Integrated Formulas of the Fine-structure Constant and Feigenbaum Constants (viXra:2102.0162v4)

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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 the previous paper "Formulas of Feigenbaum Constants and Their Physical Meanings" (viXra:2101.0187). In the previous paper, some formulas of Feigenbaum constants in fractional number format were given and the physical meanings of the factors in the formulas were exhibited, especially their relationships with nuclides, the fine-structure constant and 2π. In the previous paper, some integrated formulas of the fine-structure constant, Feigenbaum constants and 2π were also given, briefly denoted as $\alpha_1\delta^2(2\pi)\approx1$, and their relationships with nuclides were illustrated. In this paper, some formulas for $\alpha_1\delta^2(2\pi)\approx1$ are supplemented, some formulas for $\alpha_2(\delta\alpha)^2\approx1$, $[\alpha_1(2\pi)]/(\alpha_2\alpha^2)\approx1$ and $(2\pi)/\alpha^2\approx1$ are given, some formulas of the fine-structure constant (α_1 and α_2) based on the key number 103 instead of 112, 173, 137, 83 and 29 are supplemented. In the end, by introducing correction factors γ_1, γ_2 and γ, accurate formulas $\alpha_1(\delta/\gamma_1)^2(2\pi)=1$, $\alpha_2(\delta\alpha/\gamma_2)^2=1$ and $2\pi/(\alpha\gamma)^2=1$ are gained.

Keywords: Formulas; the fine-structure constant; Feigenbaum constants; 2π.

1. Introduction

In our previous papers[1,2,3,4,5], we gave or exhibited the following formulas.

$$(2\pi)_{Chen-k}=e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{k+1}{k})^{2k+1}};\quad (2\pi)_{Wallis-k}=4\cdot(2\frac{2}{3}\frac{4}{3}\frac{4}{5}\frac{6}{5}\cdots\frac{2k}{2k+1}\frac{2k+2}{2k+1})$$

$$(2\pi)_{GL-k}=8\cdot(1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\cdots+(-1)^{k+1}\frac{1}{2k+1})\quad (GL\text{ means Gregory-Leibniz})$$

$$(2\pi)_{NC-k}=6+\sum_{n=1}^{k}\frac{(-1)^{n+1}}{\mathrm{n(n+1/2)(n+1)}}\quad (NC\text{ means Nilakantha-Chen})$$

$$\alpha_1 = \frac{\lambda_e}{2\pi a_0} = \frac{36}{7\cdot(2\pi)_{Chen-112}} \frac{1}{112+\frac{1}{75^2}} = 1/137.035999037435$$

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

$$c_{au} = \frac{1}{\alpha_c} = \frac{1}{\sqrt{\alpha_1\alpha_2}} = \sqrt{112\times(168-\frac{1}{3}+\frac{1}{12\cdot 47}-\frac{1}{14\cdot 112\cdot(2\cdot 173+1)})}$$

$$= 137.035999074626$$

$$1/\alpha_1 = 56+81+\frac{1}{28-\frac{13\cdot(2\cdot 56\cdot 11-1)}{3\cdot 5\cdot(2\cdot 56\cdot 43+1)}} = 137.035999037435$$

$$1/\alpha_2 = 56+81+\frac{1}{28-\frac{2\cdot(16\cdot 27-1)}{3\cdot(16\cdot 81+1)}} = 137.035999111818$$

$$c_{au} = \frac{1}{\alpha_c} = 56+81+\frac{1}{28-\frac{5\cdot(4\cdot 3\cdot 7\cdot 17-1)}{2\cdot 5\cdot(4\cdot 5\cdot 7\cdot 23+1)+1}} = 137.035999074626$$

Note: c_{au} refers to the speed of light in vacuum in atomic units

Feigenbaum Constants: $\delta = 4.66920160910299$

$\alpha = 2.50290787509589$

$$\frac{1}{\delta} = \frac{1}{4.66920160910299} = 0.214169377062326$$

$$= \frac{1}{4}-\frac{1}{27}+\frac{1}{4\cdot 9\cdot 23}-\frac{1}{2\cdot 3\cdot 7\cdot 23\cdot(2\cdot 3\cdot(4\cdot 3\cdot 11-1)+1)+\frac{2\cdot 23}{3\cdot 19}}$$

$$\frac{1}{\alpha} = \frac{1}{2.50290787509589} = 0.399535280523135$$

$$= \frac{1}{2}-\frac{1}{9}+\frac{1}{3\cdot 31}-\frac{1}{23\cdot(8\cdot 3\cdot 17+1)}+\frac{1}{17\cdot 23\cdot(8\cdot 3\cdot 11^4-1)}$$

Note: 136=$8\cdot 17$, 138=$6\cdot 23$

$\alpha_1\delta^2(2\pi) \approx 1$

On Feb. 8, 2021, we also noticed that Hieb uploaded a paper[6] in viXra in April of 2017, and gave an approximate formula of the fine-structure constant and Feigenbaum constant as follows, but without any explanations to its physical meanings.

$$\delta' = (1/(2\pi\alpha))^{1/2} = 4.670114 \approx \delta = 4.669201609$$

$$\delta' - \delta = 0.000912$$

α: the fine-structure constant, $\alpha \approx 1/137.036$

2. Integrated Formulas of α_1, δ and 2π

A Concise Deduction

The Fine-structure Constant:

$$\alpha_1=\frac{\lambda_e}{2\pi a_0}=\frac{36}{7\cdot(2\pi)_{Chen-112}}\frac{1}{112+\frac{1}{75^2}}=1/137.035999037435$$

Feigenbaum Constants: $\delta=4.66920160910299$

$$\alpha_1=\frac{36}{7\cdot(2\pi)_{Chen-112}}\frac{1}{112+\frac{1}{75^2}}\approx\frac{36}{7\cdot(2\pi)}\frac{1}{112}=(\frac{3}{14})^2\frac{1}{2\pi}\approx\frac{1}{\delta^2(2\pi)}$$

$$=\frac{1}{4.66920160910299^2\cdot(2\cdot3.14159265358979)}\approx\frac{1}{136.982}$$

So it should be resonable to assume the following approximate formulas:

$$\alpha_1\delta^2(2\pi)\approx1 \text{ or } \frac{1}{\alpha_1\delta^2(2\pi)}\approx1$$

Numerically: $\alpha_1\delta^2(2\pi)=\frac{4\cdot6692^2\times6.2832}{137.036}=0.99961\approx1$

2021/2/1-3

The above approximate formula $\alpha_1\delta^2(2\pi)\approx1$ is assumed to be the brief form of integrated formulas of α_1, δ and 2π. There should be some corresponding accurate forms of integrated formulas of α_1, δ and 2π as follows.

$$\alpha_1\delta^2(2\pi)_{Chen-25\cdot17}=\frac{4.66920160910299^2\cdot(e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{2\cdot3\cdot71}{25\cdot17})^{23\cdot37}})}{137.035999037435}$$

$$=\frac{4.66920160910299^2\cdot6.28564399787948}{137.035999037435}$$

$$=1+\frac{1}{128\cdot9\cdot(2\cdot3\cdot173+1)+\frac{7}{10}}=1.0000008354717\approx1$$

$^{14,15}_{7}N_{7,8}$ $^{16,17,18}_{8}O_{8,9,10}$ $^{23}_{11}Na_{12}$ $^{35,37}_{17}Cl_{18,20}$ $^{50,51}_{23}V_{27,28}$ $^{64,66,67,68}_{30}Zn_{34,36,37,38}$ $^{80}_{34}Se_{46}$ $^{79,81}_{35}Br_{44,46}$

$^{82,83,84,86}_{36}Kr_{46,47,48,50}$ $^{85,87}_{37}Rb_{48,50}$ $^{105,110}_{46}Pd_{59,64}$ $^{111,112}_{48}Cd_{63,64}$ $^{112,114,115-120,122,124}_{50}Sn_{62,64,65-70,72,74}$

$^{121,123}_{51}Sb_{70,72}$ $^{126}_{52}Te_{74}$ $^{128}_{54}Xe_{74}$ $^{136,137,138}_{56}Ba_{80,81,82}$ $^{157}_{64}Gd_{93}$ $^{168,170}_{68}Er_{100,102}$ $^{171,173}_{70}Yb_{101,103}$

$^{169}_{69}Tm_{100}$ $^{175,176}_{71}Lu_{104,105}$ $^{185,187}_{75}\mathrm{Re}_{110,112}$ $^{208}_{82}Pb_{126}$ $^{209}_{83}Bi^{*}_{126}$ $^{209}_{84}Po^{*}_{125}$ $^{210}_{85}At^{*}_{125}$ $^{261,262}_{103}Lr^{*}_{158,159}$

$^{257}_{100}Fm^{*}_{157}$ $^{285}_{112}Cn^{*}_{173}$ $^{4\cdot71,286}_{113}Nh^{ie}_{171,173}$ $^{326}_{128}Ch^{ie}_{18\cdot11}$ $^{344,2\cdot173,348}_{136,137,138}Fy^{ie}_{208,209,210}$ $^{6\cdot71}_{169}Ch^{ie}_{257}$ $^{434,435}_{173}Ch^{ie}_{261,262}$

2021/1/31

$$\frac{1}{\alpha_1\delta^2(2\pi)_{Chen-25\cdot 17}}=\frac{137.035999037435}{4.66920160910299^2\cdot(e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{2\cdot3\cdot71}{25\cdot17})^{23\cdot37}})}$$

$$=\frac{137.035999037435}{4.66920160910299^2\cdot 6.28564399787948}$$

$$=1-\frac{1}{2\cdot5\cdot7\cdot(2\cdot83\cdot103+1)-\frac{9}{29}}=0.999999164529037\approx 1$$

$^{19}_{9}F_{10}$ $^{28,29,30}_{14}Si_{14,15,16}$ $^{63,65}_{29}Cu_{34,36}$ $^{79,81}_{35}Br_{44,46}$ $^{83}_{36}Kr_{47}$ $^{103}_{45}Rh_{58}$ $^{136,137,138}_{56}Ba_{80,81,82}$ $^{140,142}_{58}Ce_{82,84}$
$^{166}_{68}Er_{98}$ $^{173}_{70}Yb_{103}$ $^{209}_{83}Bi^{*}_{126}$ $^{9\cdot29,262}_{103}Lr^{*}_{158,159}$ $^{285}_{112}Cn^{*}_{173}$ $^{344,2\cdot173,12\cdot29}_{136,137,138}Fy^{ie}_{208,209,210}$ $^{434,15\cdot29}_{173}Ch^{ie}_{9\cdot29,262}$

2021/2/19

$$\alpha_1\delta^2(2\pi)_{Walllis-9\cdot71}=\frac{4.66920160910299^2\cdot\cdot4\cdot(2\frac{2}{3}\frac{4}{3}\frac{4}{5}\frac{6}{5}\cdots\frac{1278}{1279}\frac{1280}{2\cdot9\cdot71+1})}{137.035999037435}$$

$$=\frac{4.66920160910299^2\cdot 6.28564015562186}{137.035999037435}$$

$$=1+\frac{1}{2\cdot9\cdot(8\cdot3\cdot25\cdot7\cdot59-1)-\frac{5}{17}}=1.00000022419606\approx 1$$

$^{28,29,30}_{14}Si_{14,15,16}$ $^{35,37}_{17}Cl_{18,20}$ $^{55}_{25}Mn_{30}$ $^{59}_{27}Co_{32}$ $^{64,66,70}_{30}Zn_{34,36,40}$ $^{69,71}_{31}Ga_{38,40}$ $^{105}_{46}Pd_{59}$
$^{82,83,84,86}_{36}Kr_{46,47,48,50}$ $^{85,87}_{37}Rb_{48,50}$ $^{112}_{48}Cd_{64}$ $^{118,120,122}_{50}Sn_{68,70,72}$ $^{136,137,138}_{56}Ba_{80,81,82}$ $^{3\cdot47}_{59}\mathrm{Pr}_{82}$
$^{144,145,150}_{60}Nd_{84,85,90}$ $^{173}_{70}Yb_{103}$ $^{175,176}_{71}Lu_{104,105}$ $^{3\cdot59}_{72}Hf_{105}$ $^{185,187}_{75}\mathrm{Re}_{110,112}$ $^{208}_{82}Pb_{126}$ $^{209}_{83}Bi^{*}_{126}$
$^{209}_{84}Po^{*}_{125}$ $^{210}_{85}At^{*}_{125}$ $^{285}_{112}Cn^{*}_{173}$ $^{344,2\cdot173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/2/1

$$\frac{1}{\alpha_1\delta^2(2\pi)_{Wallis-9\cdot71}}=\frac{137.035999037435}{4.66920160910299^2\cdot4\cdot(2\frac{2}{3}\frac{4}{3}\frac{4}{5}\frac{6}{5}\cdots\frac{1278}{1279}\frac{1280}{2\cdot9\cdot71+1})}$$

$$=\frac{137.035999037435}{4.66920160910299^2\cdot 6.28564015562186}$$

$$=1-\frac{1}{2\cdot9\cdot(8\cdot3\cdot25\cdot7\cdot59-1)+\frac{3\cdot4}{17}}=0.999999775803991\approx 1$$

$^{28,29,30}_{14}Si_{14,15,16}$ $^{35,37}_{17}Cl_{18,20}$ $^{55}_{25}Mn_{30}$ $^{59}_{27}Co_{32}$ $^{64,66,68,70}_{30}Zn_{34,36,38,40}$ $^{69,71}_{31}Ga_{38,40}$ $^{76,80,82}_{34}Se_{42,46,48}$
$^{79,81}_{35}Br_{44,46}$ $^{82,83,84,86}_{36}Kr_{46,47,48,50}$ $^{85,87}_{37}Rb_{48,50}$ $^{100}_{44}Ru_{56}$ $^{105}_{46}Pd_{59}$ $^{112}_{48}Cd_{64}$ $^{118,120,122}_{50}Sn_{68,70,72}$
$^{136,137,138}_{56}Ba_{80,81,82}$ $^{3\cdot47}_{59}\mathrm{Pr}_{82}$ $^{168}_{68}Er_{100}$ $^{173}_{70}Yb_{103}$ $^{175,176}_{71}Lu_{104,105}$ $^{3\cdot59}_{72}Hf_{105}$ $^{185,187}_{75}\mathrm{Re}_{110,112}$
$^{208}_{82}Pb_{126}$ $^{209}_{83}Bi^{*}_{126}$ $^{209}_{84}Po^{*}_{125}$ $^{210}_{85}At^{*}_{125}$ $^{285}_{112}Cn^{*}_{173}$ $^{344,2\cdot173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/2/20

$$\alpha_1\delta^2(2\pi)_{GL-22\cdot37}=\frac{4.66920160910299^2\cdot8\cdot(1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\cdots+\frac{1}{2\cdot2\cdot11\cdot37+1})}{137.035999037435}$$

$$=\frac{4.66920160910299^2\cdot6.28563929398602}{137.035999037435}$$

$$=1+\frac{1}{163\cdot(6\cdot11^2\cdot97+1)+\frac{9}{10}}=1.00000008711598\approx1$$

$^{23}_{11}Na_{12}$ $^{35,37}_{17}Cl_{18,20}$ $^{48,50}_{22}Ti_{26,28}$ $^{66,67}_{30}Zn_{36,37}$ $^{75}_{33}As_{42}$ $^{85,87}_{37}Rb_{48,50}$ $^{97}_{42}Mo_{55}$ $^{97}_{43}Tc^{*}_{54}$ $^{163}_{66}Dy_{97}$

$^{165}_{67}Ho_{98}$ $^{3\cdot67}_{80}Hg_{121}$ $^{6\cdot37}_{86}Rn^{*}_{136}$ $^{247}_{97}Bk^{*}_{150}$ $^{4\cdot67}_{105}Db^{*}_{163}$ $^{269,271}_{106}Sg^{*}_{163,165}$ $^{270}_{107}Bh^{*}_{163}$ $^{2\cdot163}_{128}Ch^{*}_{3\cdot66}$ $^{410}_{163}Ch^{ie}_{247}$

2021/2/1

$$\frac{1}{\alpha_1\delta^2(2\pi)_{GL-22\cdot37}}=\frac{137.035999037435}{4.66920160910299^2\cdot8\cdot(1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\cdots+\frac{1}{2\cdot2\cdot11\cdot37+1})}$$

$$=\frac{137.035999037435}{4.66920160910299^2\cdot6.28563929398602}$$

$$=1-\frac{1}{9\cdot11\cdot47\cdot(2\cdot9\cdot137+1)-\frac{2}{25}}=0.999999912884025\approx1$$

$^{35,37}_{17}Cl_{18,20}$ $^{47,50}_{22}Ti_{25,28}$ $^{55}_{25}Mn_{30}$ $^{36,38,40}_{18}Ar_{18,20,22}$ $^{75}_{33}As_{42}$ $^{83}_{36}Kr_{47}$ $^{85,87}_{37}Rb_{48,50}$ $^{98,99,100}_{44}Ru_{54,55,56}$

$^{107,109}_{47}Ag_{60,62}$ $^{116,118,119}_{50}Sn_{66,68,69}$ $^{128,129,132}_{54}Xe_{74,75,78}$ $^{136,137,138}_{56}Ba_{80,81,82}$ $^{168}_{68}Er_{100}$ $^{169}_{69}Tm_{100}$

$^{5\cdot37,16\cdot11}_{75}\mathrm{Re}_{110,112}$ $^{209}_{83}Bi^{*}_{126}$ $^{6\cdot37}_{87}Fr^{*}_{136}$ $^{226}_{88}Ra^{*}_{138}$ $^{285}_{112}Cn^{*}_{173}$ $^{344,2\cdot173,12\cdot29}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/2/19

$$\alpha_1\delta^2(2\pi)_{NC-3}=\frac{4.66920160910299^2\cdot(6+\sum_{n=1}^{3}\frac{(-1)^{n+1}}{\mathrm{n(n+1/2)(n+1)}})}{137.035999037435}$$

$$=\frac{4.66920160910299^2\cdot6.29047619047619}{137.035999037435}$$

$$=1+\frac{1}{3\cdot(2\cdot7\cdot31-1)}-\frac{1}{13\cdot89\cdot(2\cdot37\cdot53+1)-\frac{2\cdot9}{25}}=1.00076960262352\approx1$$

$^{25}_{12}Mg_{13}$ $^{27}_{13}Al_{14}$ $^{28,29,30}_{14}Si_{14,15,16}$ $^{50,52,53}_{24}Cr_{26,28,29}$ $^{54,56,57}_{26}Fe_{28,30,31}$ $^{69,71}_{31}Ga_{38,40}$ $^{85,87}_{37}Rb_{48,50}$ $^{74}_{32}Ge_{42}$

$^{89}_{39}Y_{50}$ $^{95}_{42}Mo_{53}$ $^{127}_{53}I_{74}$ $^{150,152}_{62}Sm_{88,90}$ $^{178}_{72}Hf_{106}$ $^{180,186}_{74}W_{106,112}$ $^{227}_{89}Ac^{*}_{138}$ $^{262}_{103}Lr^{*}_{3\cdot53}$ $^{14\cdot31,435}_{173}Ch^{ie}_{261,262}$

2021/2/1,3

$$\frac{1}{\alpha_1\delta^2(2\pi)_{NC-3}}=\frac{137.035999037435}{4.66920160910299^2\cdot(6+\sum_{n=1}^{3}\frac{(-1)^{n+1}}{\mathrm{n(n+1/2)(n+1)}})}$$

$$=\frac{137.035999037435}{4.66920160910299^2\cdot6.29047619047619}$$

$$=1-\frac{1}{4\cdot 25\cdot 13}+\frac{1}{4\cdot 9\cdot 25\cdot(2\cdot 25\cdot(4\cdot 25+1)+1)+\frac{2}{7}}=0.999230989209198\approx 1$$

${}^{12,13}_{6}C_{6,7}$ ${}^{20,21,22}_{10}Ne_{10,11,12}$ ${}^{24,25,26}_{12}Mn_{12,13,14}$ ${}^{27}_{13}Al_{14}$ ${}^{47,48,50}_{22}Ti_{25,26,28}$ ${}^{55}_{25}Mn_{30}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{84,86}_{36}Kr_{48,50}$
${}^{100,101}_{44}Ru_{56,57}$ ${}^{115,117,118,119,120,122}_{50}Sn_{65,67,68,69,70,72}$ ${}^{168}_{68}Er_{100}$ ${}^{169}_{69}Tm_{100}$ ${}^{170,171}_{70}Yb_{100,101}$ ${}^{257}_{100}Fm^{*}_{157}$

2021/2/20

$$\alpha_1\delta^2(2\pi)=\frac{4.66920160910299^2\cdot(2\cdot 3.14159265358979)}{137.035999037435}$$

$$=1-\frac{1}{13\cdot 197}+\frac{1}{2\cdot 7\cdot 41\cdot(4\cdot 5\cdot 19\cdot 31-1)}=0.99960967543223\approx 1$$

${}^{27}_{13}Al_{14}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{50,52}_{24}Cr_{26,28}$ ${}^{54,56,57}_{26}Fe_{28,30,31}$ ${}^{68,70}_{31}Ga_{38,40}$ ${}^{93}_{41}Nb_{52}$ ${}^{123,124,128,130}_{52}Te_{71,72,76,78}$
${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{197}_{79}Au_{118}$ ${}^{206}_{82}Pb_{124}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{310}_{124}Ch^{ie}_{186}$ ${}^{326}_{129}Ch^{ie}_{197}$ ${}^{344,2\cdot 173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

$$\frac{1}{\alpha_1\delta^2(2\pi)}=\frac{137.035999037435}{4.66920160910299^2\cdot(2\cdot 3.14159265358979)}$$

$$=1+\frac{1}{512\cdot 5}-\frac{1}{4\cdot 9\cdot 7\cdot 17\cdot 19\cdot 83}=1.00039047698053\approx 1$$

${}^{19}_{9}F_{10}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{28,29,30}_{14}Si_{14,15,16}$ ${}^{36,38,40}_{18}Ar_{18,20,22}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{58,60,62,64}_{28}Ni_{30,32,34,36}$ ${}^{83,84}_{36}Kr_{47,48}$
${}^{64,66,68,70}_{30}Zn_{34,36,38,40}$ ${}^{114,118,119}_{50}Sn_{64,68,69}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{157,160}_{64}Gd_{93,96}$ ${}^{166,168,170}_{68}Er_{98,100,102}$
${}^{188,190}_{76}Os_{112,114}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{257}_{100}Fm^{*}_{157}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{2\cdot 157}_{126}Ch^{ie}_{188}$ ${}^{344,2\cdot 173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/2/8

3. Integrated Formulas of α_2, δ and α

The Fine-structure Constant:

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

Feigenbaum Constants: $\delta=4.66920160910299$

$\alpha=2.50290787509589$

$$\alpha_2=\frac{13\cdot(2\pi)_{Chen-278}}{100}\frac{1}{112-\frac{1}{64\cdot 3\cdot 29}}\approx\frac{13\cdot(2\pi)}{100}\frac{1}{112}\approx\frac{(2\pi)}{(\delta\alpha)^2(2\pi)}$$

$$\approx\frac{1}{(\delta\alpha)^2}=\frac{1}{(4.66920160910299\cdot 2.50290787509589)^2}\approx 1/136.575$$

So it should be resonable to assume the following approximate formulas:

$$\alpha_2(\delta\alpha)^2\approx 1 \text{ or } \frac{1}{\alpha_2(\delta\alpha)^2}\approx 1$$

Numerically: $\alpha_2(\delta\alpha)^2=\frac{(4\cdot 6692\times 2.5029)^2}{137.036}=0.99664\approx 1$

2021/2/7

The above approximate formula $\alpha_2(\delta\alpha)^2 \approx 1$ is assumed to be the brief form of integrated formulas of α_2, δ and α. There should be some corresponding accurate forms of integrated formulas of α_2, δ and α as follows.

$$\alpha_2(\delta\alpha)^2 = \frac{(4.66920160910299 \cdot 2.50290787509589)^2}{137.035999111818}$$

$$= 1 - \frac{1}{2 \cdot 149} + \frac{1}{29 \cdot 31 \cdot (2 \cdot 3 \cdot 49 \cdot 13 + 1) - \frac{16}{19}} = 0.996644586263908 \approx 1$$

$^{12,13}_{6}C_{6,7}$ $^{14,15}_{7}N_{7,8}$ $^{19}_{9}F_{10}$ $^{24,25,26}_{12}Mg_{12,13,14}$ $^{27}_{13}Al_{14}$ $^{28,29,30}_{14}Si_{14,15,16}$ $^{31}_{15}P_{16}$ $^{39,40,41}_{19}K_{20,21,22}$

$^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ $^{50,52,53}_{24}Cr_{26,28,29}$ $^{54,56,57,58}_{26}Fe_{28,30,31,32}$ $^{58,60,62,64}_{28}Ni_{30,32,34,36}$

$^{63,65}_{29}Cu_{34,36}$ $^{69,71}_{31}Ga_{38,40}$ $^{70,74,76}_{32}Ge_{38,42,44}$ $^{76,78}_{34}Se_{42,44}$ $^{85,87}_{37}Rb_{48,50}$ $^{89}_{39}Y_{50}$ $^{93}_{41}Nb_{52}$

$^{94,95,96,98,100}_{42}Mo_{52,53,54,56,58}$ $^{112,113}_{48}Cd_{64,65}$ $^{113,115}_{49}In_{64,66}$ $^{7\cdot 19}_{54}Xe_{76,78}$ $^{7\cdot 19}_{55}Cs_{78}$ $^{149}_{62}Sm_{87}$

$^{134,136,137,138}_{56}Ba_{78,80,81,82}$ $^{155,156,157,160}_{64}Gd_{91,92,93,96}$ $^{186,187,189,190,192}_{76}Os_{110,112,113,114,116}$

$^{190,192,194,195,196}_{78}Pt_{112,114,116,117,118}$ $^{223}_{87}Fr^{*}_{136}$ $^{227}_{89}Ac^{*}_{138}$ $^{21\cdot 11}_{91}Pa^{*}_{140}$ $^{237}_{93}Np^{*}_{144}$ $^{15\cdot 19}_{112}Cn^{*}_{173}$

$^{22\cdot 13}_{113}Nh^{ie}_{173}$ $^{344,2\cdot 173,12\cdot 29}_{136,137,138}Fy^{ie}_{208,209,210}$ $^{8\cdot 47}_{149}Ch^{ie}_{227}$ $^{14\cdot 31,15\cdot 29}_{173}Ch^{ie}_{9\cdot 19,262}$

2021/2/7

$$\frac{1}{\alpha_2(\delta\alpha)^2} = \frac{137.035999111818}{(4.66920160910299 \cdot 2.50290787509589)^2}$$

$$= 1 + \frac{1}{27 \cdot 11} - \frac{1}{2 \cdot 3 \cdot 25 \cdot 11 \cdot (4 \cdot 11 \cdot 47 + 1) - \frac{2}{5}}$$

$$= 1 + \frac{1}{27 \cdot 11} - \frac{1}{2 \cdot 3 \cdot 25 \cdot 11 \cdot (2 \cdot 9 \cdot 5 \cdot 23 - 1) - \frac{2}{5}} = 1.00336671044256 \approx 1$$

$^{10,11}_{5}Be_{5,6}$ $^{23}_{11}Na_{12}$ $^{24,25}_{12}Mg_{12,13}$ $^{46,47,49,50}_{22}Ti_{24,25,27,28}$ $^{50,51}_{23}V_{27,28}$ $^{55}_{25}Mn_{30}$ $^{75}_{33}As_{42}$

$^{80,82,83,86}_{36}Kr_{44,46,47,50}$ $^{98,99,100,104}_{44}Ru_{54,55,56,60}$ $^{107,109}_{47}Ag_{60,62}$ $^{115,116,119,120}_{50}Sn_{65,66,69,70}$

$^{129,131,132}_{54}Xe_{75,77,78}$ $^{136,137,138}_{56}Ba_{80,81,82}$ $^{169}_{69}Tm_{100}$ $^{185,187}_{75}\mathrm{Re}_{110,112}$ $^{226}_{88}Ra^{*}_{138}$

$^{344,346,348}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/2/9

4. Integrated Formulas of α_1, α_2, α and 2π

$$\alpha_1\delta^2(2\pi) = 0.99961 \approx 1$$

$$\alpha_2(\delta\alpha)^2 = 0.99664 \approx 1$$

$$\frac{\alpha_1\delta^2(2\pi)}{\alpha_2(\delta\alpha)^2} = \frac{\alpha_1(2\pi)}{\alpha_2\alpha^2} \approx \frac{2\pi}{\alpha^2} = 1.002975 \approx 1$$

2021/2/11

$$\frac{\alpha_1(2\pi)}{\alpha_2\alpha^2}=\frac{137.035999111818\cdot(2\cdot 3.14159265358979)}{137.035999037435\cdot 2.50290787509589^2}$$

$$=1+\frac{1}{16\cdot 3\cdot 7}-\frac{1}{2\cdot 3\cdot 7\cdot(4\cdot 17\cdot(2\cdot 157-1)-1)-\frac{1}{4}}=1.00297507176499\approx 1$$

${}^{45}_{21}Sc_{24}$ ${}^{100}_{44}Ru_{56}$ ${}^{112}_{48}Cd_{64}$ ${}^{136}_{56}Ba_{80}$ ${}^{157}_{64}Gd_{93}$ ${}^{168}_{68}Er_{100}$ ${}^{257}_{100}Fm^{*}_{157}$ ${}^{2\cdot 157}_{126}Ch^{ie}_{188}$ ${}^{400}_{157}Ch^{ie}_{243}$

2021/2/11,17

$$\frac{\alpha_2\alpha^2}{\alpha_1(2\pi)}=\frac{137.035999037435\cdot 2.50290787509589^2}{137.035999111818\cdot(2\cdot 3.14159265358979)}$$

$$=1-\frac{1}{16\cdot 3\cdot 7+1}+\frac{1}{7\cdot 19\cdot(2\cdot 3\cdot 7^2\cdot 23-1)+\frac{16}{3\cdot 13}}$$

$$=1-\frac{1}{16\cdot 3\cdot 7+1}+\frac{1}{7\cdot 19\cdot(8\cdot 5\cdot 13^2+1)+\frac{16}{3\cdot 13}}$$

$$=1-\frac{1}{16\cdot 3\cdot 7+1}+\frac{1}{2\cdot 3\cdot 73\cdot(4\cdot 27\cdot 19+1)-\frac{23}{3\cdot 13}}=0.997033753032614\approx 1$$

${}^{27}_{13}Al_{14}$ ${}^{50,51}_{23}V_{37,28}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{69,71}_{31}Ga_{38,40}$ ${}^{87}_{38}Sr_{49}$ ${}^{89}_{39}Y_{50}$ ${}^{125}_{52}Te_{73}$ ${}^{133}_{55}Cs_{78}$ ${}^{137,138}_{56}Ba_{81,82}$
${}^{169}_{69}Tm_{100}$ ${}^{180,181}_{73}Ta_{107,108}$ ${}^{203,205}_{81}Tl_{122,124}$ ${}^{227}_{89}Ac^{*}_{138}$ ${}^{238}_{92}U^{*}_{146}$ ${}^{336}_{133}Ch^{ie}_{203}$

2021/2/21

$$\frac{2\pi}{\alpha^2}=\frac{2\cdot 3.14159265358979}{2.50290787509589^2}=1+\frac{1}{16\cdot 3\cdot 7}-\frac{1}{3\cdot 13\cdot 31\cdot(2\cdot 9\cdot 41+1)-\frac{1}{22}}$$

$$=1.00297507122057\approx 1$$

${}^{20,21,22}_{10}Ne_{10,11,12}$ ${}^{23}_{11}Na_{12}$ ${}^{31}_{15}P_{16}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{46,48,50}_{22}Ti_{24,26,28}$ ${}^{54,56,57,58}_{26}Fe_{28,30,31,32}$ ${}^{69,71}_{31}Ga_{38,40}$
${}^{73,74}_{32}Ge_{41,42}$ ${}^{89}_{39}Y_{50}$ ${}^{93}_{41}Nb_{52}$ ${}^{112}_{48}Cd_{64}$ ${}^{138}_{56}Ba_{82}$ ${}^{203,205}_{81}Tl_{122,124}$ ${}^{206,208}_{82}Pt_{124,126}$ ${}^{227}_{89}Ac^{*}_{138}$

2021/2/11,17

$$\frac{\alpha^2}{2\pi}=\frac{2.50290787509589^2}{2\cdot 3.14159265358979}=1-\frac{1}{16\cdot 3\cdot 7+1}+\frac{1}{8\cdot 81\cdot 19\cdot 73+\frac{1}{3\cdot 13}}$$

$$=0.997033753573803\approx 1$$

${}^{19}_{9}F_{10}$ ${}^{27}_{13}Al_{14}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{73}_{32}Ge_{41}$ ${}^{125}_{52}Te_{73}$ ${}^{137}_{56}Ba_{81}$ ${}^{180,181}_{73}Ta_{107,108}$ ${}^{203,205}_{81}Tl_{122,124}$ ${}^{336}_{133}Ch^{ie}_{203}$

2021/2/21

5. Marvelous Coincidences

There are some marvelous coincidences of factors with nuclides in the above formulas. One typical example of these coincidences is listed as follows, which indicates the methodology and the formulas in this paper should be correct.

$$\alpha_1\delta^2(2\pi)_{Chen-25\cdot17}=1+\frac{1}{128\cdot9\cdot(2\cdot3\cdot173+1)+\dfrac{7}{10}}=1.0000008354717\approx1$$

$$\frac{1}{\alpha_1\delta^2(2\pi)_{Chen-25\cdot17}}=1-\frac{1}{2\cdot5\cdot7\cdot(2\cdot83\cdot103+1)-\dfrac{9}{29}}=0.999999164529037\approx1$$

$$(2\pi)_{Chen-25\cdot17}=e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{2\cdot3\cdot71}{25\cdot17})^{23\cdot37}}$$

${}^{28,29,30}_{14}Si_{14,15,16}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{80}_{34}Se_{46}$ ${}^{79,81}_{35}Br_{44,46}$ ${}^{82,83,84,86}_{36}Kr_{46,47,48,50}$

${}^{85,87}_{37}Rb_{48,50}$ ${}^{103}_{45}Rh_{58}$ ${}^{112}_{48}Cd_{64}$ ${}^{128}_{54}Xe_{74}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{140,142}_{58}Ce_{82,84}$ ${}^{173}_{70}Yb_{103}$ ${}^{209}_{83}Bi^{*}_{126}$

${}^{209}_{84}Po^{*}_{125}$ ${}^{210}_{85}At^{*}_{125}$ ${}^{9\cdot29,262}_{103}Lr^{*}_{158,159}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{344,2\cdot173,12\cdot29}_{136,137,138}Fy^{ie}_{208,209,210}$ ${}^{434,15\cdot29}_{173}Ch^{ie}_{9\cdot29,262}$

6. Formulas of the Fine-structure Constant based on 103

In our previous paper[1,2,4], many formulas of the fine-structure constant based on the key numbers 112, 173, 137, 83 and 29 were given. As shown in the above two formulas in **Section 5**, it seems 103 is another key number comparable to the above stated key numbers, so some formulas of the fine-structure constant based on the key number 103 instead of them are constructed as follows.

$$\alpha_1=\frac{137}{29\cdot e^2\dfrac{e^2}{(\frac{2}{1})^3}\dfrac{e^2}{(\frac{3}{2})^5}\dfrac{e^2}{(\frac{4}{3})^7}\cdots\dfrac{e^2}{(\frac{11\cdot47}{4\cdot3\cdot43})^{1033}}}\frac{1}{103+\dfrac{1}{32\cdot(32\cdot29+1)-\dfrac{3}{2\cdot17}}}$$

$$=\frac{137}{29\cdot e^2\dfrac{e^2}{(\frac{2}{1})^3}\dfrac{e^2}{(\frac{3}{2})^5}\dfrac{e^2}{(\frac{4}{3})^7}\cdots\dfrac{e^2}{(\frac{11\cdot47}{4\cdot3\cdot43})^{1033}}}\frac{1}{103+\dfrac{1}{81\cdot(2\cdot3\cdot61+1)+\dfrac{31}{2\cdot17}}}$$

$$=\frac{137}{29\cdot e^2\dfrac{e^2}{(\frac{2}{1})^3}\dfrac{e^2}{(\frac{3}{2})^5}\dfrac{e^2}{(\frac{4}{3})^7}\cdots\dfrac{e^2}{(\frac{11\cdot47}{4\cdot3\cdot43})^{1033}}}\frac{1}{103+\dfrac{1}{81\cdot(16\cdot23-1)+\dfrac{31}{2\cdot17}}}$$

$$=1/137.035999037435$$

${}^{23}_{11}Na_{12}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{54,56,57,58}_{26}Fe_{28,30,31,32}$ ${}^{63,65}_{29}Cu_{34,36}$

${}^{69,71}_{31}Ga_{38,40}$ ${}^{70,72,76}_{32}Ge_{38,40,44}$ ${}^{77,78}_{34}Se_{43,44}$ ${}^{79,81}_{35}Br_{44,46}$ ${}^{80,82,83,84,86}_{36}Kr_{44,46,47,48,50}$ ${}^{97,98,99}_{43}Tc^{*}_{54,55,56}$

${}^{103}_{45}Rh_{58}$ ${}^{107,109}_{47}Ag_{60,62}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{5\cdot29,146,147}_{61}Pm^{*}_{84,85,86}$ ${}^{173}_{70}Yb_{103}$ ${}^{7\cdot29,205}_{81}Tl_{122,124}$

${}^{9\cdot29,262}_{103}Lr^{*}_{158,159}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{8\cdot43,2\cdot173,12\cdot29}_{136,137,138}Fy^{ie}_{208,209,210}$ ${}^{14\cdot31,15\cdot29}_{173}Ch^{ie}_{9\cdot29,262}$

2021/2/25

$$\alpha_1=\frac{137}{29\cdot4\cdot(2\frac{2}{3}\frac{4}{3}\frac{4}{5}\frac{6}{5}\cdots\frac{1548}{1549}\frac{2\cdot25\cdot31}{2\cdot2\cdot9\cdot43+1})}\frac{1}{103+\frac{1}{2\cdot3\cdot5\cdot(2\cdot3\cdot5\cdot7\cdot13-1)-\frac{3}{17}}}$$

$=1/137.035999037435$

${}^{27}_{13}Al_{14}$ ${}^{31}_{15}P_{16}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{55}_{25}Mn_{30}$ ${}^{54,56,57,58}_{26}Fe_{28,30,31,32}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{69,71}_{31}Ga_{38,40}$ ${}^{99}_{43}Tc^{*}_{56}$ ${}^{103}_{45}Rh_{58}$

${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{173}_{70}Yb_{103}$ ${}^{9\cdot29,262}_{103}Lr^{*}_{158,159}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{8\cdot43,2\cdot173,12\cdot29}_{136,137,138}Fy^{ie}_{208,209,210}$ ${}^{14\cdot31,15\cdot29}_{173}Ch^{ie}_{9\cdot29,262}$

$$\alpha_1=\frac{137}{29\cdot8\cdot(1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\cdots+\frac{1}{2\cdot2\cdot17\cdot29+1})}\frac{1}{103+\frac{1}{7\cdot(4\cdot7\cdot199+1)+\frac{4}{7}}}$$

$=1/137.035999037435$

${}^{28,29,30}_{14}Si_{14,15,16}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{58,62}_{28}Ni_{30,34}$ ${}^{80}_{34}Se_{46}$ ${}^{103}_{45}Rh_{58}$ ${}^{116,118,119,120}_{50}Sn_{66,68,69,70}$

${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{173}_{70}Yb_{103}$ ${}^{198,199,200}_{80}Hg_{118,119,120}$ ${}^{9\cdot29,262}_{103}Lr^{*}_{158,159}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{344,2\cdot173,12\cdot29}_{136,137,138}Fy^{ie}_{208,209,210}$

$$\alpha_1=\frac{137}{29\cdot(6+\sum_{n=1}^{7}\frac{(-1)^{n+1}}{n(n+1/2)(n+1)})}\frac{1}{103+\frac{1}{3\cdot19}-\frac{1}{125\cdot(8\cdot7\cdot11+1)+\frac{1}{4}}}$$

$=1/137.035999037435$

${}^{23}_{11}Na_{12}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{173}_{70}Yb_{103}$ ${}^{11\cdot19}_{84}Po^{*}_{125}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{344,2\cdot173,12\cdot29}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/2/26

$$\alpha_2=\frac{25\cdot e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{2500}{3\cdot49\cdot17})^{4999}}}{11\cdot19}\frac{1}{103-\frac{1}{32\cdot(512\cdot25-1)+\frac{3}{10}}}$$

$=1/137.035999111818$

${}^{35,37}_{17}Cl_{18,20}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{47,49,50}_{22}Ti_{25,27,28}$ ${}^{55}_{25}Mn_{30}$ ${}^{64,66,68}_{30}Zn_{34,36,38}$ ${}^{98,99,100,101,102}_{44}Ru_{54,55,56,57,58}$

${}^{113,115}_{49}In_{64,66}$ ${}^{114,116,118,119}_{50}Sn_{64,66,68,69}$ ${}^{157}_{64}Gd_{93}$ ${}^{166,167,168,170}_{68}Er_{98,99,100,102}$ ${}^{169}_{69}Tm_{100}$ ${}^{173}_{70}Yb_{103}$

${}^{11\cdot19}_{83}Bi^{*}_{126}$ ${}^{11\cdot19}_{84}Po^{*}_{125}$ ${}^{257}_{100}Fm^{*}_{157}$ ${}^{15\cdot19}_{112}Cn^{*}_{173}$ ${}^{2\cdot173}_{137}Fy^{ie}_{11\cdot19}$

2021/2/25

$$\alpha_2=\frac{25\cdot4\cdot(2\frac{2}{3}\frac{4}{3}\frac{4}{5}\frac{6}{5}\cdots\frac{7496}{7497}\frac{2\cdot23\cdot163}{9\cdot49\cdot17})}{11\cdot19}\frac{1}{103-\frac{1}{7\cdot(16\cdot3\cdot19\cdot257-1)}}$$

$=1/137.035999111818$

${}^{23}_{11}Na_{12}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{98,99,100,101}_{44}Ru_{54,55,56,57}$

${}^{112}_{48}Cd_{64}$ ${}^{113,115}_{49}In_{64,66}$ ${}^{118,119}_{50}Sn_{68,69}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{157}_{64}Gd_{93}$ ${}^{163}_{66}Dy_{97}$ ${}^{168}_{68}Er_{100}$ ${}^{169}_{69}Tm_{100}$

${}^{173}_{70}Yb_{103}$ ${}^{11\cdot19}_{83}Bi^{*}_{126}$ ${}^{11\cdot19}_{84}Po^{*}_{125}$ ${}^{257}_{100}Fm^{*}_{157}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{8\cdot43,2\cdot173,12\cdot29}_{136,137,138}Fy^{ie}_{208,209,210}$

$$\alpha_2=\frac{25\cdot 8\cdot(1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\cdots+\frac{1}{5\cdot 23\cdot 83})}{11\cdot 19}\frac{1}{103-\frac{1}{2\cdot 3\cdot 5\cdot 13\cdot 23\cdot(2\cdot 11\cdot 17-1)}}$$

$$=1/137.035999111818$$

${}^{23}_{11}Na_{12}$ ${}^{27}_{13}Al_{14}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{55}_{25}Mn_{30}$ ${}^{168}_{68}Er_{100}$ ${}^{169}_{69}Tm_{100}$ ${}^{11\cdot 19}_{83}Bi^{*}_{126}$

$$\alpha_2=\frac{25\cdot(6+\sum_{n=1}^{11}\frac{(-1)^{n+1}}{n(n+1/2)(n+1)})}{11\cdot 19}\frac{1}{103-\frac{1}{4\cdot 5\cdot 23}+\frac{1}{2\cdot(2\cdot 3\cdot 5\cdot 7+1)\cdot(2\cdot 9\cdot 17+1)+\frac{2}{3}}}$$

$$=1/137.035999111818$$

${}^{23}_{11}Na_{12}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{55}_{25}Mn_{30}$ ${}^{103}_{45}Rh_{58}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{173}_{70}Yb_{103}$
${}^{11\cdot 19}_{83}Bi^{*}_{126}$ ${}^{11\cdot 19}_{84}Po^{*}_{125}$ ${}^{210}_{85}At^{*}_{125}$ ${}^{238}_{92}U^{*}_{143}$ ${}^{15\cdot 19}_{112}Cn^{*}_{173}$ ${}^{344,2\cdot 173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/2/26

7. Integrated Formulas of α₁, δ, 2π and γ₁

By introducing a correction factor γ_1, some integrated formulas of α_1, δ, 2π and γ_1 in the format of $\alpha_1(\delta\gamma_1)^2(2\pi)=1$ could be obtained as follows.

$$\alpha_1(\delta/\gamma_1)^2(2\pi)=1$$

$$\gamma_1=\sqrt{2\pi\alpha_1}\delta=\sqrt{\frac{6.28564399787948}{137.035999037435}}4.66920160910299$$

$$=1-\frac{1}{47\cdot 109}+\frac{1}{27\cdot 7\cdot(3\cdot 8\cdot(3\cdot 8\cdot(4\cdot 137-1)-1)-1)}=0.999804818668238$$

${}^{45}_{21}V_{24}$ ${}^{59}_{27}Co_{32}$ ${}^{83,84}_{36}Kr_{47,48}$ ${}^{107,109}_{47}Ag_{60,62}$ ${}^{3\cdot 47}_{59}Pr_{82}$ ${}^{158}_{64}Gd_{94}$ ${}^{183}_{74}W_{109}$ ${}^{4\cdot 47}_{76}Os_{112}$ ${}^{137}_{56}Ba_{81}$ ${}^{209}_{83}Bi^{*}_{126}$
${}^{209}_{84}Po^{*}_{125}$ ${}^{278}_{109}Mt^{*}_{169}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{2\cdot 173}_{137}Fy^{ie}_{209}$

$$\frac{1}{\gamma_1}=\frac{1}{\sqrt{2\pi\alpha_1}\delta}=\sqrt{\frac{137.035999037435}{2\cdot 3.14159265358979}}\frac{1}{4.66920160910299}$$

$$=1+\frac{1}{2\cdot 13\cdot 197}-\frac{16\cdot 7\cdot 17\cdot(16\cdot 3\cdot 23-1)}{125\cdot 10^{12}}=1.00019521943495\approx 1$$

${}^{24,25,26}_{12}Mg_{12,13,14}$ ${}^{27}_{13}Al_{14}$ ${}^{28,29,30}_{14}Si_{14,15,16}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{46,48,50}_{22}Ti_{24,26,28}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{54,56,58}_{26}Fe_{28,30,32}$
${}^{58,60,62,64}_{28}Ni_{30,32,34,36}$ ${}^{74,76,78,80,82}_{34}Se_{40,42,44,46,48}$ ${}^{79,81}_{35}Br_{44,46}$ ${}^{90,91,92,96}_{40}Zr_{50,51,52,56}$ ${}^{112,116}_{48}Cd_{64,68}$
${}^{102,104,105,106,110}_{46}Pd_{56,58,59,60,64}$ ${}^{114,115,118,119,120}_{50}Sn_{64,65,68,69,70}$ ${}^{135,136,137,138}_{56}Ba_{79,80,81,82}$ ${}^{156,160}_{64}Gd_{92,96}$
${}^{168}_{68}Er_{100}$ ${}^{169}_{69}Tm_{100}$ ${}^{173}_{70}Yb_{103}$ ${}^{185,187}_{75}Re_{110,112}$ ${}^{197}_{79}Au_{118}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{210}_{85}At^{*}_{125}$ ${}^{222}_{86}Rn^{*}_{136}$ ${}^{223}_{87}Fr^{*}_{136}$
${}^{226}_{88}Ra^{*}_{138}$ ${}^{227}_{89}Ac^{*}_{138}$ ${}^{238}_{92}U^{*}_{146}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{24\cdot 13}_{125}Ch^{ie}_{187}$ ${}^{326}_{129}Ch^{ie}_{197}$ ${}^{344,2\cdot 173,348}_{136,137,138}Fy^{ie}_{208,209,210}$ ${}^{2\cdot 197}_{156}Ch^{ie}_{238}$

2021/2/28

$$\alpha_1(\delta/\gamma_{1-Chen-25\cdot17})^2(2\pi)_{Chen-25\cdot17}=1$$

$$\gamma_{1-Chen-25\cdot17}=\sqrt{(2\pi)_{Chen-25\cdot17}\alpha_1\delta}$$

$$=\frac{\sqrt{e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{2\cdot3\cdot71}{25\cdot17})^{23\cdot37}}}\cdot4.66920160910299}{\sqrt{137.035999037435}}$$

$$=\frac{\sqrt{6.28564399787948\cdot4.66920160910299}}{\sqrt{137.035999037435}}$$

$$=1+\frac{1}{2\cdot79\cdot109\cdot139-\frac{2}{17}\ or\ \frac{3}{25}}=1.00000041773574$$

$^{23}_{11}Na_{12}$ $^{31}_{15}P_{16}$ $^{35,37}_{17}Cl_{18,20}$ $^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ $^{50,51}_{23}V_{27,28}$ $^{69,71}_{31}Ga_{38,40}$ $^{79,81}_{35}Br_{44,46}$ $^{85,87}_{37}Rb_{48,50}$ $^{100}_{44}Ru_{56}$ $^{107,109}_{47}Ag_{60,62}$ $^{118,119}_{50}Sn_{68,69}$ $^{157,2\cdot79}_{64}Gd_{93,94}$ $^{168}_{68}Er_{100}$ $^{169}_{69}Tm_{100}$ $^{183}_{74}W_{109}$ $^{197}_{79}Au_{118}$ $^{257}_{100}Fm^*_{157}$ $^{2\cdot139}_{109}Mt^*_{169}$ $^{6\cdot71}_{169}Ch^{ie}_{257}$

$$\frac{1}{\gamma_{1-Chen-25\cdot17}}=\frac{1}{\sqrt{(2\pi)_{Chen-25\cdot17}\alpha_1\delta}}$$

$$=1-\frac{1}{2\cdot79\cdot109\cdot139+\frac{15}{17}\ or\ \frac{22}{25}}=0.999999582264432$$

$^{23}_{11}Na_{12}$ $^{31}_{15}P_{16}$ $^{35,37}_{17}Cl_{18,20}$ $^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ $^{50,51}_{23}V_{27,28}$ $^{69,71}_{31}Ga_{38,40}$ $^{79,81}_{35}Br_{44,46}$ $^{85,87}_{37}Rb_{48,50}$ $^{100}_{44}Ru_{56}$ $^{107,109}_{47}Ag_{60,62}$ $^{118,119}_{50}Sn_{68,69}$ $^{157,2\cdot79}_{64}Gd_{93,94}$ $^{168}_{68}Er_{100}$ $^{169}_{69}Tm_{100}$ $^{183}_{74}W_{109}$ $^{197}_{79}Au_{118}$ $^{257}_{100}Fm^*_{157}$ $^{2\cdot139}_{109}Mt^*_{169}$ $^{6\cdot71}_{169}Ch^{ie}_{257}$

2021/3/1

$$\alpha_1(\delta^2/\gamma_{1-Wallis-9\cdot71})(2\pi)_{Wallis-9\cdot71}$$

$$\gamma_{1-Wallis-9\cdot71}=\sqrt{(2\pi)_{Wallis-9\cdot71}\alpha_1\delta}$$

$$=\frac{\sqrt{4\cdot(2\frac{2}{3}\frac{4}{3}\frac{4}{5}\frac{6}{5}\cdots\frac{1278}{1279}\frac{1280}{2\cdot9\cdot71+1})}\cdot4.66920160910299}{\sqrt{137.035999037435}}$$

$$=\frac{\sqrt{6.28564015562186\cdot4.66920160910299}}{\sqrt{137.035999037435}}$$

$$=1+\frac{1}{4\cdot9\cdot(8\cdot3\cdot25\cdot7\cdot59-1)}=1.00000011209802$$

$^{27}_{13}Al_{14}$ $^{50,51}_{23}V_{27,28}$ $^{59}_{27}Co_{32}$ $^{69,71}_{31}Ga_{38,40}$ $^{82,83,84,86}_{36}Kr_{46,47,48,50}$ $^{105}_{46}Pd_{59}$ $^{112}_{48}Cd_{64}$ $^{121,123}_{51}Sb_{70,72}$ $^{112,114,118,120,122}_{50}Sn_{62,64,68,70,72}$ $^{141}_{59}Pr_{82}$ $^{173}_{70}Yb_{103}$ $^{175,176}_{71}Lu_{104,105}$ $^{175}_{75}Re_{112}$ $^{208}_{82}Pb_{126}$ $^{209}_{83}Bi^*_{126}$ $^{209}_{84}Po^*_{125}$ $^{210}_{85}At^*_{125}$ $^{285}_{112}Cn^*_{173}$ $^{344,2\cdot173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/3/2

$$\frac{1}{\gamma_{1-Wallis-9\cdot 71}} = \frac{1}{\sqrt{(2\pi)_{Wallis-9\cdot 71}\alpha_1\delta}}$$

$$=1-\frac{1}{5\cdot 7\cdot(32\cdot 27\cdot 5\cdot 59-1)} = 0.999999887901990$$

$^{27}_{13}Al_{14}$ $^{50,51}_{23}V_{27,28}$ $^{59}_{27}Co_{32}$ $^{69,71}_{31}Ga_{38,40}$ $^{82,83,84,86}_{36}Kr_{46,47,48,50}$ $^{105}_{46}Pd_{59}$ $^{112}_{48}Cd_{64}$ $^{121,123}_{51}Sb_{70,72}$

$^{112,114,118,120,122}_{50}Sn_{62,64,68,70,72}$ $^{141}_{59}\mathrm{Pr}_{82}$ $^{173}_{70}Yb_{103}$ $^{175,176}_{71}Lu_{104,105}$ $^{175}_{75}\mathrm{Re}_{112}$ $^{208}_{82}Pb_{126}$ $^{209}_{83}Bi^{*}_{126}$

$^{209}_{84}Po^{*}_{125}$ $^{210}_{85}At^{*}_{125}$ $^{285}_{112}Cn^{*}_{173}$ $^{344,2\cdot 173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/3/2

$$\alpha_1(\delta/\gamma_{1-GL-22\cdot 37})^2(2\pi)_{GL-22\cdot 37} = 1$$

$$\gamma_{1-GL-22\cdot 37} = \sqrt{(2\pi)_{GL-22\cdot 37}\alpha_1\delta}$$

$$= \frac{\sqrt{8\cdot(1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\cdots+\frac{1}{2\cdot 2\cdot 11\cdot 37+1})}\cdot 4.66920160910299}{\sqrt{137.035999037435}}$$

$$= \frac{\sqrt{6.28563929398602}\cdot 4.66920160910299}{\sqrt{137.035999037435}}$$

$$=1+\frac{1}{4\cdot 25\cdot 7\cdot(2\cdot 23^2\cdot 31-1)+\frac{6}{11}} = 1.00000004355799$$

$^{23}_{11}Na_{12}$ $^{47}_{22}Ti_{25}$ $^{50,51}_{23}V_{27,28}$ $^{55}_{25}Mn_{30}$ $^{69,71}_{31}Ga_{38,40}$ $^{75}_{33}As_{42}$ $^{85,87}_{37}Rb_{48,50}$ $^{99,100}_{44}Ru_{55,56}$ $^{108}_{46}Pd_{62}$

$^{112,115,116,119,120,124}_{50}Sn_{62,65,66,69,70,74}$ $^{136,137,138}_{56}Ba_{80,81,82}$ $^{169}_{69}Tm_{100}$ $^{184}_{74}W_{110}$ $^{257}_{100}Fm^{*}_{157}$

$$\frac{1}{\gamma_{1-GL-22\cdot 37}} = \frac{1}{\sqrt{(2\pi)_{GL-22\cdot 37}\alpha_1\delta}}$$

$$=1-\frac{1}{2\cdot 9\cdot 11\cdot 47\cdot(2\cdot 9\cdot 137+1)-\frac{5}{11}} = 0.999999956442012$$

$^{23}_{11}Na_{12}$ $^{47}_{22}Ti_{25}$ $^{55}_{25}Mn_{30}$ $^{83,84}_{36}Kr_{47,48}$ $^{85,87}_{37}Rb_{48,50}$ $^{99,100}_{44}Ru_{55,56}$ $^{107,109}_{47}Ag_{60,62}$ $^{137}_{56}Ba_{81}$

$^{160,162}_{66}Dy_{94,96}$ $^{182,184}_{74}W_{108,110}$ $^{209}_{83}Bi^{*}_{126}$ $^{209}_{84}Po^{*}_{125}$ $^{285}_{112}Cn^{*}_{173}$ $^{2\cdot 173}_{137}Fy^{*}_{209}$

2021/3/2

$$\alpha_1(\delta/\gamma_{1-NC-3})^2(2\pi)_{NC-3} = 1$$

$$\gamma_{1-NC-3} = \sqrt{(2\pi)_{NC-3}\alpha_1\delta}$$

$$= \frac{\sqrt{(6+\sum_{n=1}^{3}\frac{(-1)^{n+1}}{\mathrm{n(n+1/2)(n+1)}})}\cdot 4.66920160910299}{\sqrt{137.035999037435}}$$

$$= \frac{\sqrt{6.29047619047619}\cdot 4.66920160910299}{\sqrt{137.035999037435}}$$

$$=1+\frac{1}{23\cdot113}-\frac{1}{2\cdot3\cdot257\cdot(4\cdot5\cdot29\cdot31+1)}=1.00038472730421$$

$^{50,51}_{23}V_{27,28}$ $^{63,65}_{29}Cu_{34,36}$ $^{69,71}_{31}Ga_{38,40}$ $^{104,108}_{46}Pd_{58,62}$ $^{113,115}_{49}In_{64,66}$ $^{157}_{64}Gd_{93}$ $^{169}_{69}Tm_{100}$ $^{189}_{76}Os_{113}$

$^{226}_{88}Ra^{*}_{138}$ $^{257}_{100}Fm^{*}_{157}$ $^{284,286}_{113}Nh^{ie}_{171,173}$ $^{426}_{169}Ch^{ie}_{257}$

2021/3/3

$$\frac{1}{\gamma_{1-NC-3}}=\frac{1}{\sqrt{(2\pi)_{NC-3}\alpha_1}\delta}$$

$$=1-\frac{1}{8\cdot25\cdot13}+\frac{1}{179\cdot(8\cdot9\cdot(2\cdot3\cdot(2\cdot179+1)-1)+1)-\frac{3}{7}}=0.999615420653963$$

$^{56}_{26}Fe_{30}$ $^{100}_{44}Ru_{56}$ $^{115,119}_{50}Sn_{65,69}$ $^{124}_{52}Te_{72}$ $^{169}_{69}Tm_{100}$ $^{179}_{72}Hf_{107}$ $^{257}_{100}Fm^{*}_{157}$ $^{298}_{119}Ch^{ie}_{179}$

2021/3/2

8. Integrated Formulas of α_2, α, δ and γ_2

By introducing a correction factor γ_2, some integrated formulas of α_2, α, δ and γ_2 in the format of $\alpha_2(\delta\alpha\gamma_2)^2=1$ could be obtained as follows.

$$\alpha_2(\delta\alpha/\gamma_2)^2=1$$

$$\gamma_2=\sqrt{\alpha_2(\alpha\delta)^2}=\frac{4.66920160910299\cdot2.50290787509589}{\sqrt{137.035999111818}}$$

$$=1-\frac{1}{5\cdot7\cdot17}+\frac{1}{4\cdot3\cdot17\cdot23\cdot137-\frac{11}{59}}=0.998320883415699$$

$^{23}_{11}Na_{12}$ $^{35,37}_{17}Cl_{18,20}$ $^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ $^{50,51}_{23}V_{27,28}$ $^{59}_{27}Co_{32}$ $^{78,80}_{34}Se_{44,46}$ $^{79,81}_{35}Br_{44,46}$

$^{82,83,84,86}_{36}Kr_{46,47,48,50}$ $^{99,100}_{44}Ru_{55,56}$ $^{105}_{46}Pd_{59}$ $^{118,7\cdot17,120}_{50}Sn_{68,69,70}$ $^{121,123}_{51}Sb_{70,72}$ $^{136,137,138}_{56}Ba_{80,81,82}$

$^{141}_{59}\mathrm{Pr}_{82}$ $^{168}_{68}Er_{100}$ $^{169}_{69}Tm_{100}$ $^{173}_{70}Yb_{103}$ $^{208}_{82}\mathrm{Pt}_{126}$ $^{209}_{83}Bi^{*}_{126}$ $^{209}_{84}Po^{*}_{125}$ $^{210}_{85}At^{*}_{125}$ $^{222}_{86}Rn^{*}_{136}$ $^{223}_{87}Fr^{*}_{136}$

$^{226}_{88}Ra^{*}_{138}$ $^{227}_{89}Ac^{*}_{138}$ $^{238}_{92}U^{*}_{146}$ $^{285}_{112}Cn^{*}_{173}$ $^{344,2\cdot173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/2/28

$$\frac{1}{\gamma_2}=\frac{1}{\sqrt{\alpha_2}\delta\alpha}=\frac{\sqrt{137.035999111818}}{4.66920160910299\cdot2.50290787509589}$$

$$=1+\frac{1}{2\cdot27\cdot11}-\frac{1}{5\cdot17\cdot(16\cdot3\cdot157+1)+\frac{16}{17}}=1.00168194075892$$

$^{19}_{9}F_{10}$ $^{23}_{11}Na_{12}$ $^{35,37}_{17}Cl_{18,20}$ $^{36,38,40}_{18}Ar_{18,20,22}$ $^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ $^{59}_{27}Co_{32}$ $^{74,78,80,82}_{34}Se_{40,44,46,48}$

$^{82,83,84,86}_{36}Kr_{46,47,48,50}$ $^{85,87}_{37}Rb_{48,50}$ $^{99,100}_{44}Ru_{55,56}$ $^{112}_{48}Cd_{64}$ $^{118,120}_{50}Sn_{68,70}$ $^{136,137,138}_{56}Ba_{80,81,82}$

$^{143,144,145}_{60}Nd_{83,84,85}$ $^{157}_{64}Gd_{93}$ $^{167,168}_{68}Er_{99,100}$ $^{200}_{80}Hg_{120}$ $^{208}_{82}\mathrm{Pt}_{126}$ $^{209}_{83}Bi^{*}_{126}$ $^{209}_{84}Po^{*}_{125}$ $^{210}_{85}At^{*}_{125}$

$^{257}_{100}Fm^{*}_{157}$ $^{2\cdot157}_{126}Ch^{ie}_{188}$ $^{400}_{157}Ch^{ie}_{243}$

2021/2/27

9. Integrated Formulas of α₁, α₂, α, 2π, γ₁ and γ₂

$$\frac{\alpha_1(2\pi)}{\alpha_2(\alpha\gamma_1/\gamma_2)^2}=1$$

$$\frac{\gamma_1}{\gamma_2}=\frac{\sqrt{137.035999111818\cdot(2\cdot3.14159265358979)}}{\sqrt{137.035999037435}\cdot2.50290787509589}$$

$$=1+\frac{1}{32\cdot3\cdot7}-\frac{1}{32\cdot89\cdot(4\cdot53-1)-\frac{25}{2\cdot23}}=1.00148643114372$$

$^{50,51}_{23}V_{27,28}$ $^{53}_{24}Cr_{29}$ $^{89}_{39}Y_{50}$ $^{95}_{42}Mo_{53}$ $^{2\cdot53}_{46}Pd_{60}$ $^{112}_{48}Cd_{64}$ $^{119}_{50}Sn_{69}$ $^{127}_{53}I_{74}$ $^{136,137,138}_{56}Ba_{80,81,82}$ $^{151,153}_{63}Eu_{88,90}$

$^{169}_{69}Tm_{100}$ $^{2\cdot89}_{72}Hf_{2\cdot53}$ $^{185,187}_{75}\mathrm{Re}_{110,112}$ $^{227}_{89}Ac^{*}_{138}$ $^{285}_{112}Cn^{*}_{173}$ $^{6\cdot53-320}_{127}Ch^{ie}_{191-193}$ $^{344,2\cdot173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

$$\frac{\gamma_2}{\gamma_1}=1-\frac{1}{32\cdot3\cdot7+1}+\frac{1}{4\cdot53\cdot(2\cdot49\cdot29+1)+\frac{2\cdot3}{23}}=0.99851577505446$$

$^{28,29,30}_{14}Si_{14,15,16}$ $^{50,51}_{23}V_{27,28}$ $^{53}_{24}Cr_{29}$ $^{63,65}_{29}Cu_{34,36}$ $^{95}_{42}Mo_{53}$ $^{2\cdot53}_{46}Pd_{60}$ $^{112}_{48}Cd_{64}$ $^{127}_{53}I_{74}$ $^{136,137,138}_{56}Ba_{80,81,82}$

$^{285}_{112}Cn^{*}_{173}$ $^{336}_{133}Ch^{ie}_{7\cdot29}$ $^{6\cdot53,11\cdot29,320}_{127}Ch^{ie}_{191,192,193}$ $^{344,2\cdot173,12\cdot29}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/3/3

10. Integrated Formulas α, 2π and γ

By introducing a correction factor γ, some integrated formulas of 2π, α and γ in the format of $2\pi/(\alpha\gamma)^2=1$ could be obtained as follows.

$$\frac{2\pi}{(\alpha\gamma)^2}=1$$

$$\gamma=\frac{\sqrt{(2\cdot3.14159265358979)}}{2.50290787509589^2}$$

$$=1+\frac{1}{32\cdot3\cdot7}-\frac{1}{23\cdot151\cdot173+\frac{9}{4\cdot7}}=1.00148643087192$$

$^{23}_{11}Na_{12}$ $^{50,51}_{23}V_{27,28}$ $^{82,83,84}_{36}Kr_{46,47,48}$ $^{136,137,138}_{56}Ba_{80,81,82}$ $^{151,153}_{63}Eu_{88,90}$ $^{208}_{82}Pd_{126}$ $^{209}_{83}Bi^{*}_{126}$ $^{209}_{84}Po^{*}_{125}$

$^{247}_{96}Cm^{*}_{151}$ $^{285}_{112}Cn^{*}_{173}$ $^{344,2\cdot173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

$$\frac{1}{\gamma}=1-\frac{1}{32\cdot3\cdot7+1}+\frac{1}{2\cdot41\cdot(2\cdot3\cdot25\cdot49-1)-\frac{1}{6}}=0.99851577532546$$

$^{55}_{25}Mn_{30}$ $^{73}_{32}Ge_{41}$ $^{82,83,84,86}_{36}Kr_{46,47,48,50}$ $^{93}_{41}Nb_{52}$ $^{140,142}_{58}Ce_{82,84}$ $^{208}_{82}Pd_{126}$ $^{209}_{83}Bi^{*}_{126}$ $^{209}_{84}Po^{*}_{125}$ $^{210}_{85}At^{*}_{125}$

2021/3/3

11. Summary

The above integrated formulas of the fine-structure constant and Feigenbaum constants are summarized as follows.

The Fine-structure Constant:

$$\alpha_1 = \frac{\lambda_e}{2\pi a_0} = \frac{36}{7\cdot(2\pi)_{Chen-112}} \frac{1}{112+\frac{1}{75^2}} = 1/137.035999037435$$

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

Feigenbaum Constants: $\delta = 4.66920160910299$

$\alpha = 2.50290787509589$

$2\pi = 2\cdot 3.14159265358979$

$$\alpha_1(\delta/\gamma_1)^2(2\pi) = 1$$

$$\gamma_1 = 1 - \frac{1}{47\cdot109} + \frac{1}{27\cdot7\cdot(3\cdot8\cdot(3\cdot8\cdot(4\cdot137-1)-1)-1)} = 0.999804818668238$$

$$\frac{1}{\gamma_1} = 1 + \frac{1}{2\cdot13\cdot197} - \frac{16\cdot7\cdot17\cdot(16\cdot3\cdot23-1)}{125\cdot10^{12}} = 1.00019521943495$$

$$\gamma_1^2 = 1 - \frac{1}{13\cdot197} + \frac{1}{2\cdot7\cdot41\cdot(4\cdot5\cdot19\cdot31-1)} = 0.99960967543223$$

$$\frac{1}{\gamma_1^2} = 1 + \frac{1}{512\cdot5} - \frac{1}{4\cdot9\cdot7\cdot17\cdot19\cdot83} = 1.00039047698053$$

$$\alpha_1(\delta/\gamma_{1-Chen-25\cdot17})^2(2\pi)_{Chen-25\cdot17} = 1$$

$$(2\pi)_{Chen-25\cdot17} = e^2 \frac{e^2}{(\frac{2}{1})^3} \frac{e^2}{(\frac{3}{2})^5} \frac{e^2}{(\frac{4}{3})^7} \cdots \frac{e^2}{(\frac{2\cdot3\cdot71}{25\cdot17})^{23\cdot37}} 6.28564399787948$$

$$\gamma_{1-Chen-25\cdot17} = 1 + \frac{1}{2\cdot79\cdot109\cdot139-\frac{3}{25}} = 1.00000041773574$$

$$\frac{1}{\gamma_{1-Chen-25\cdot17}} = 1 - \frac{1}{2\cdot79\cdot109\cdot139+\frac{22}{25}} = 0.999999582264432$$

$$\gamma_{1-Chen-25\cdot17}^{\ 2} = 1 + \frac{1}{128\cdot9\cdot(2\cdot3\cdot173+1)+\frac{7}{10}} = 1.0000008354717$$

$$\frac{1}{\gamma_{1-Chen-25\cdot17}^{\ 2}} = 1 - \frac{1}{2\cdot5\cdot7\cdot(2\cdot83\cdot103+1)-\frac{9}{29}} = 0.999999164529037 \approx 1$$

$$\alpha_1(\delta/\gamma_{1-Wallis-9\cdot71})^2(2\pi)_{Wallis-9\cdot71}=1$$

$$(2\pi)_{Wallis-9\cdot71}=4\cdot(2\frac{2}{3}\frac{4}{3}\frac{4}{5}\frac{6}{5}\cdots\frac{1278}{1279}\frac{1280}{2\cdot9\cdot71+1})=6.28564015562186$$

$$\gamma_{1-Wallis-9\cdot71}=1+\frac{1}{4\cdot9\cdot(8\cdot3\cdot25\cdot7\cdot59-1)}=1.00000011209802$$

$$\frac{1}{\gamma_{1-Wallis-9\cdot71}}=1-\frac{1}{5\cdot7\cdot(32\cdot27\cdot5\cdot59-1)}=0.999999887901990$$

$$\gamma_{1-Wallis-9\cdot71}{}^2=1+\frac{1}{2\cdot9\cdot(8\cdot3\cdot25\cdot7\cdot59-1)-\frac{5}{17}}=1.00000022419606$$

$$\frac{1}{\gamma_{1-Wallis-9\cdot71}{}^2}=1-\frac{1}{2\cdot9\cdot(8\cdot3\cdot25\cdot7\cdot59-1)+\frac{3\cdot4}{17}}=0.99999977580399$$

$$\alpha_1\delta^2(2\pi/\gamma_{1-GL-22\cdot37})_{GL-22\cdot37}=1$$

$$(2\pi)_{GL-22\cdot37}=8\cdot(1-\frac{1}{3}+\frac{1}{5}-\frac{1}{7}+\cdots+\frac{1}{2\cdot2\cdot11\cdot37+1})=6.28563929398602$$

$$\gamma_{1-GL-22\cdot37}=1+\frac{1}{4\cdot25\cdot7\cdot(2\cdot23^2\cdot31-1)+\frac{6}{11}}=1.00000004355799$$

$$\frac{1}{\gamma_{1-GL-22\cdot37}}=1-\frac{1}{2\cdot9\cdot11\cdot47\cdot(2\cdot9\cdot137+1)-\frac{5}{11}}=0.999999956442012$$

$$\gamma_{1-GL-22\cdot37}{}^2=1+\frac{1}{163\cdot(6\cdot11^2\cdot97+1)+\frac{9}{10}}=1.00000008711598$$

$$\frac{1}{\gamma_{1-GL-22\cdot37}{}^2}=1-\frac{1}{9\cdot11\cdot47\cdot(2\cdot9\cdot137+1)-\frac{2}{25}}=0.999999912884025$$

$$\alpha_1(\delta/\gamma_{1-NC-3})^2(2\pi)_{NC-3}=1$$

$$(2\pi)_{NC-3}=(6+\sum_{n=1}^{3}\frac{(-1)^{n+1}}{\mathrm{n(n+1/2)(n+1)}})=6.29047619047619$$

$$\gamma_{1-NC-3}=1+\frac{1}{23\cdot113}-\frac{1}{2\cdot3\cdot257\cdot(4\cdot5\cdot29\cdot31+1)}=1.00038472730421$$

$$\frac{1}{\gamma_{1-NC-3}}=1-\frac{1}{8\cdot25\cdot13}+\frac{1}{179\cdot(8\cdot9\cdot(2\cdot3\cdot(2\cdot179+1)-1)+1)-\frac{3}{7}}$$

$$=0.999615420653963$$

$$\gamma_{1-NC-3}{}^2 = 1 + \frac{1}{3\cdot(2\cdot7\cdot31-1)} - \frac{1}{13\cdot89\cdot(2\cdot37\cdot53+1) - \frac{2\cdot9}{25}} = 1.00076960262352$$

$$\frac{1}{\gamma_{1-NC-3}{}^2} = 1 - \frac{1}{4\cdot25\cdot13} + \frac{1}{4\cdot9\cdot25\cdot(2\cdot25\cdot(4\cdot25+1)+1) + \frac{2}{7}} = 0.999230989209198$$

$$\alpha_2(\delta\alpha/\gamma_2)^2 = 1$$

$$\gamma_2 = 1 - \frac{1}{5\cdot7\cdot17} + \frac{1}{4\cdot3\cdot17\cdot23\cdot137 - \frac{11}{59}} = 0.998320883415699$$

$$\frac{1}{\gamma_2} = 1 + \frac{1}{2\cdot27\cdot11} - \frac{1}{5\cdot17\cdot(16\cdot3\cdot157+1) + \frac{16}{17}} = 1.00168194075892$$

$$\gamma_2{}^2 = 1 - \frac{1}{2\cdot149} + \frac{1}{29\cdot31\cdot(2\cdot3\cdot49\cdot13+1) - \frac{16}{19}} = 0.996644586263908$$

$$\frac{1}{\gamma_2{}^2} = 1 + \frac{1}{27\cdot11} - \frac{1}{2\cdot3\cdot25\cdot11\cdot(4\cdot11\cdot47+1) - \frac{2}{5}} = 1.00336671044256$$

$$\frac{\alpha_1(2\pi)}{\alpha_2(\alpha\gamma_1/\gamma_2)^2} = 1$$

$$\frac{\gamma_1}{\gamma_2} = 1 + \frac{1}{32\cdot3\cdot7} - \frac{1}{32\cdot89\cdot(4\cdot53-1) - \frac{25}{2\cdot23}} = 1.00148643114372$$

$$\frac{\gamma_2}{\gamma_1} = 1 - \frac{1}{32\cdot3\cdot7+1} + \frac{1}{4\cdot53\cdot(2\cdot49\cdot29+1) + \frac{2\cdot3}{23}} = 0.99851577505446$$

$$(\frac{\gamma_1}{\gamma_2})^2 = 1 + \frac{1}{16\cdot3\cdot7} - \frac{1}{2\cdot3\cdot7\cdot(4\cdot17\cdot(2\cdot157-1)-1) - \frac{1}{4}} = 1.00297507176499$$

$$(\frac{\gamma_2}{\gamma_1})^2 = 1 - \frac{1}{16\cdot3\cdot7+1} + \frac{1}{7\cdot19\cdot(2\cdot3\cdot7^2\cdot23-1) + \frac{16}{3\cdot13}}$$

$$= 1 - \frac{1}{16\cdot3\cdot7+1} + \frac{1}{7\cdot19\cdot(8\cdot5\cdot13^2+1) + \frac{16}{3\cdot13}}$$

$$= 1 - \frac{1}{16\cdot3\cdot7+1} + \frac{1}{2\cdot3\cdot73\cdot(4\cdot27\cdot19+1) - \frac{23}{3\cdot13}} = 0.997033753032614$$

$$\frac{2\pi}{(\alpha\gamma)^2}=1$$

$$\gamma=1+\frac{1}{32\cdot 3\cdot 7}-\frac{1}{23\cdot 151\cdot 173+\frac{9}{4\cdot 7}}=1.00148643087192$$

$$\frac{1}{\gamma}=1-\frac{1}{32\cdot 3\cdot 7+1}+\frac{1}{2\cdot 41\cdot(2\cdot 3\cdot 25\cdot 49-1)-\frac{1}{6}}=0.99851577532546$$

$$\gamma^2=1+\frac{1}{16\cdot 3\cdot 7}-\frac{1}{3\cdot 13\cdot 31\cdot(2\cdot 9\cdot 41+1)-\frac{1}{22}}=1.0029750712205$$

$$\frac{1}{\gamma^2}=1-\frac{1}{16\cdot 3\cdot 7+1}+\frac{1}{8\cdot 81\cdot 19\cdot 73+\frac{1}{3\cdot 13}}=0.997033753573803$$

12. **Some Supplement Formulas of Feigenbaum Constants**

$$(\delta\alpha)^2=(4.66920160910299\cdot 2.50290787509589)^2=136.576186638059$$

$$=\frac{100\cdot(112+\frac{1}{3\cdot 5\cdot 73}-\frac{1}{2\cdot 5\cdot 73\cdot(32\cdot 3\cdot 23-1)})}{13\cdot e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{42}{41})^{83}}}$$

${}^{24,25,26}_{12}Mg_{12,13,14}$ ${}^{27}_{13}Al_{14}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ ${}^{55}_{25}Mn_{30}$ ${}^{56,58}_{26}Fe_{30,32}$

${}^{73,74}_{32}Ge_{41,42}$ ${}^{75}_{33}As_{42}$ ${}^{82,83,84}_{36}Kr_{46,47,48}$ ${}^{93}_{41}Nb_{52}$ ${}^{92,93,94,96,100}_{42}Mo_{50,51,52,54,58}$ ${}^{100}_{44}Ru_{56}$

${}^{107,109}_{47}Ag_{60,62}$ ${}^{112}_{48}Cd_{64}$ ${}^{125}_{52}Te_{73}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{142,143,144,146}_{60}Nd_{82,83,84,86}$ ${}^{146}_{61}Pm^{*}_{85}$

${}^{157,160}_{64}Gd_{93,96}$ ${}^{169}_{69}Tm_{100}$ ${}^{180,181}_{73}Ta_{107,108}$ ${}^{185,187}_{75}\mathrm{Re}_{110,112}$ ${}^{9\cdot 23,208}_{82}Pb_{125,126}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$

${}^{235,238}_{92}U^{*}_{143,146}$ ${}^{257}_{100}Fm^{*}_{157}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{344,2\cdot 173,348}_{137}Fy^{ie}_{208,209,210}$ ${}^{370}_{146}Ch^{ie}_{224}$

$$(\delta\alpha)^2=(4.66920160910299\cdot 2.50290787509589)^2=136.57618663\cdot 1518059$$

$$=\frac{100\cdot(112-\frac{1}{2\cdot 53}+\frac{1}{25\cdot 19\cdot 181+\frac{23}{29}})}{13\cdot e^2\frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{43}{42})^{85}}}$$

${}^{19}_{9}F_{10}$ ${}^{27}_{13}Al_{14}$ ${}^{28,29,30}_{14}Si_{14,15,16}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{40,42,43,46}_{20}Ca_{20,22,23,26}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{53}_{24}Cr_{29}$ ${}^{55}_{25}Mn_{30}$

${}^{54,56,57,58}_{26}Fe_{28,30,31,32}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{74}_{33}Ar_{42}$ ${}^{88}_{38}Sr_{50}$ ${}^{92,94,95,97,98,100}_{42}Mo_{50,52,53,55,56,58}$ ${}^{97,99}_{43}Tc^{*}_{54,56}$

${}^{100}_{44}Ru_{56}$ ${}^{106}_{46}\mathrm{Pd}_{60}$ ${}^{112,114,115,116,119}_{50}Sn_{62,64,65,66,69}$ ${}^{145}_{60}Nd_{85}$ ${}^{161,163}_{66}Dy_{95,97}$ ${}^{168}_{68}Er_{100}$ ${}^{180,181}_{73}Ta_{107,108}$

${}^{169}_{69}Tm_{100}$ ${}^{185,187}_{75}\mathrm{Re}_{110,112}$ ${}^{210}_{85}At^{*}_{125}$ ${}^{243}_{95}Am^{*}_{148}$ ${}^{257}_{100}Fm^{*}_{157}$ ${}^{269,271}_{106}Sg^{*}_{163,165}$ ${}^{302}_{121}Ch^{ie}_{181}$ ${}^{400}_{157}Ch^{ie}_{243}$

2021/3/23

$$(\delta\alpha)^2 = (4.66920160910299 \cdot 2.50290787509589)^2 = 136.576186638059$$

$$= \frac{11\cdot 19\cdot(103+\frac{1}{2\cdot 109}-\frac{1}{4\cdot 3\cdot 11\cdot(4\cdot 13^2+1)+\frac{19}{30}})}{25\cdot e^2 \frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{48}{47})^{5\cdot 19}}}$$

$$= \frac{11\cdot 19\cdot(103+\frac{1}{2\cdot 109}-\frac{1}{4\cdot 3\cdot 11\cdot(6\cdot 113-1)+\frac{19}{30}})}{25\cdot e^2 \frac{e^2}{(\frac{2}{1})^3}\frac{e^2}{(\frac{3}{2})^5}\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{48}{47})^{5\cdot 19}}}$$

${}^{23}_{11}Na_{12}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{55}_{25}Mn_{30}$ ${}^{75}_{33}As_{42}$ ${}^{83,84}_{36}Kr_{47,48}$ ${}^{107,109}_{47}Ag_{60,62}$ ${}^{112,113}_{48}Cd_{64,65}$ ${}^{173}_{70}Yb_{103}$ ${}^{183}_{74}W_{109}$
${}^{160,161,162}_{66}Dy_{94,95,96}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{226}_{88}Ra^{*}_{138}$ ${}^{5\cdot 47}_{92}U^{*}_{143}$ ${}^{243}_{95}Am^{*}_{148}$ ${}^{278}_{109}Mt^{*}_{169}$ ${}^{15\cdot 19}_{112}Cn^{*}_{173}$ ${}^{2\cdot 143}_{113}Nh^{ie}_{173}$

2021/3/24

$$(\delta\alpha)^2 = (4.66920160910299 \cdot 2.50290787509589)^2 = 136.576186638059$$

$$= 137 - \frac{1}{2} + \frac{1}{13} - \frac{1}{23\cdot 59} + \frac{1}{8\cdot 3\cdot 19\cdot(16\cdot 3\cdot 5\cdot 19+1)}$$

${}^{19}_{9}F_{10}$ ${}^{23}_{11}Na_{12}$ ${}^{27}_{13}Al_{14}$ ${}^{31}_{15}P_{16}$ ${}^{36,38,40}_{18}Ar_{18,20,22}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{40,43,44,46,48}_{20}Ca_{20,23,24,26,28}$ ${}^{50,51}_{23}V_{27,28}$
${}^{54,56,57,58}_{26}Fe_{28,30,31,32}$ ${}^{59}_{27}Co_{32}$ ${}^{68}_{30}Zn_{38}$ ${}^{86,88}_{38}Sr_{48,50}$ ${}^{105}_{46}Pd_{59}$ ${}^{112}_{48}Cd_{64}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{15\cdot 19}_{112}Cn^{*}_{173}$
${}^{344,2\cdot 173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

2021/3/24

$$(\delta\alpha)^2 = (4.66920160910299 \cdot 2.50290787509589)^2 = 136.5761866380594500$$

$$= 137 - \cfrac{1}{2+\cfrac{1}{2+\cfrac{1}{1+\cfrac{1}{3+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{2+\cfrac{1}{1+\cfrac{1}{5+\cfrac{1}{5+\cfrac{1}{3+\cfrac{1}{2+\cfrac{1}{2+\cfrac{1}{1+\cfrac{1}{6}}}}}}}}}}}}}}$$

$$=137-\frac{11\cdot139\cdot(4\cdot73+1)}{2\cdot3\cdot41\cdot(8\cdot3\cdot179+1)}$$

${}^{23}_{11}Na_{12}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{72,73}_{32}Ge_{40,41}$ ${}^{121,123}_{51}Sb_{70,72}$ ${}^{138,139}_{57}La_{81,82}$ ${}^{179}_{72}Hf_{107}$ ${}^{180,181}_{73}Ta_{107,108}$

${}^{346}_{137}Fy^{ie}_{209}$ ${}^{348}_{139}Ch^{ie}_{209}$

2021/4/5

$$\delta^2=(4.66920160910299)^2=21.8014436664500$$

$$=\frac{7\cdot(112+\frac{1}{8}-\frac{1}{3\cdot101}+\frac{1}{3\cdot31\cdot(4\cdot11\cdot23+1)+\frac{4}{7}})}{36}=21.8014436664499$$

${}^{23}_{11}Na_{12}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{56,57}_{26}Fe_{30,31}$ ${}^{58,60,61,62,64}_{28}Ni_{30,32,33,34,36}$ ${}^{69,71}_{31}Ga_{38,40}$ ${}^{93}_{41}Nb_{52}$ ${}^{100,101}_{44}Ru_{56,57}$

${}^{157}_{64}Gd_{93}$ ${}^{171,173}_{70}Yb_{101,103}$ ${}^{237}_{93}Np^{*}_{144}$ ${}^{258}_{101}Md^{*}_{157}$

2021/3/23

$$\delta^2=(4.66920160910299)^2=21.8014436664500$$

$$=\frac{29\cdot(103-\frac{1}{11\cdot13}+\frac{1}{2\cdot131\cdot191+\frac{9\cdot5}{7\cdot11}})}{137}$$

${}^{28,29,30}_{14}Si_{14,15,16}$ ${}^{45}_{21}Sc_{24}$ ${}^{53}_{24}Cr_{29}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{79,81}_{35}Br_{44,46}$ ${}^{103}_{45}Rh_{58}$ ${}^{131}_{54}Xe_{77}$ ${}^{137}_{56}Ba_{81}$ ${}^{143}_{60}Nd_{83}$

${}^{173}_{70}Yb_{103}$ ${}^{191,193}_{77}Ir_{114,116}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{235}_{92}U^{*}_{143}$ ${}^{2\cdot131}_{103}Lr^{*}_{159}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{2\cdot143}_{113}Nh^{ie}_{173}$ ${}^{2\cdot159,11\cdot29,320}_{127}Ch^{ie}_{191,192,193}$

${}^{4\cdot83}_{131}Ch^{ie}_{201}$ ${}^{2\cdot173}_{137}Fy^{ie}_{209}$ ${}^{363,364}_{143}Ch^{ie}_{220,221}$ ${}^{434,15\cdot29}_{173}Ch^{ie}_{9\cdot29,2\cdot131}$

2021/3/24

$$\delta^2=(4.66920160910299)^2=21.8014436664500$$

$$=22-\frac{1}{5}+\frac{1}{4\cdot173}-\frac{1}{11^3\cdot23^2-\frac{4}{19}}$$

${}^{10,11}_{5}B_{5,6}$ ${}^{20,21,22}_{10}Ne_{10,11,12}$ ${}^{23}_{11}Na_{12}$ ${}^{39,40,41}_{19}K_{20,21,22}$ ${}^{40,42,43,44,46,48}_{20}Ca_{20,22,23,24,26,28}$ ${}^{45}_{21}Sc_{24}$

${}^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{69,71}_{31}Ga_{38,40}$ ${}^{79,80}_{35}Br_{44,46}$ ${}^{83,84}_{36}Kr_{47,48}$ ${}^{88}_{38}Sr_{50}$ ${}^{100}_{44}Ru_{56}$

${}^{103}_{45}Rh_{58}$ ${}^{110,112,113,114}_{48}Cd_{62,64,65,66}$ ${}^{113,115}_{49}In_{64,66}$ ${}^{112,114,115,116,119,120,122}_{50}Sn_{62,64,65,66,69,70,72}$

${}^{121,123}_{51}Sb_{70,72}$ ${}^{151,153}_{63}Eu_{88,90}$ ${}^{169}_{69}Tm_{100}$ ${}^{173}_{70}Yb_{103}$ ${}^{185,187}_{75}Re_{110,112}$ ${}^{188,9\cdot21,190}_{76}Os_{112,113,114}$

${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{226}_{88}Ra^{*}_{138}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{276}_{113}Nh^{ie}_{173}$ ${}^{2\cdot151}_{121}Ch^{ie}_{181}$ ${}^{2\cdot173}_{137}Fy^{ie}_{209}$ ${}^{434,435}_{173}Ch^{ie}_{261,262}$

2021/4/3

$$\delta^2 = (4.66920160910299)^2 = 21.8014436664500$$

$$= 22 - \cfrac{1}{5+\cfrac{1}{27+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{34+\cfrac{1}{13+\cfrac{1}{1+\cfrac{1}{2+\cfrac{1}{1+\cfrac{1}{11}}}}}}}}}}$$

$$= 22 - \cfrac{1}{5+\cfrac{1}{27+\cfrac{1}{1+\cfrac{1}{1+\cfrac{1}{34+\cfrac{47}{2\cdot 17\cdot 19}}}}}} = 22 - \cfrac{1}{5+\cfrac{1}{27+\cfrac{139\cdot 163}{4\cdot 13\cdot(2\cdot 3\cdot 11\cdot 13+1)}}}$$

$^{23}_{11}Na_{12}$ $^{27}_{13}Al_{14}$ $^{35,37}_{17}Cl_{18,20}$ $^{39,40,41}_{19}K_{20,21,22}$ $^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ $^{76,78}_{34}Se_{42,44}$ $^{83,84}_{36}Kr_{47,48}$

$^{88}_{38}Sr_{50}$ $^{107,109}_{47}Ag_{60,62}$ $^{138,139}_{57}La_{81,82}$ $^{163}_{66}Dy_{97}$ $^{209}_{83}Bi^{*}_{126}$ $^{209}_{84}Po^{*}_{125}$ $^{270}_{107}Bh^{*}_{163}$ $^{2\cdot 139}_{109}Mt^{*}_{169}$ $^{348}_{139}Ch^{ie}_{209}$

$^{410}_{163}Ch^{ie}_{13\cdot 19}$

2021/4/4

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Appendix I: Research History

Section	Page	Date	Location
Abstract	1	2021/2/20	Hanyuan
1	2	2021/2/20-21	
2	3-6	2021/1/31	Shanghai
		2021/2/1	
		2021/2/2-3	Chengdu
		2021/2/8	
		2021/2/19-20	Hanyuan
3	6-7	2021/2/7	Chengdu
	7	2021/2/9	
4	7-8	2021/2/11	Chengdu – Hanyuan
		2021/2/17,21	Hanyuan
5	8-9	2021/2/25	Chengdu
6	9-11	2021/2/25-26	Chengdu
7	11-14	2021/2/28-3/3	Chengdu
8	14	2021/2/27-28	Chengdu
9	15	2021/3/3	Chengdu
10	15	2021/3/3	Chengdu
11	16-19	2021/3/7-8	Chengdu
12	19-22	2021/3/23-4/5	Chengdu
13	22-23	2021/4/4-5	Chengdu
Preparing this paper	1-24	2021/1/31-4/5	
Note: Time was recorded according to Beihing Time.			