The Game Played by 2π, the Fine-structure Constant and Feigenbaum Constants in Nuclides

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

Abstract

In our previous papers, we exhibited the relationships of 2π, the fine-structure constant and Feigenbaum constants with nuclides. In this paper, we show that there should be direct relationships of the second Feigenbaum constant α≈2.5029 with nuclides ${}_{83}\mathrm{Bi}^{*}{}_{126}$ and ${}_{84}\mathrm{Po}^{*}{}_{125}$ (both with nucleon number 209) in the form of (209/83+209/84)=2.503. So it is supposed that 2π, the fine-structure constant and Feigenbaum constants play a game in the world of nuclides and hence determine the nucleon numbers of some nuclides at critical points. In the end, a picture indicating this kind of game is concluded.

Keywords: 2π; the fine-structure constant; Feigenbaum constants; nuclides; game theory.

1. Introduction

In our previous papers[1-10], we exhibited the relationships of 2π, the fine-structure constant and Feigenbaum constants with nuclides. The following is one of the most typical examples.

$$2\pi \approx 6.28 = \frac{4\cdot 157}{100}$$

$${}^{50,51}_{23}V_{27,28} \quad {}^{55}_{25}Mn_{30} \quad {}^{90}_{40}Zr_{50} \quad {}^{100}_{44}Ru_{56} \quad {}^{118,119,120}_{50}Sn_{68,69,70} \quad {}^{157}_{64}Gd_{93} \quad {}^{168}_{68}Er_{100} \quad {}^{169}_{69}Tm_{100}$$

$${}^{185,187}_{75}\mathrm{Re}_{110,112} \quad {}^{188}_{76}Os_{112} \quad {}^{200}_{80}Hg_{120} \quad {}^{257}_{100}Fm^{*}_{157} \quad {}^{258}_{101}Md^{*}_{157} \quad {}^{259}_{102}No^{*}_{157} \quad {}^{300}_{120}Ch^{ie}_{180}$$

$${}^{312}_{125}Ch^{ie}_{187} \quad {}^{2\cdot 157}_{126}Ch^{ie}_{188} \quad {}^{330}_{130}Ch^{ie}_{200} \quad {}^{400}_{157}Ch^{ie}_{243} \quad {}^{426}_{169}Ch^{ie}_{257}$$

Note: 68=136/2, 69=138/2

It shows that the neutron number 157 of the most stable isotopes of 100th element Fm* should be directly determined by 2π≈(4×157)/100. And the number 100 is indirectly related to the fine-structure numbers 136 and 138 through nuclides ${}_{68}\mathrm{Er}_{100}$ and ${}_{69}\mathrm{Tm}_{100}$.

Some other most typical examples are listed as follows.

$$2\pi \approx \frac{44}{7} = \frac{2\cdot 22}{7} = 6.2857\cdots$$

${}^{50}_{22}Ti_{28}$ ${}^{61}_{28}Ni_{33}$ ${}^{100}_{44}Ru_{56}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{226}_{88}Ra^{*}_{138}$ ${}^{294}_{118}Og^{ie}_{176}$ ${}^{8\cdot 44}_{140}Ch^{ie}_{212}$ ${}^{22\cdot 17}_{148}Ch^{ie}_{226}$

$$2\pi \approx \frac{2\cdot 355}{113} = \frac{4\cdot 5\cdot 71}{2\cdot 113} = 6.2831858\cdots$$

${}^{71}_{31}Ga_{40}$ ${}^{112,113}_{48}Cd_{64,65}$ ${}^{113,115}_{49}In_{64,66}$ ${}^{120,122}_{50}Sn_{70,72}$ ${}^{2\cdot 71}_{60}Nd_{82}$ ${}^{171}_{70}Yb_{101}$ ${}^{175}_{71}Lu$ ${}^{186}_{74}W_{112}$ ${}^{187}_{75}\mathrm{Re}_{112}$

${}^{188,189}_{76}Os_{112,113}$ ${}^{226}_{88}Ra^{*}_{138}$ ${}^{232}_{90}Th^{*}_{2\cdot 71}$ ${}^{4\cdot 71}_{113}Nh^{ie}_{171}$ ${}^{358/360}_{142=2\cdot 71}Ch^{ie}_{6\cdot 36/218}$ ${}^{22\cdot 17}_{148}Ch^{ie}_{226}$ ${}^{6\cdot 71}_{169}Ch^{ie}_{257}$

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

$$\alpha_1 = \frac{36}{7\cdot e^2\,\frac{e^2}{(\frac{2}{1})^3}\,\frac{e^2}{(\frac{3}{2})^5}\,\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{113}{112})^{225}}}\;\frac{1}{112+\frac{1}{75^2}} = 1/137.035999037435$$

Note: $7\cdot(2\pi)_{112} \approx 44$

${}^{75}_{33}As_{42}$ ${}^{82,83,84}_{36}Kr_{46,47,48}$ ${}^{98}_{42}Mo_{56}$ ${}^{100}_{44}Ru_{56}$ ${}^{112}_{48}Cd_{64}$ ${}^{113,115}_{49}In_{64,66}$ ${}^{136,137,138}_{56}\mathrm{Ba}_{80,81,82}$ ${}^{185,187}_{75}\mathrm{Re}_{110,112}$

${}^{188,189}_{76}Os_{112,113}$ ${}^{208}_{82}Pb_{126}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{226}_{88}Ra^{*}_{138}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{286}_{113}Nh^{ie}_{173}$ ${}^{344,2\cdot 173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

$$\alpha_2 = \frac{13\cdot e^2\,\frac{e^2}{(\frac{2}{1})^3}\,\frac{e^2}{(\frac{3}{2})^5}\,\frac{e^2}{(\frac{4}{3})^7}\cdots\frac{e^2}{(\frac{9\cdot 31}{2\cdot 139})^{557}}}{100}\;\frac{1}{112-\frac{1}{64\cdot 3\cdot 29}} = 1/137.035999111818$$

Note: $13\cdot(2\pi)_{278} \approx 81.73 \approx 82$

${}^{54,56,57,58}_{26}\mathrm{Fe}_{28,30,31,32}$ ${}^{63,65}_{29}Cu_{34,36}$ ${}^{82,83,84}_{36}Kr_{46,47,48}$ ${}^{85,87}_{37}Rb_{48,50}$ ${}^{100}_{44}Ru_{56}$ ${}^{112}_{48}Cd_{64}$ ${}^{118,119}_{50}Sn_{68,69}$

${}^{136,137,138}_{56}\mathrm{Ba}_{80,81,82}$ ${}^{138,139}_{57}La_{81,82}$ ${}^{149}_{62}Sm_{87}$ ${}^{157}_{64}Gd_{93}$ ${}^{166,168}_{68}Er_{98,100}$ ${}^{169}_{69}Tm_{100}$ ${}^{208}_{82}Pb_{126}$ ${}^{209}_{83}Bi^{*}_{126}$

${}^{209}_{84}Po^{*}_{125}$ ${}^{223}_{87}Fr^{*}_{136}$ ${}^{257}_{100}Fm^{*}_{157}$ ${}^{2\cdot 139}_{109}Mt^{*}_{169}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{344,2\cdot 173,12\cdot 29}_{136,137,138}Fy^{ie}_{16\cdot 13,209,210}$ ${}^{12\cdot 29}_{139}Ch^{ie}_{209}$ ${}^{400}_{157}Ch^{ie}_{243}$

${}^{14\cdot 31,15\cdot 29}_{173}Ch^{ie}_{9\cdot 29,262}$

$$c_{au} = \frac{1}{\sqrt{\alpha_1\alpha_2}} = \sqrt{112\times(168-\frac{1}{3}+\frac{1}{12\cdot 47}-\frac{1}{14\cdot 112\cdot(2\cdot 173+1)})} = 137.035999074626$$

${}^{47}_{22}Ti_{25}$ ${}^{54,56}_{26}Fe_{28,30}$ ${}^{83,84}_{36}Kr_{47,48}$ ${}^{100}_{44}Ru_{56}$ ${}^{107,109}_{47}Ag_{60,62}$ ${}^{112,113}_{48}Cd_{64,65}$ ${}^{113,115}_{49}In_{65,66}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$

${}^{157,158}_{64}Gd_{93,94}$ ${}^{159}_{65}Tb_{94}$ ${}^{168}_{68}Er_{100}$ ${}^{169}_{69}Tm_{100}$ ${}^{173}_{70}Yb_{103}$ ${}^{185,187}_{75}\mathrm{Re}_{110,112}$ ${}^{4\cdot 47,189}_{76}Os_{112,113}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$

${}^{262}_{103}Lr^{*}_{159}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{286}_{113}Nh^{ie}_{173}$ ${}^{2\cdot 157}_{126}Ch^{ie}_{4\cdot 47}$ ${}^{344,2\cdot 173,348}_{136,137,138}Fy^{ie}_{208,209,210}$ ${}^{418,420}_{168}Ch^{ie}_{250,252}$ ${}^{434,435}_{173}Ch^{ie}_{261,262}$

$$1/\alpha_1 = 56+81+\cfrac{1}{28-\cfrac{13\cdot(2\cdot56\cdot11-1)}{3\cdot5\cdot(2\cdot56\cdot43+1)}} = 137.035999037435$$

$$1/\alpha_2 = 56+81+\cfrac{1}{28-\cfrac{2\cdot(16\cdot27-1)}{3\cdot(16\cdot81+1)}} = 137.035999111818$$

$$c_{au} = \frac{1}{\alpha_c} = 56+81+\cfrac{1}{28-\cfrac{5\cdot(4\cdot3\cdot7\cdot17-1)}{2\cdot5\cdot(4\cdot5\cdot7\cdot23+1)+1}} = 137.035999074626$$

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

Feigenbaum Constants: $\delta = 4.66920160910299$

$\alpha = 2.50290787509589$

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

$$= \frac{1}{4} - \frac{1}{27} + \frac{1}{4\cdot9\cdot23} - \cfrac{1}{2\cdot3\cdot7\cdot23\cdot(2\cdot3\cdot(4\cdot3\cdot11-1)+1)+\cfrac{2\cdot23}{3\cdot19}}$$

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

$$= \frac{1}{2} - \frac{1}{9} + \frac{1}{3\cdot31} - \frac{1}{23\cdot(8\cdot3\cdot17+1)} + \frac{1}{17\cdot23\cdot(8\cdot3\cdot11^4-1)}$$

Note: 136=8·17, 138=6·23

${}^{23}_{11}Na_{12}$ ${}^{35,37}_{17}Cl_{18,20}$ ${}^{46,47,48,49,50}_{22}Ti_{24,25,26,27,28}$ ${}^{50,51}_{23}V_{27,28}$ ${}^{54,56,57,58}_{26}Fe_{28,30,31,32}$ ${}^{69,71}_{31}Ga_{38,40}$ ${}^{99}_{43}Tc^{*}_{56}$

${}^{99,100}_{44}Ru_{55,56}$ ${}^{118,119}_{50}Sn_{68,69}$ ${}^{121,123}_{51}Sb_{70,72}$ ${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{150,152}_{62}Sm_{88,90}$ ${}^{156,157}_{64}Gd_{92,93}$ ${}^{168}_{68}Er_{100}$

${}^{169}_{69}Tm_{100}$ ${}^{200}_{80}Hg_{120}$ ${}^{222}_{86}Rn^{*}_{136}$ ${}^{226}_{88}Ra^{*}_{138}$ ${}^{14\cdot17}_{92}U^{*}_{146}$ ${}^{257}_{100}Fm^{*}_{157}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{8\cdot43,2\cdot173,348}_{136,137,138}Fy^{ie}_{208,209,210}$

In this paper, we report a new example of direct relationships of the second Feigenbaum constant with nuclides and conclude a picture of relationships of 2π, the fine-structure constant and Feigenbaum constants with nuclides.

2. Direct Relationships of the Second Feigenbaum Constant with Nuclides

$\alpha = 2.50290787509589$

${}^{136,137,138}_{56}Ba_{80,81,82}$ ${}^{173}_{70}Yb_{103}$ ${}^{209}_{83}Bi^{*}_{126}$ ${}^{209}_{84}Po^{*}_{125}$ ${}^{210}_{85}At^{*}_{125}$ ${}^{222}_{86}Rn^{*}_{136}$

${}^{223}_{87}Fr^{*}_{136}$ ${}^{226}_{88}Ra^{*}_{138}$ ${}^{227}_{89}Ac^{*}_{138}$ ${}^{262}_{103}Lr^{*}_{159}$ ${}^{285}_{112}Cn^{*}_{173}$ ${}^{2\cdot173}_{137}Fy^{ie}_{209}$ ${}^{435}_{173}Ch^{ie}_{262}$

$$\frac{209/83+209/84}{2} = 2.503$$

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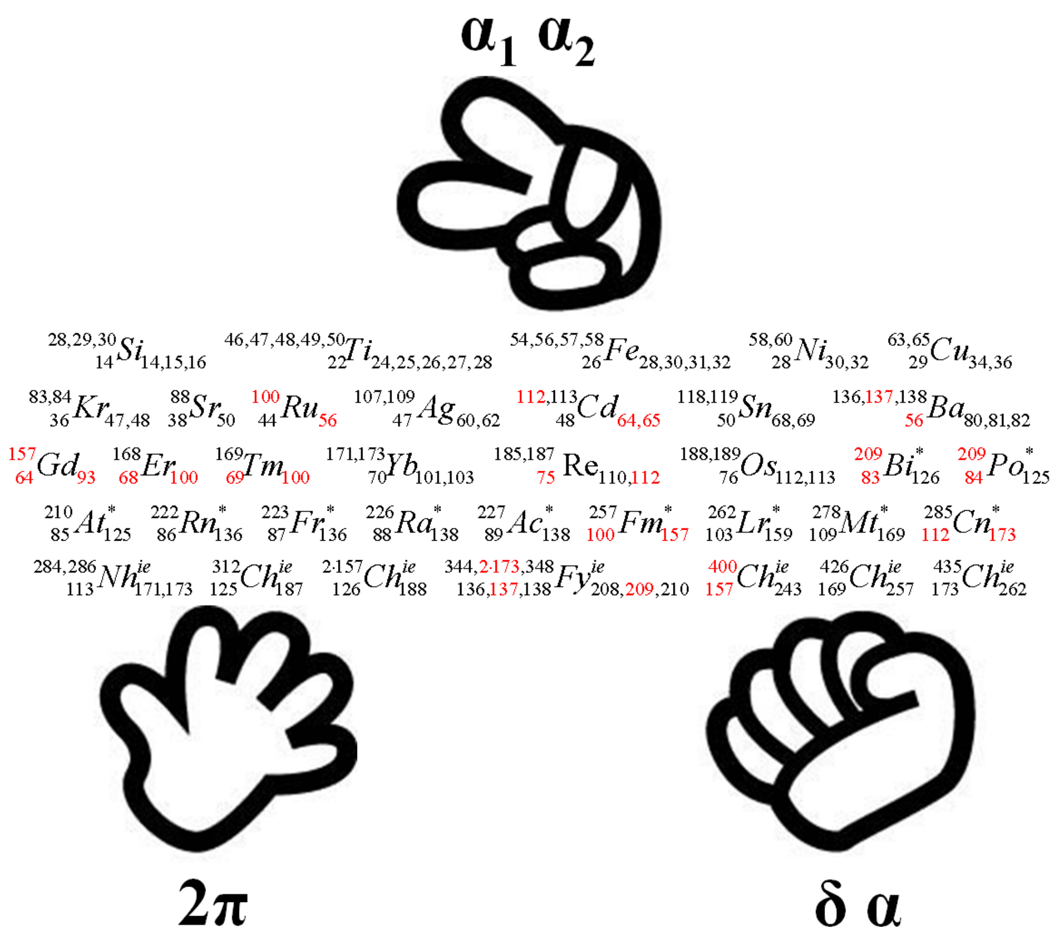
According to our previous theory[9], the neutron number and nucleon number of the most stable isotopes of the 84th element Po* should be 126 and 210, however they are 125 and 209 actually. And the nucleon number of the most stable isotope of the 83rd element Bi* is also 209. That means 209 is a stable number in the world of nuclides. But why? the main reason should be that the average ratio of nucleon to proton number of the most stable isotopes of Bi* and Po* is 2.503, almost equal to the second Feigenbaum constant α≈2.5029. This shows that there should be direct relationships of the second Feigenbaum constant to nuclides.

3. Game Played by 2π, the Fine-structure Constant and Feigenbaum Constants

In conclusion, it seems that 2π, the fine-structure constant and Feigenbaum constants play a game in the world of nuclides, and their synergistic or competitive functions determine the nucleon numbers of some nuclides at critical points (**Fig. 1**).



The Game Played by 2π, the Fine-structure Constant (α₁ α₂) and Feigenbaum Constants (δ α) in Nuclides

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Fig. 1

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Appendix I: Research History

Section	Page	Date	Location
Abstract	1	2021/4/9	Chengdu
1	1-3	2021/4/10	Chengdu
2	3-4	2021/4//4-5	Chengdu
3	4	2021/4/5-6	Chengdu
Preparing this paper	1-6	2021/4/4-4/10	Chengdu

Note: Time was recorded according to Beihing Time.