Concise Formulas of the Anomalous Magnetic Moment of Electron/Muon/Tauon and the Fine-structure Constant

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

Abstract

This paper is a subsequent paper to our previous paper "Schrödinger Equation of Hydrogen Atom in Atomic Unites, Theory of Chirality and the Territory of Modern Physics" (viXra:2103.0088v3). In the end of it, we gave some preliminary formulas and values of the anomalous magnetic moment (a=(g-2)/2) of electron and muon. In this paper, we test the value of the anomalous magnetic moment of electron (a_e) given in the previous paper by a new method which employs our formulas of the fine-structure constant and quantization of 2π, and hence we have verified the value to be precise and give a concise formula of the anomalous magnetic momentum of electron (a_e) and the fine-structure constant (α_2). The same formulas for muon and tauon are also given.

Keywords: formula; value; the anomalous magnetic moment; electron; muon; tauon; the fine-structure constant.

1. Introduction

In our previous paper[1], we gave a new formula of the anomalous magnetic moment of electron (a_e) and suppose it to relate to nuclides.

$$a_e = \frac{g_e - 2}{2} = \frac{1}{2\cdot(16\cdot 27-1)} - \frac{1}{2\cdot 7\cdot 11\cdot(16\cdot 3\cdot(4\cdot 7\cdot 11-1)+1)} = 0.00115965218134781$$

$${}^{16,17,18}_{8}O_{8,9,10}\quad {}^{23}_{11}Na_{12}\quad {}^{28,30}_{14}Si_{14,16}\quad {}^{32,33,34,36}_{16}S_{16,17,18,20}\quad {}^{46,48,49,50}_{22}Ti_{24,26,27,28}\quad {}^{54}_{26}Fe_{28}\quad {}^{59}_{27}Co_{32}$$

$${}^{60,61,64}_{28}Ni_{32,33,36}\quad {}^{72,74,76}_{32}Ge_{40,42,44}\quad {}^{75}_{33}As_{42}\quad {}^{96}_{42}Mo_{54}\quad {}^{98,100}_{44}Ru_{54,56}\quad {}^{131}_{54}Xe_{77}$$

CODATA recomended values: $a_e = \frac{g_e - 2}{2} = 0.00115965218128(18)$

With theoretical and experimental values of the anomalous magnetic moment of electron (a_e), physicists can calculate the fine-structure constant (α) by means of Quantum Electrodynamics (QED) and Standard Model (SM). However, the calculation is much complicated. In this paper, we introduce a simply method to connect the anomalous magnetic moment of electron (a_e) and the fine-structure constant (α_2), and give a concise formula of them. This method is also applied to muon and tauon.

2. A Concise Formula of the Anomalous Magnetic Moment of Electron and the Fine-structure Constant

In December 1947, Schwinger gave the first formula between the anomalous magnetic moment of electron and the fine-structure constant as follows based on Quantum Electrodynamics[2].

$$a_e \approx \frac{\alpha}{2\pi}$$

However, the subsequently developed more precise calculation methods are much complicated and usually demand super-computer[3-7]. And if the experiment determined a_e is not enough accurate, the calculated α shouldn't be satisfying precise either.

In our previous papers[1,8-14], we gave many formulas of the fine-structure constant, the two most typical formulas along with our 2π-e formula are listed as follows.

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

$$\alpha_2 = \frac{13\cdot(2\pi)_{Chen-278}}{100}\frac{1}{112-\frac{1}{64\cdot3\cdot29}} = 1/137.035999111818$$

$$2\pi - e \text{ formula: } (2\pi)_{Chen-k} = e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{k+1}{k})^{2k+1}}$$

In these formulas, we developed a methodology that the natural constant 2π was quantized, i. e., 2π-e formula could only adopt definite natural number k rather than infinity. So, with Schwinger formula and our 2π quantization method, we can construct the relationship formula between the anomalous magnetic moment of electron (a_e) and the fine-structure constant (α_2) as follows.

$$a_e = \frac{\alpha_2 \gamma_e}{(2\pi)_{Chen-109}} = \frac{\alpha_2 (1 + \frac{1}{25 \cdot 11 \cdot 47 \cdot 109})}{(2\pi)_{Chen-109}}$$

$$= \frac{1 + \frac{1}{11 \cdot 25 \cdot 47 \cdot 109}}{137.035999111818 \cdot 6.29271247440151} = 0.00115965218134971$$

$$a_e = \frac{\alpha_2 \gamma_e}{(2\pi)_{Chen-109}} = \frac{(\frac{13 \cdot (2\pi)_{Chen-278}}{100} \frac{1}{112 - \frac{1}{64 \cdot 3 \cdot 29}})(1 + \frac{1}{25 \cdot 11 \cdot 47 \cdot 109})}{(2\pi)_{Chen-109}}$$

$$= \frac{13 \cdot (2\pi)_{Chen-278}}{100 \cdot (2\pi)_{Chen-109}} \frac{(1 + \frac{1}{25 \cdot 11 \cdot 47 \cdot 109})}{112 - \frac{1}{64 \cdot 3 \cdot 29}}$$

$$= \frac{13 \cdot e^2 \frac{e^2}{(\frac{2}{1})^3} \frac{e^2}{(\frac{3}{2})^5} \frac{e^2}{(\frac{4}{3})^7} \cdots \frac{e^2}{(\frac{9 \cdot 31}{278})^{557}}}{100 \cdot e^2 \frac{e^2}{(\frac{2}{1})^3} \frac{e^2}{(\frac{3}{2})^5} \frac{e^2}{(\frac{4}{3})^7} \cdots \frac{e^2}{(\frac{110}{109})^{3 \cdot 73}}} \frac{(1 + \frac{1}{25 \cdot 11 \cdot 47 \cdot 109})}{112 - \frac{1}{64 \cdot 3 \cdot 29}} = 0.00115965218134971$$

${}^{23}_{11}Na_{12}$ ${}^{27}_{13}Al_{14}$ ${}^{46,47,48,50}_{22}Ti_{24,25,26,28}$ ${}^{50,52,53,54}_{24}Cr_{26,28,29,30}$ ${}^{55}_{25}Mn_{30}$ ${}^{54,56,57,58}_{26}Fe_{28,30,31,32}$ ${}^{63,65}_{29}Cu_{34,36}$

${}^{83,84}_{36}Kr_{47,48}$ ${}^{89}_{39}Y_{50}$ ${}^{93}_{41}Nb_{52}$ ${}^{99,100,102}_{44}Ru_{55,56,58}$ ${}^{107,109}_{47}Ag_{60,62}$ ${}^{110,112}_{48}Cd_{62,64}$ ${}^{112,114,116}_{50}Sn_{62,64,66}$ ${}^{125}_{52}Te_{73}$

${}^{133}_{55}Cs_{78}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{140,142}_{58}Ce_{82,84}$ ${}^{149,150}_{62}Sm_{87,88}$ ${}^{157,158}_{64}Gd_{93,94}$ ${}^{169}_{69}Tm_{100}$ ${}^{185,187}_{75}Re_{110,112}$

${}^{186,4\cdot 47,192}_{76}Os_{110,112,116}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{223}_{87}Fr^{*}_{136}$ ${}^{226}_{88}Ra^{*}_{138}$ ${}^{227}_{89}Ac^{*}_{138}$ ${}^{5\cdot 47,238}_{92}U^{*}_{143,146}$ ${}^{257}_{100}Fm^{*}_{157}$

${}^{278}_{109}Mt^{*}_{169}$ ${}^{287}_{112}Cn^{*}_{173}$ ${}^{24\cdot 13}_{125}Ch^{ie}_{187}$ ${}^{2\cdot 157}_{126}Ch^{ie}_{4\cdot 47}$ ${}^{344,2\cdot 173,12\cdot 29}_{136,137,138}Ch^{ie}_{208,209,210}$ ${}^{12\cdot 29}_{139}Ch^{ie}_{209}$ ${}^{8\cdot 47}_{149}Ch^{ie}_{227}$ ${}^{426}_{169}Ch^{ie}_{257}$

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In brief, we gave a concise formula of the anomalous magnetic moment of electron (a_e) and the fine-structure constant (α_2) as follows.

$$a_e = \frac{\alpha_2 \gamma_e}{(2\pi)_{Chen-109}} = \frac{13 \cdot (2\pi)_{Chen-278}}{100 \cdot (2\pi)_{Chen-109}} \frac{(1 + \frac{1}{25 \cdot 11 \cdot 47 \cdot 109})}{112 - \frac{1}{64 \cdot 3 \cdot 29}} = 0.00115965218134971$$

${}^{47,48}_{22}Ti_{25,26}$ ${}^{55}_{25}Mn_{30}$ ${}^{54,56,57,58}_{26}Fe_{28,30,31,32}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{99,100}_{44}Ru_{55,56}$ ${}^{107,109}_{47}Ag_{60,62}$ ${}^{110,112}_{48}Cd_{62,64}$

${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{149,150}_{62}Sm_{87,88}$ ${}^{157,158}_{64}Gd_{93,2\cdot 47}$ ${}^{169}_{69}Tm_{100}$ ${}^{186,4\cdot 47,192}_{76}Os_{110,112,116}$ ${}^{227}_{89}Ac^{*}_{138}$ ${}^{257}_{100}Fm^{*}_{157}$

${}^{5\cdot 47,238}_{92}U^{*}_{11\cdot 13,2\cdot 73}$ ${}^{278}_{109}Mt^{*}_{169}$ ${}^{287}_{112}Cn^{*}_{173}$ ${}^{2\cdot 157}_{126}Ch^{ie}_{4\cdot 47}$ ${}^{344,2\cdot 173,12\cdot 29}_{136,137,138}Ch^{ie}_{208,209,210}$ ${}^{12\cdot 29}_{139}Ch^{ie}_{209}$ ${}^{8\cdot 47}_{149}Ch^{ie}_{227}$ ${}^{426}_{169}Ch^{ie}_{257}$

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

CODATA: $a_e = 0.00115965218128(18)$; Experimental: $a_e = 0.00115965218073(28)$[5]

The relationships between the factors in the above formula such as 11, 25, 47, 109 and 278 and nuclides strongly indicate this formula and the value should be correct and precise. It also shows that the quantization of 2π, i.e., 2π-e formula's taking definite k rather than infinity, has the same effect as calculations with Quantum Electrodynamics and Standard Model, this means that in the world of nuclides 2π is quantized to be the form of $(2\pi)_{\text{Chen-k}}$ or some approximate fractional numbers like $4\times157/100$.

It is just like taking a clear photo from a moving object to calculate the fine-structure constant from experiment determined values of the anomalous magnetic moment of electron. The method with QED and SM is to calculate the all moving details, our method is to add adjusting coefficients, different paths get to the same goal.

3. Comparison of Calculated and Measured Values of the Fine-structure Constant

In our previous paper[11], we gave the following figure to illustrate comparison of calculated and measured values of the fine-structure constant. In it, the lines 4 and 5 were in black. Here in this paper, we make a correction to change them to be in red. That means g-2 method corresponds to α_2 (**Fig. 1**).

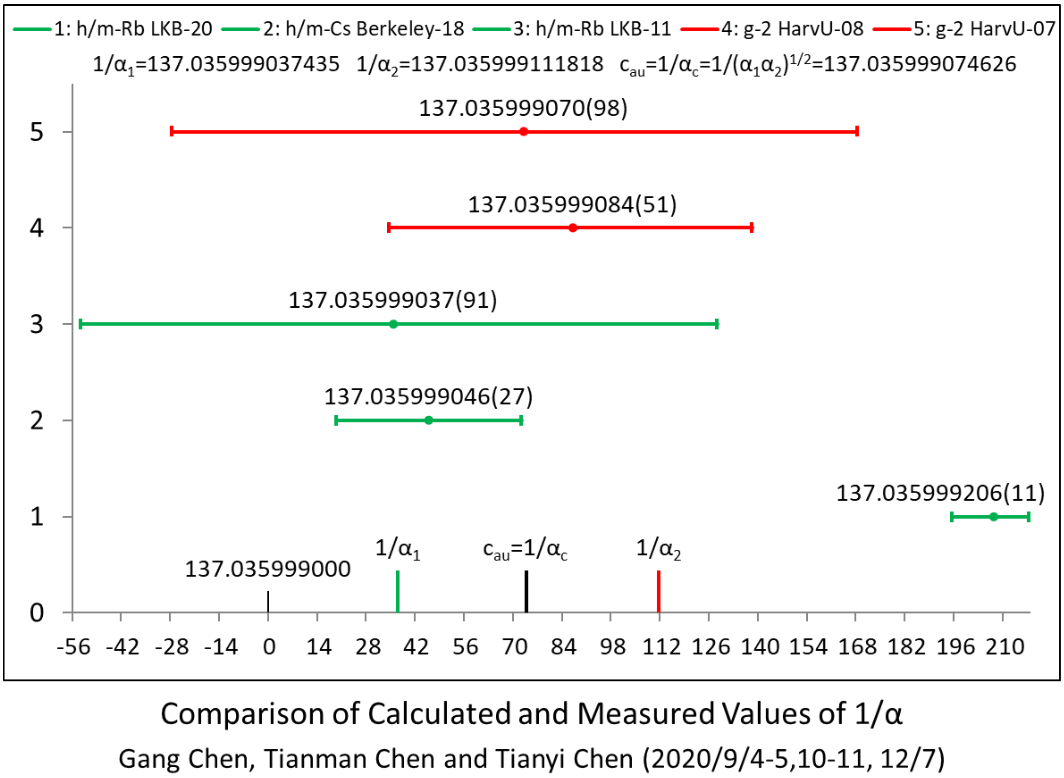

Fig. 1.

4. Concise Formulas of the Anomalous Magnetic Moment of Muon and the Fine-structure Constant

In our previous paper[1], we gave the following formula of the anomalous magnetic moment of muon.

$$a_\mu = \frac{g_\mu - 2}{2} = \frac{1}{2\cdot 3\cdot 11\cdot 13 - \frac{25}{81}} = 0.00116592057346019$$

$${}^{10,11}_{5}B_{5,6}\quad {}^{12,13}_{6}C_{6,7}\quad {}^{23}_{11}Na_{12}\quad {}^{24,25,26}_{12}Mg_{12,13,14}\quad {}^{27}_{13}Al_{14}\quad {}^{47,48,49,50}_{22}Ti_{25,26,27,28}\quad {}^{55}_{25}Mn_{30}\quad {}^{54,56}_{26}Fe_{28,30}$$

$${}^{66}_{30}Zn_{36}\quad {}^{75}_{33}As_{42}\quad {}^{78}_{34}Se_{44}\quad {}^{79,81}_{35}Br_{44,46}\quad {}^{89}_{39}Y_{50}\quad {}^{116}_{50}Sn_{66}\quad {}^{133}_{55}Cs_{78}\quad {}^{137}_{56}Ba_{81}\quad {}^{143}_{60}Nd_{83}\quad {}^{162}_{66}Dy_{96}$$

$${}^{194,195}_{78}Pt_{116,117}\quad {}^{235}_{92}U^{*}_{143}\quad {}^{286}_{113}Nh^{ie}_{173}\quad {}^{363,364}_{143}Ch^{ie}_{220,221}$$

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Here, we give another form of formula of the anomalous magnetic moment of muon (a_μ) and the fine-structure constant (α_2) as follows.

$$a_\mu = \frac{\alpha_2\gamma_\mu}{(2\pi)_{Chen-109}} = \frac{\alpha_2\gamma_e\gamma_\mu{}'}{(2\pi)_{Chen-109}} = \frac{13\cdot(2\pi)_{Chen-278}}{100\cdot(2\pi)_{Chen-109}}\,\frac{(1+\frac{1}{25\cdot 11\cdot 47\cdot 109})(1+\frac{1}{5\cdot 37})}{112-\frac{1}{64\cdot 3\cdot 29}}$$

$$= 0.00116592057151917$$

$$a_\mu = \frac{\alpha_2\gamma_\mu}{(2\pi)_{Chen-109}} = \frac{\alpha_2\gamma_e}{(2\pi)_{Chen-109}\gamma_\mu{}''} = \frac{13\cdot(2\pi)_{Chen-278}}{100\cdot(2\pi)_{Chen-109}}\,\frac{(1+\frac{1}{25\cdot 11\cdot 47\cdot 109})}{(112-\frac{1}{64\cdot 3\cdot 29})(1-\frac{1}{6\cdot 31})}$$

$$= 0.00116592057151917$$

$${}^{23}_{11}Na_{12}\quad {}^{27}_{13}Al_{14}\quad {}^{31}_{15}P_{16}\quad {}^{46,47,48,50}_{22}Ti_{24,25,26,28}\quad {}^{50,52,53,54}_{24}Cr_{26,28,29,30}\quad {}^{55}_{25}Mn_{30}\quad {}^{54,56,57,58}_{26}Fe_{28,30,31,32}$$

$${}^{63,65}_{29}Cu_{34,36}\quad {}^{69,71}_{31}Ga_{38,40}\quad {}^{83,84}_{36}Kr_{47,48}\quad {}^{85,87}_{37}Rb_{48,50}\quad {}^{89}_{39}Y_{50}\quad {}^{93}_{41}Nb_{52}\quad {}^{96,99,100,102,104}_{44}Ru_{52,55,56,58,60}$$

$${}^{107,109}_{47}Ag_{60,62}\quad {}^{110,112}_{48}Cd_{62,64}\quad {}^{112,114,116}_{50}Sn_{62,64,66}\quad {}^{125}_{52}Te_{73}\quad {}^{133}_{55}Cs_{78}\quad {}^{136,137,138}_{56}Ba_{80,81,82}\quad {}^{140,142}_{58}Ce_{82,84}$$

$${}^{149,150}_{62}Sm_{87,88}\quad {}^{157,158}_{64}Gd_{93,94}\quad {}^{169}_{69}Tm_{100}\quad {}^{183,184,186}_{74}W_{109,110,112}\quad {}^{185,187}_{75}Re_{110,112}\quad {}^{186,4\cdot 47,192}_{76}Os_{110,112,116}$$

$${}^{209}_{83}Bi^{*}_{126}\quad {}^{209}_{84}Po^{*}_{125}\quad {}^{223}_{87}Fr^{*}_{136}\quad {}^{226}_{88}Ra^{*}_{138}\quad {}^{227}_{89}Ac^{*}_{138}\quad {}^{5\cdot 47,238}_{92}U^{*}_{143,146}\quad {}^{257}_{100}Fm^{*}_{157}\quad {}^{278}_{109}Mt^{*}_{169}\quad {}^{287}_{112}Cn^{*}_{173}$$

$${}^{28\cdot 11}_{123}Ch^{ie}_{185}\quad {}^{310}_{124}Ch^{ie}_{186}\quad {}^{24\cdot 13}_{125}Ch^{ie}_{187}\quad {}^{2\cdot 157}_{126}Ch^{ie}_{4\cdot 47}\quad {}^{344,2\cdot 173,12\cdot 29}_{136,137,138}Ch^{ie}_{208,209,210}\quad {}^{8\cdot 47}_{149}Ch^{ie}_{227}\quad {}^{426}_{169}Ch^{ie}_{257}$$

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The latest meassured value[15]:

$$a_\mu = \frac{g_\mu - 2}{2} = 0.00116592061(41)$$

Calulated value with QED and Standard Model[16]:

$$a_\mu = \frac{g_\mu - 2}{2} = 0.00116591810(43)$$

5. Concise Formulas of the Anomalous Magnetic Moment of Tauon and the Fine-structure Constant

In above formulas of the anomalous magnetic moment of muon and the fine-structure constant, we notice that there are correction coefficient factors 31 and 37 which are adjacent prime numbers with relationship formula of 6×31=5×37+1. There is only the other such couple of prime numbers which are 11 and 13 in all prime numbers (6×11=5×13+1). So, by imitating the above formulas of the anomalous magnetic moment of muon and the fine-structure constant, we can construct the following formulas and guess they would be the formula of tauon.

$$a_\tau = \frac{\alpha_2 \gamma_\tau}{(2\pi)_{Chen-109}} = \frac{\alpha_2 \gamma_e \gamma_\tau'}{(2\pi)_{Chen-109}} = \frac{13\cdot(2\pi)_{Chen-278}}{100\cdot(2\pi)_{Chen-109}} \frac{(1+\frac{1}{25\cdot 11\cdot 47\cdot 109})(1+\frac{1}{5\cdot 13})}{(112-\frac{1}{64\cdot 3\cdot 29})}$$

$$= 0.00117749298413971$$

${}^{63,65}_{29}Cu_{34,36}$ ${}^{106,110,112,113,116}_{48}Cd_{58,62,64,65,68}$ ${}^{159}_{65}Tb_{2\cdot 47}$

$$a_\tau = \frac{\alpha_2 \gamma_\tau}{(2\pi)_{Chen-109}} = \frac{\alpha_2 \gamma_e}{(2\pi)_{Chen-109}\gamma_\tau''} = \frac{13\cdot(2\pi)_{Chen-278}}{100\cdot(2\pi)_{Chen-109}} \frac{(1+\frac{1}{25\cdot 11\cdot 47\cdot 109})}{(112-\frac{1}{64\cdot 3\cdot 29})(1-\frac{1}{6\cdot 11})}$$

$$= 0.00117749298413971$$

${}^{64,66}_{30}Zn_{34,36}$ ${}^{75}_{33}As_{42}$ ${}^{106,110,112,114,116}_{48}Cd_{58,62,64,66,68}$ ${}^{116}_{50}Sn_{66}$ ${}^{160,162}_{66}Dy_{2\cdot 47,96}$

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Then we searched literature and found the theoretically calculated value of the anomalous magnetic moment of tauon was 0.00117721(5)[17]. It is really amazing.

6. Comparison of Theoretically Calculated and Experiment Measured Values of the Anomalous Magnetic Moment of Electron, Muon and Tauon

Table 1. Comparison of Theoretically Calculated and Experiment Measured a_e, a_μ and a_τ.

Lepton	Calculated a^{SM} By Standard Model	Calculated a^{TC} By Theory of Chirality	Measured a^{EXP} By Experiment	$(a^{SM}-a^{TC})/a^{TC}$
e	0.001159652181606(23)[7]	0.00115965218134971	0.00115965218073(28)[5]	2.2×10^{-10}
μ	0.00116591810(43)[16]	0.00116592057151917	0.00116592061(41)[15]	-2.1×10^{-6}
τ	0.00117721(5)[17]	0.00117749298413971	-0.052–0.013[18]	-2.4×10^{-4}
		0.00117722266894592		-8.5×10^{-6}

Note: Lifetime of tauon is very short, so it is quite difficult to measure a_τ with ordinary spin precession experiments[17]; The second a^{TC} value of tauon is more possible than the first one (refer to **Section 8**).

In our previous paper[1], our theory was named to be Theory of Chirality (TC), which is one of the four plates (Theory of Relativity, Quantum Theory, Chaos Theory and Theory of Chirality) of the modern physics. As collision among earth plates makes mountains, interaction among the plates of modern physics makes some anomalies in physics. For example, Standard Model (SM) should be perfect in Quantum Theory plate of modern physics, however, errors in calculation of the anomalous magnetic moment of electron, muon and tauon (a_e, a_μ and a_τ) with Standard Model would become larger and larger (**Table 1**). So, in the calculation of a_e, a_μ and a_τ with Theory of Chirality, we added adjusting coefficient such as γ_e, γ_μ and γ_τ, which could be called Plate Interaction Coefficients (Pics). From electron to muon to tauon, Pics become larger and larger. As for the magnetic moment anomaly of electron, muon and tauon (probably caused by the interaction among the plates of modern physics), electron is like a plain, muon is like a hill and tauon is like a mount.

7. Other Possible Formulas of the Anomalous Magnetic Moment of Tauon and the Fine-structure Constant

There should be possible formulas of the anomalous magnetic moment of tauon and the fine-structure constant as follows.

$$a_\tau = \frac{\alpha_2\gamma_\tau}{(2\pi)_{Chen-109}} = \frac{\alpha_2\gamma_e\gamma_\tau'}{(2\pi)_{Chen-109}} = \frac{13\cdot(2\pi)_{Chen-278}}{100\cdot(2\pi)_{Chen-109}} \frac{(1+\frac{1}{25\cdot 11\cdot 47\cdot 109})(1+\frac{1}{6\cdot 11})}{(112-\frac{1}{64\cdot 3\cdot 29})}$$

$$= 0.00117722266894592$$

${}^{64,66}_{30}Zn_{34,36}$ ${}^{75}_{33}As_{42}$ ${}^{106,110,112,114,116}_{48}Cd_{58,62,64,66,68}$ ${}^{116}_{50}Sn_{66}$ ${}^{160,162}_{66}Dy_{2\cdot 47,96}$

$$a_\tau = \frac{\alpha_2\gamma_\tau}{(2\pi)_{Chen-109}} = \frac{\alpha_2\gamma_e}{(2\pi)_{Chen-109}\gamma_\tau''} = \frac{13\cdot(2\pi)_{Chen-278}}{100\cdot(2\pi)_{Chen-109}} \frac{(1+\frac{1}{25\cdot 11\cdot 47\cdot 109})}{(112-\frac{1}{64\cdot 3\cdot 29})(1-\frac{1}{67})}$$

$$= 0.00117722266894592$$

${}^{64,67}_{30}Zn_{34,37}$ ${}^{9\cdot 13}_{50}Rb_{67}$ ${}^{2\cdot 67}_{56}Ba_{78}$ ${}^{3\cdot 55}_{67}Ho_{98}$

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8. Formulas of the Anomalous Magnetic Moment of Electron, Muon and Tauon in Fractional Number Form

In the above formulas of the anomalous magnetic moment of electron, muron and tauon (a_e, a_μ and a_τ) and the fine-structure constant (α_2), there are several kinds of adjusting coefficients which are logically reasonable respectively, however, they could be combined to just one kind of adjusting coefficients (γ_1, γ_2 and γ_3) and hence formulas of a_e, a_μ and a_τ in fractional number form could be gained as follows.

$$a=\frac{\alpha_2\gamma_{e/\mu/\tau}}{(2\pi)_{Chen-109}}=\frac{13\cdot(2\pi)_{Chen-278}}{100\cdot(2\pi)_{Chen-109}}\frac{\gamma_{e/\mu/\tau}}{(112-\frac{1}{64\cdot3\cdot29})}=\frac{13\cdot\gamma_{1/2/3}}{100\cdot112}$$

$$a_e=\frac{13\cdot\gamma_1}{100\cdot112}=\frac{13\cdot(1-\frac{1}{4\cdot3\cdot7\cdot13}+\frac{1}{4\cdot9\cdot11\cdot(4\cdot19\cdot47-1)+\frac{1}{8}})}{100\cdot112}$$
$$=0.00115965218134971$$

${}^{19}_{9}F_{10}$ ${}^{23}_{11}Na_{12}$ ${}^{27}_{13}Al_{14}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{47,48,50}_{22}Ti_{25,26,28}$ ${}^{54,56,57}_{26}Fe_{28,30,31}$ ${}^{61}_{28}Ni_{33}$ ${}^{83,84}_{36}Kr_{47,48}$ ${}^{88}_{38}Sr_{50}$
${}^{89}_{39}Y_{50}$ ${}^{99,100,101}_{44}Ru_{55,56,57}$ ${}^{4\cdot47}_{76}Os_{112}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{257}_{100}Fm^{*}_{157}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{2\cdot157}_{126}Ch^{ie}_{4\cdot47}$ ${}^{2\cdot173}_{137}Fy^{ie}_{209}$

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$$a_\mu=\frac{13\cdot\gamma_2}{100\cdot112}=\frac{13\cdot(1+\frac{1}{6\cdot37}-\frac{1}{6\cdot(4\cdot37\cdot59-1)+\frac{8}{105}})}{100\cdot112}=0.00115965205715191 7$$

${}^{27}_{13}Al_{14}$ ${}^{54,56}_{26}Fe_{28,30}$ ${}^{85,87}_{37}Rb_{48,50}$ ${}^{105}_{46}Pd_{59}$ ${}^{118}_{50}Sn_{68}$ ${}^{126}_{52}Te_{74}$ ${}^{3\cdot59}_{72}Hf_{105}$ ${}^{184,186}_{74}W_{110,112}$ ${}^{222}_{86}Rn^{*}_{136}$

$$a_\tau=\frac{13\cdot\gamma_3}{100\cdot112}=\frac{13\cdot(1+\frac{1}{3\cdot23}-\frac{1}{2\cdot27\cdot7\cdot71+\frac{197}{16\cdot17}})}{100\cdot112}=0.00117749298413971$$

${}^{27}_{13}Al_{14}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{54,56}_{26}Fe_{28,30}$ ${}^{69,71}_{31}Ga_{38,40}$ ${}^{118,119}_{50}Sn_{68,69}$ ${}^{121,123}_{51}Sb_{70,72}$ ${}^{136,137.138}_{56}Ba_{80,81,82}$
${}^{169}_{69}Tm_{100}$ ${}^{175,176}_{71}Lu_{104,105}$ ${}^{197}_{79}Au_{118}$ ${}^{232}_{90}Th^{*}_{142}$

$$a_\tau=\frac{13\cdot\gamma_3}{100\cdot112}=\frac{13\cdot(1+\frac{1}{2\cdot5\cdot7}-\frac{1}{2\cdot3\cdot19\cdot139+\frac{19}{32\cdot11}})}{100\cdot112}=0.00117722266894592$$

${}^{19}_{9}F_{10}$ ${}^{27}_{13}Al_{14}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{54,56,57,58}_{26}Fe_{28,30,31,32}$ ${}^{69,71}_{31}Ga_{38,40}$ ${}^{70,76}_{32}Ge_{38,44}$ ${}^{79,81}_{35}Br_{44,46}$ ${}^{88}_{38}Sr_{50}$
${}^{100,101}_{44}Ru_{56,57}$ ${}^{112,114,120}_{50}Sn_{62,64,70}$ ${}^{121,123}_{51}Sb_{70,72}$ ${}^{138,139}_{57}La_{81,82}$ ${}^{170,171,173,174,176}_{70}Yb_{100,101,103,104,106}$
${}^{188,190}_{76}Os_{112,114}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{226}_{88}Ra^{*}_{138}$ ${}^{2\cdot139}_{109}Mt^{*}_{169}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{2\cdot173}_{137}Fy^{ie}_{209}$ ${}^{348}_{139}Ch^{ie}_{209}$

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In above, the second formula of a_τ is more mearningful reasonable than the first one, so $a_\tau=0.00117722266894592$ is more possible.

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Appendix I: Research History

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