} = 5.0182\times10^{-8} m_e = 2.5643\times10^{-2} eV/c^2$$

$$m_{\nu_1} + m_{\nu_2} + m_{\nu_3} = 0.10960 eV/c^2$$

$$m_{\nu_1}{}^2 - m_{\nu_2}{}^2 = 2.5040\times10^{-3} eV^2/c^4 \qquad m_{\nu_2}{}^2 - m_{\nu_3}{}^2 = 7.5052\times10^{-5} eV^2/c^4$$

$^{7}_{3}Li_4$ $^{99}_{44}Ru_{55}$ $^{114,116}_{48}Cd_{66,68}$ $^{166-168}_{68}Er_{98-100}$ $^{28}_{14}Sii_{14}$ $^{50}_{22}Ti_{28}$ $^{52}_{24}Cr_{28}$ $^{61,62,64}_{28}Ni_{33,34,36}$
$^{66,67}_{30}Zn_{36,37}$ $^{84}_{36}Kr_{48}$ $^{85}_{37}Rb_{48}$ $^{72}_{32}Ge_{40}$ $^{124}_{52}Te_{72}$ $^{124,126}_{54}Xe_{70,72}$ $^{180}_{72}Tf_{108}$ $^{111}_{48}Cd_{63}$ $^{79}_{35}Br_{44}$
$^{135}_{56}Ba_{79}$ $^{137}_{56}Ba_{81}$ $^{205}_{81}Tl_{124}$

$$\begin{vmatrix} m_{\nu_e} & m_{\nu_\mu} & m_{\nu_t} \end{vmatrix} = \begin{vmatrix} \frac{m_{\nu_1}}{2} & \frac{m_{\nu_1}}{3} & \frac{m_{\nu_1}}{6} \\ \frac{m_{\nu_2}}{3} & \frac{m_{\nu_2}}{6} & \frac{m_{\nu_2}}{2} \\ \frac{m_{\nu_3}}{6} & \frac{m_{\nu_3}}{2} & \frac{m_{\nu_3}}{3} \end{vmatrix}$$

$$m_{\nu_e} = \frac{m_{\nu_1}}{2} + \frac{m_{\nu_2}}{3} + \frac{m_{\nu_3}}{6} = \frac{m_e}{2(81\cdot37)^2} + \frac{m_e}{3(55\cdot79)^2} + \frac{m_e}{6(36\cdot124)^2}$$

$$= \frac{m_e}{[55(64-1/2+1/8-1/3/34+1/136/137)]^2} = 8.1687\times10^{-8} m_e$$

$$m_{\nu_\mu} = \frac{m_{\nu_1}}{3} + \frac{m_{\nu_2}}{6} + \frac{m_{\nu_3}}{2} = \frac{m_e}{3(81\cdot37)^2} + \frac{m_e}{6(55\cdot79)^2} + \frac{m_e}{2(36\cdot124)^2}$$

$$= \frac{1}{[66(57-1/6+1/2/29-1/29/181)]^2} = 7.1031\times10^{-8} m_e$$

$$m_{\nu_t} = \frac{m_{\nu_1}}{6} + \frac{m_{\nu_2}}{2} + \frac{m_{\nu_3}}{3} = \frac{m_e}{6(81\cdot37)^2} + \frac{m_e}{2(55\cdot79)^2} + \frac{m_e}{3(36\cdot124)^2}$$

$$= \frac{1}{[66(61-1/28+1/3/61/71)]^2} = 6.1768\times10^{-8} m_e$$

$^{61}_{28}Ni_{33}$ $^{63,65}_{29}Cu_{34,36}$ $^{78}_{34}Se_{44}$ $^{99,102}_{44}Ru_{55,58}$ $^{114}_{48}Cd_{66}$ $^{142}_{58}Ce_{84}$ $^{167,170}_{68}Er_{99,102}$

(10) There should be relationships between factors of some elementary particles to electron mass ratios and nuclides.

$$\beta_{t/e} = [24(24 + \frac{1}{4} - \frac{1}{22 + \frac{3}{25\cdot11}})]^2 = 337456 = 16\cdot7\cdot23\cdot13$$

$^{23}_{11}Na_{12}$ $^{27}_{13}Al_{14}$ $^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ $^{50,51}_{23}V_{27,28}$ $^{54,56,58}_{26}Fe_{28,30,32}$ $^{58,60,61}_{28}Ni_{30,32,33}$
$^{96,99,100,104}_{44}Ru_{52,55,56,60}$ $^{110,112,113,114}_{48}Cd_{62,64,65,66}$ $^{136,137,138}_{56}Ba_{80,81,82}$ $^{187}_{75}\mathrm{Re}_{112}$ $^{285}_{112}Cn^{*}_{173}$

$$\beta_{b/e} = [10(10 - 1 + \frac{1}{22 + \frac{3}{11}})]^2 = 8181 = 81\cdot101$$

$^{19}_{9}F_{10}$ $^{20,21,22}_{10}Ne_{10,11,12}$ $^{23}_{11}Na_{12}$ $^{50,51}_{23}V_{27,28}$ $^{79,81}_{35}Br_{44,46}$ $^{98,99,100,101}_{44}Ru_{54,55,56,57}$ $^{137}_{56}Ba_{81}$
$^{171,173}_{70}Yb_{101,103}$ $^{203,205}_{81}Tl_{122,124}$

$$\beta_{c/e} = [7(7+\frac{1}{5}-\frac{1}{44-\frac{9}{22}})]^2 = 2524 = 8\cdot(2\cdot9\cdot5\cdot7+1)$$

${}^{63,65}_{29}Cu_{34,36}$ ${}^{79,81}_{35}Br_{44,46}$ ${}^{98,99,100,104}_{44}Ru_{54,55,56,60}$ ${}^{108,110,111,112,114}_{48}Cd_{60,62,63,64,66}$ ${}^{151,153}_{63}Eu_{88,90}$

$$\beta_{D/e} = [33(34+\frac{1}{2}-\frac{1}{26-\frac{5}{21}})]^2 = 1293320 = 4\cdot5\cdot7\cdot31\cdot149$$

${}^{27}_{13}Al_{14}$ ${}^{31}_{15}P_{16}$ ${}^{54,56,57}_{26}Fe_{28,30,31}$ ${}^{58,60,61,62}_{28}Ni_{30,32,33,34}$ ${}^{69,71}_{31}Ga_{38,40}$ ${}^{75}_{33}As_{42}$ ${}^{76,78}_{34}Se_{42,44}$ ${}^{79,81}_{35}Br_{44,46}$
${}^{149}_{62}Sm_{87}$ ${}^{4\cdot47}_{149}Ch^{ie}_{227}$

$$\beta_{H/e} = [22(22+\frac{1}{2}-\frac{1}{2\cdot47+\frac{33}{49}})]^2 = 244795 = 5\cdot173\cdot(6\cdot47+1)$$

${}^{23}_{11}Na_{12}$ ${}^{47,49}_{22}Ti_{25,27}$ ${}^{80,82,83,84,86}_{36}Kr_{44,46,47,48,50}$ ${}^{85,87}_{37}Rb_{48,50}$ ${}^{107,109}_{47}Ag_{60,62}$ ${}^{113,115}_{49}In_{64,66}$ ${}^{3\cdot47}_{59}\mathrm{Pr}_{82}$
${}^{4\cdot47}_{76}Os_{112}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{286}_{113}Nh^{ie}_{173}$ ${}^{2\cdot173}_{137}Fy^{ie}_{209}$ ${}^{4\cdot47}_{149}Ch^{ie}_{227}$ ${}^{14\cdot31,15\cdot29}_{173}Ch^{ie}_{9\cdot29,2\cdot131}$

$$\beta_{Z/e} = [20(22-1+\frac{1}{8}-\frac{1}{2\cdot9\cdot17})]^2 = 178451 = 7\cdot13\cdot37\cdot53$$

${}^{16,17,18}_{8}O_{8,9,10}$ ${}^{27}_{13}Al_{14}$ ${}^{32,33,34,36}_{16}S_{16,17,18,20}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{36,38,40}_{18}Ar_{18,20,22}$ ${}^{53}_{24}Cr_{29}$ ${}^{63,65}_{29}Cu_{34,36}$
${}^{58,60,61,62,64}_{28}Ni_{30,32,33,34,36}$ ${}^{64,66,67,68,70}_{30}Zn_{34,36,37,38,40}$ ${}^{85,87}_{37}Rb_{48,50}$ ${}^{94,95,98}_{42}Mo_{52,53,56}$ ${}^{127}_{53}I_{74}$

$$\beta_{W/e} = [20(20-1+\frac{1}{5}-\frac{1}{33})]^2 = 157296 = 16\cdot3\cdot29\cdot113$$

${}^{23}_{11}Na_{12}$ ${}^{28,29,30}_{14}Si_{14,15,16}$ ${}^{32,33,36}_{16}S_{16,17,20}$ ${}^{40,42,43,44,46,48}_{20}Ca_{20,22,23,24,26,28}$ ${}^{53}_{24}Cr_{29}$ ${}^{63,65}_{29}Cu_{34,36}$
${}^{106,108,110,111,112,113,114,116}_{48}Cd_{58,60,62,63,64,65,66,68}$ ${}^{113,115}_{49}In_{64,66}$ ${}^{188,189}_{76}Os_{112,113}$ ${}^{286}_{113}Nh^{ie}_{173}$

$$\beta_{H/e} + \beta_{D/e} = 1293320 + 244795 = 1538115 = 3\cdot5\cdot41^2\cdot61$$

${}^{31}_{15}P_{16}$ ${}^{58,60,61}_{28}Ni_{30,32,33}$ ${}^{73}_{32}Ge_{41}$ ${}^{93}_{41}Nb_{52}$ ${}^{107,109}_{47}Ag_{60,62}$ ${}^{145,146,147}_{61}Pm^{*}_{84,85,86}$ ${}^{203,205}_{81}Tl_{122,124}$

(11) It seems there is a conservation law for numbers of Yin and Yang of elementary particles in some particle reactions, for examples:

$$2p + 2\gamma \rightarrow {}^{2}H^{+} + e^{+} + \nu_e$$
$$2(uud) + 2\gamma \rightarrow (uud)(uud) + e + e^{+} \rightarrow (uud)(udd) + e^{+} + \nu_e$$
$$n \rightarrow p + e + \bar{\nu}_e$$
$$(udd) \rightarrow (uud) + e + e^{+} + \bar{\nu}_e \rightarrow (uud) + e + \bar{\nu}_e$$

In the above reaction, it is supposed that 1 Yang and 1 Yin should neutralize each other or 1 Yang and 1 Yin should be created simultaneously. So the net numbers of Yang and Yin before and after a particle reaction are conserved. But this kind of conservation is not always obeyed. There should be some ultra-restrictions.

$$\mu \rightarrow e + \bar{\nu}_e + \nu_\mu \qquad \mu^{+} \rightarrow e^{+} + \nu_e + \bar{\nu}_\mu$$

9. Figure of Mass Model of Elementary Particles

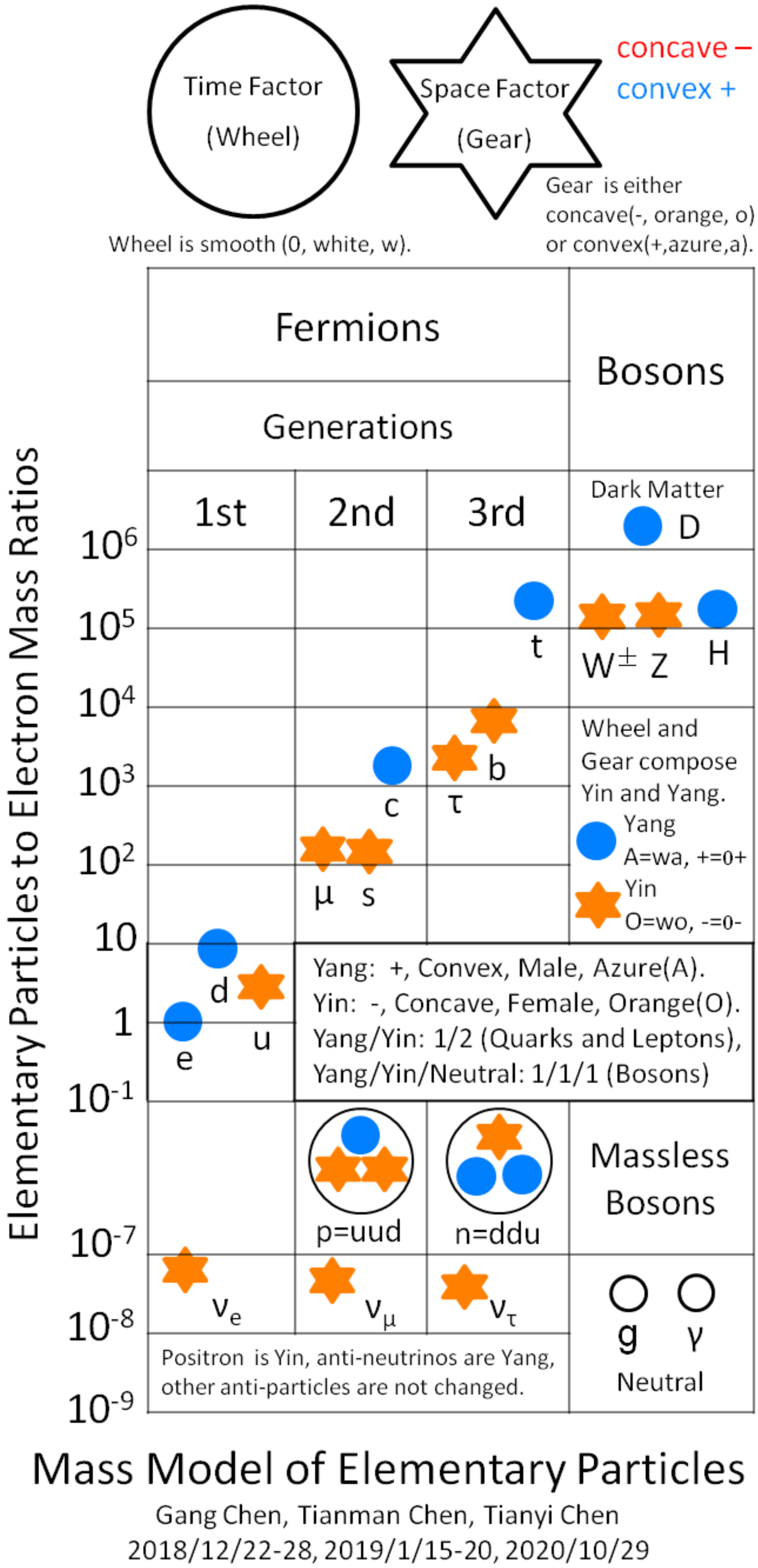

Fig. 3

10. Table of Elementary Particles

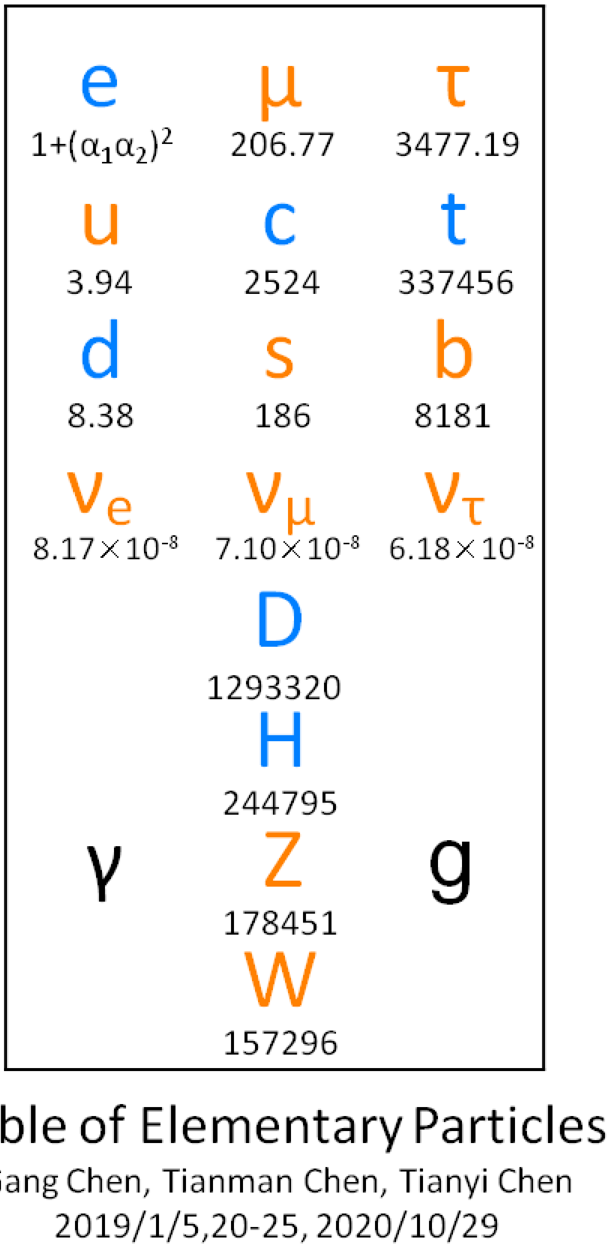

Fig. 4

Table 3. Coupling of Electric Charges and Yang-Yin Ratios of Quarks and Leptons and the reason why quarks and leptons have three generations.

Quarks and Leptons	Electric Charges	Yang-Yin Ratios
ν_e, ν_μ, ν_τ	0	0/3
d, s, b quarks	-1/3	1/2
u, c, t quarks	+2/3	2/1
e, μ, τ	-1	1/2
Total	+2/-4=+1/-2	4/8=1/2

11. Supplements

(1) Nutron to proton mass ratio:

$$m_n / m_p = \frac{\beta_{n/e}}{\beta_{p/e}} = \frac{1838.68366167489}{1836.15267343002} = 1.00137841927934$$

$$= 1 + \frac{1}{25 \cdot 29} + \frac{1}{13 \cdot 173 \cdot (6 \cdot 83 + 1) + \frac{5 \cdot 7}{4 \cdot 9}}$$

${}^{7}_{3}Li_{4}$ ${}^{9}_{4}Be_{5}$ ${}^{10,11}_{5}B_{5,6}$ ${}^{12,13}_{6}C_{6,7}$ ${}^{14,15}_{7}N_{7,8}$ ${}^{19}_{9}F_{10}$ ${}^{20,21,22}_{10}Ne_{10,11,12}$ ${}^{24,25,26}_{12}Mg_{12,13,14}$ ${}^{27}_{13}Al_{14}$

${}^{28,29,30}_{14}Si_{14,15,16}$ ${}^{39}_{19}K_{20}$ ${}^{40,41,42,46,48}_{20}Ca_{20,21,22,26,28}$ ${}^{45}_{21}Sc_{24}$ ${}^{47}_{22}Ti_{25}$ ${}^{55}_{25}Mn_{30}$ ${}^{54,56,58}_{26}Fe_{28,30,32}$

${}^{58,60,64}_{28}Ni_{30,32,36}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{69,71}_{31}Ga_{38,40}$ ${}^{79,81}_{35}Br_{44,46}$ ${}^{83,84}_{36}Kr_{47,48}$ ${}^{89}_{39}Y_{50}$ ${}^{90,91,92}_{40}Zr_{50,51,52}$

${}^{103}_{45}Rh_{58}$ ${}^{107,109}_{47}Ag_{60,62}$ ${}^{133}_{55}Cs_{78}$ ${}^{137}_{56}Ba_{81}$ ${}^{143,144,145,150}_{60}Nd_{83,84,85,90}$ ${}^{151,153}_{63}Eu_{88,90}$ ${}^{173}_{70}Yb_{103}$

${}^{185,187}_{75}\mathrm{Re}_{110,112}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{232}_{90}Th^{*}_{142}$ ${}^{262}_{103}Lr^{*}_{159}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{2\cdot173}_{137}Fy^{ie}_{209}$ ${}^{14\cdot31,15\cdot29}_{173}Ch^{ie}_{9\cdot29,262}$

(2) Why is there ratio of 1/2 of positive-negative electric charges and Yang-Yin particles in quarks and leptons?

The reason should be that elementary particles are "living" in time and space, time is of one dimension with only one piece of 2π in it, and space is of three dimensions with two pieces of 2π in it. The ratio of the pieces of 2π in time and space is 1/2, this should lead the ratios of positive-negative electric charges and Yang-Yin particles in quarks and leptons to be 1/2 (**Fig. 5**). In **Fig. 5**, ±2π means one can get forwards and backwards in space, and +2π means one can only get forwards in time.

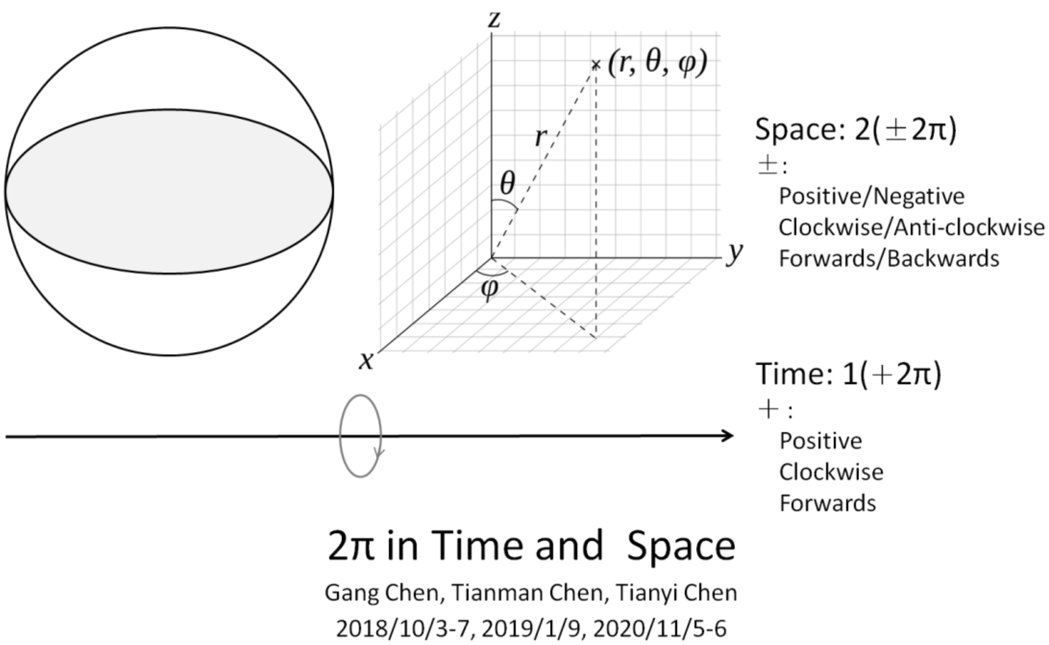

Fig. 5

(3) Why is the general formula of proton, neutron, H/He/Li atoms and elementary particles to electron mass ratios as follows.

$$\beta = \frac{m}{m_e} = \frac{1}{(\alpha'_\theta \alpha'_\varphi)^{1/2,1,-1}} = \frac{1}{(\alpha')^{1,2,-2}} = \frac{1}{(\alpha'_1 \alpha'_2)^{1,2,-2}}$$
$$= [TF(SF + \sum 1/SSF)]^{1,2,-2}$$

As stated in our previous papers[2,3], the ratio of Bohr radius of hydrogen atom to electron classic radius is as follows.

$$\frac{a_0}{r_e} = \frac{1}{\alpha_c^2} = \frac{1}{\alpha_1 \alpha_2} = 112 \times (168 - \frac{1}{3} + \frac{1}{12 \cdot 47} - \frac{1}{14 \cdot 112 \cdot (2 \cdot 173 + 1)})$$
$$= 18788.865042381$$

$$\alpha_1 = \frac{36}{7 \cdot (2\pi)_{112}} \frac{1}{112 + \frac{1}{75^2}} = 1/137.035999037435$$

$$\alpha_2 = \frac{13 \cdot (2\pi)_{278}}{100} \frac{1}{112 - \frac{1}{3 \cdot 29 \cdot 64}} = 1/137.035999111818$$

$$(2\pi)_k = e^2 \frac{e^2}{(\frac{2}{1})^3} \frac{e^2}{(\frac{3}{2})^5} \frac{e^2}{(\frac{4}{3})^7} \cdots \frac{e^2}{(\frac{k+1}{k})^{2k+1}}$$

These formulas should be supposed to correspond to a piece of 2π in space as there is a 2π factor in each of α_1 and α_2 and they balance each other in the first equation.

As the shape of proton, neutron, H/He/Li atoms and elementary particles should be spherical, so it is supposed that their mass should be proportional to their sphere in which there should be two pieces of 2π (**Fig. 5**), and hence the general formula of them to electron mass ratios is assumed to be similar to that of Bohr radius to electron classic radius but usually squared or even minus squared. This is just a reasonable illustration rather than a proof.

12. Discussion and Conclusion

According to Time Factors and Space Factors in **Table 2**, Higgs boson (H) should relate to elementary particles with mass except neutrinos, and the particle of dark matter (D) should relate to neutrinos. Or it seems that neutrinos would be the bridge between other regular elementary particles and the particle of dark matter.

The Sub-space Factors of u and d quarks (8 and 32) seem to relate to the Space Factor of ν_e (64), this would imply that u and d quarks contain ν_e in their "cogs". Neutrinos seem to be the gender factors of other elementary particles with mass. Electron would contain neutrino but they should be integral and inseparable.

In the formulas of the relative mass of electron and positron, $\beta_e=1+(\alpha_1\alpha_2)^2$ and $\beta_{e+}=1-(\alpha_1\alpha_2)^2$, there is $(\alpha_1\alpha_2)^2$ term and $1/c_{au}{}^4=(\alpha_1\alpha_2)^2$, c_{au} is the speed of light in atomic unites[2,3]. It is noticed that there is also c^4 factor in Einstein's field equation of general relativity. So we suppose that there would be some subtle relationships between the mass of electron and general relativity.

$$\beta_e = 1+(\alpha_1\alpha_2)^2 = 1+\frac{1}{c_{au}{}^4} \quad \beta_{e^+} = 1-(\alpha_1\alpha_2)^2 = 1-\frac{1}{c_{au}{}^4}$$

c_{au}: the speed of light in atomic unites

Einstein's Field Equation of General Relativity:

$$G_{\mu\nu} + g_{\mu\nu}\Lambda = \frac{8\pi G}{c^4}T_{\mu\nu}$$

For atomic nuclei, there should be similar time-space model, for example, the four stable nuclides of Fe can be expressed as 26(30/-2,0,1,2). For atoms, the situation is analogous, Na^+ can be express as 11(11-1) and Cl^- can be expressed as 17(17+1). This similarity in different areas indicates our Mass Model of Elementary Particles should be reasonable and has principle meanings.

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Appendix I: Research History

Items	Page	Discover/Create	Revise/Supplement
$\beta_{p/e-1}$	2	2018/10/11-14	2019/1/22,27, 2020/11/3-4
$\beta_{p/e-2}$	2	2019/1/8	2019/1/22,27, 2020/11/3-4
$\beta_{n/e-1}$	3	2018/11/19-20	2019/1/22, 2020/11/3-4
$\beta_{n/e-2}$	3	2019/1/17,22	2020/11/3-4
$\beta_{n/e-3}$	3	2019/1/8,22	2020/11/3-4
$\beta_{^1H/e-1}$	3	2018/12/14	
$\beta_{^1H/e-2}$	3	2019/1/8,22	2019/8/29
$\beta_{^2H/e-1}$	4	2018/12/14	2019/1/22
$\beta_{^2H/e-2}$	4	2019/1/9,17,22	
$\beta_{^3H/e-1}$	4	2018/12/15	
$\beta_{^3H/e-2}$	4	2019/1/9	
$\beta_{^3He/e-1}$	4	2018/12/19	2019/1/20
$\beta_{^3He/e-2}$	4	2019/1/9	
$\beta_{^4He/e-1}$	5	2018/12/19	2019/1/23
$\beta_{^4He/e-2}$	5	2019/1/8	2019/1/23
$\beta_{^6Li/e-1}$	5	2018/12/19	
$\beta_{^6Li/e-2}$	5	2019/1/9	2019/1/21
$\beta_{^7Li/e-1}$	5	2018/12/19	
$\beta_{^7Li/e-2}$	5	2019/1/9-10	2019/1/21
Table 1	6	2018/12/21-26	2019/1/5, 2020/10/15,24-25
$\beta_{\mu/e}$	6	2018/12/17-20,22	
$\beta_{\tau/e}$	6	2018/12/17-20,22	
β_{e}	6	2018/12/27	2019/1/2, 2020/10/15
$\beta_{t/e}$	6	2018/12/21-22	2020/10/24-25
$\beta_{b/e}$	6	2018/12/21-22	2020/10/24-25
$\beta_{c/e}$	6	2018/12/21-22	
$\beta_{s/e}$	6	2018/12/21-22	
$\beta_{u/e}$	6	2018/12/21-22	
$\beta_{d/e}$	6	2018/12/21-22	
$\beta_{\nu_1/e}$	6	2018/12/29-30	2019/1/2
$\beta_{\nu_2/e}$	6	2018/12/29-30	2019/1/2
$\beta_{\nu_3/e}$	6	2018/12/29-30	2019/1/2
$\beta_{\nu_e/e}$	6	2019/1/15-19	
$\beta_{\nu_\mu/e}$	6	2019/1/15-19	

$\beta_{\nu_\tau/e}$	6	2019/1/15-19	
$\beta_{H/e}$	6	2018/12/30	2019/1/24-25, 2020/10/24-25
$\beta_{Z/e}$	6	2018/12/21-22	2020/10/24-25
$\beta_{W/e}$	6	2018/12/21-22	
$\beta_{D/e}$	6	2019/1/19,23-24	2019/4/17,5/7-11,5/22-24 2019/9/29, 2020/10/24-25
Table 2	7	2018/12/22-26	2020/10/24-25
Mass Model of Elementary Particles	8-12	2018/12/22-28	2019/1/15-20,4/20 2020/10/15,24-25
explain three generations with Yang/Yin	8	2019/1/2-3	
explain three generations with +/- electric charge	8	2019/1/4-5	
Relationships between $(\beta_{H/e}+\beta_{D/e})/\beta_{H/e}$ and nuclides	8-9	2020/10/28	
Fig. 1	9	2020/10/28	
Fig. 2	10	2018/10-12	2020/10/28
Relationships between β and nuclides	11-12	2020/10/24-25,28	
Figure of Mass Model of elementary particle	13	2018/12/22-28	2019/1/15-20, 2020/10/29
Table 2	14	2019/1/5,20-25	2020/10/29
Table 3	14	2020/11/2-3	
Supplements (1)	15	2020/11/4	
Supplements (2)	15	2020/11/4-6	
Fig. 5	15	2018/10/3-7	2019/1/9, 2020/11/5-6
Supplements (3)	15-16	2018/10/3-7	2019/1/9, 2020/11/5
Preparing of this paper	1-20	2018/10/11-2020/11/6	

Notes: Dates were recorded according to Beijing Time.