A Synthetic Route to the 126th Element: Ba141+Yb173=Ch314

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Abstract

In our previous papers[1-12], we predicted the 119th to 173th ideal extended elements, and illustrated the 126th element Ch314 should have the best relative stability among them and should be worthy to be synthesized preferentially. In this paper, we define the natural number axis (NNA) and the natural number coordinate system (NNCS), and suppose that in the world of nuclides, NNA and NNCS would be applicable, so in the world of nuclides the square root of 2, the square root of 3 and π would become rational numbers of 1.41, 1.73 and 3.14. Their relationships with nuclides and with the formula of the speed of light in atomic unites are exhibited to demonstrate this effect, the relative stability of U238 and U235 and the fission mode of U235 are explained, and finally we design a synthetic route to the 126th element, which is Ba141+Yb173=Ch314.

Keywords: natural number axis; natural number coordinate system; rational number and irrational number; elements and nuclides; the speed of light in atomic unites; stability of Uranium; fission of U235; synthetic route; the 126th element.

1. Introduction

We know modern sciences were derived from ancient Greek, which not only had the seeds of sciences, but also made the seeds sprouted. So its original philosophy and scientific concepts should not be negligible. A central belief of Pythagoreans was that "everything is number (rational number)". However, they found the square root of 2 which couldn’t be expressed as a rational number, this lead to the first crisis of mathematics, and later generations of mathematicians gave the solution of irrational number and real number. Here we give a real practical way to solve this problem.

2. Principles

Principle 1: Definition of the Natural Number Axis (NNA)

A natural number axis (NNA) is defined to be an axis with natural numbers sequentially located on it, but a specific natural number on it stands for a specific length of a line as follows (**Fig. 1**).

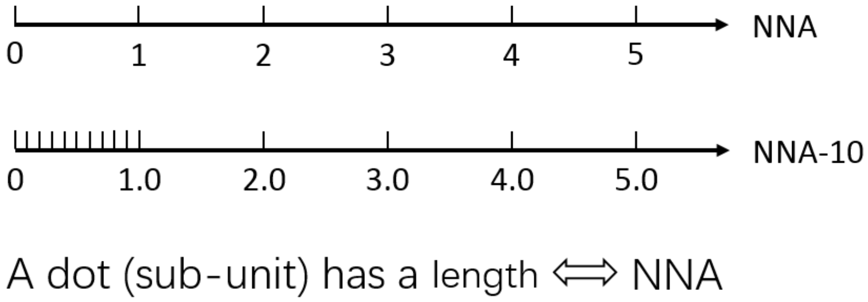

Fig. 1 A natural number axis (NNA) and a 10-parts divided natural axis (NNA-10)

On a NNA, a specific number such as 2 stands for a length from 1 to 2 or 0 to 2. Most importantly, NNA is continuous with no need to add any irrational numbers on it. And the length between two adjacent natural numbers on a NNA is called a unit of the NNA. For example, a unit of the above NNA has a length of 1.

Every unit of a NNA can be divided to a number of sub-units, for example, 10 or 100 equal parts. And hence the corresponding divided NNA can be called NNA-10 or NNA-100. A unit of a NNA-10 has a length of 1.0 and a sub-unit of 0.1. A sub-unit of a NNA is defined as a dot of the NNA. A dot of a NNA has a length and even a width with a shape, and it can't be divided further. So if a place is located within a dot of a divided NNA, its value on this NNA must be the value of this dot no matter where it is exactly located in the dot. If a NNA-10 is amplified 10 times, its sub-unit will become a unit of a new NNA. So a dot with a length and a NNA with continuity are equivalent to each other.

Principle 2: A Square in a Natural Number Coordinate System with a Diagonal length of Rational Number

Use divided natural number axis x and y to compose a rectangular plane coordinate system which is called a natural number coordinate system (NNCS), and a square is located in this coordinate system. The line length of this square (l) is 1, and the line width of this square (dl) is the sub-unite such as 0.1 or 0.01. Then the diagonal length of the square would be 1.4 or 1.41 in the form of rational number especially in this natural number coordinate system as follows (**Fig. 2** and **Fig. 3**).

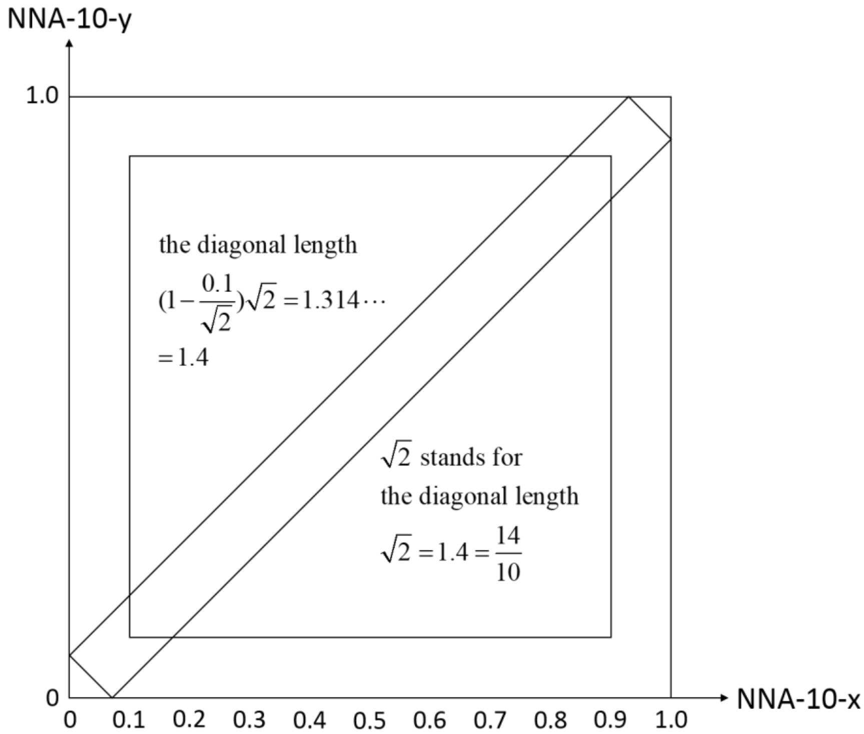

Fig. 2 A square in a natural number coordinate system (NNCS-10) with diagonal length of 1.4

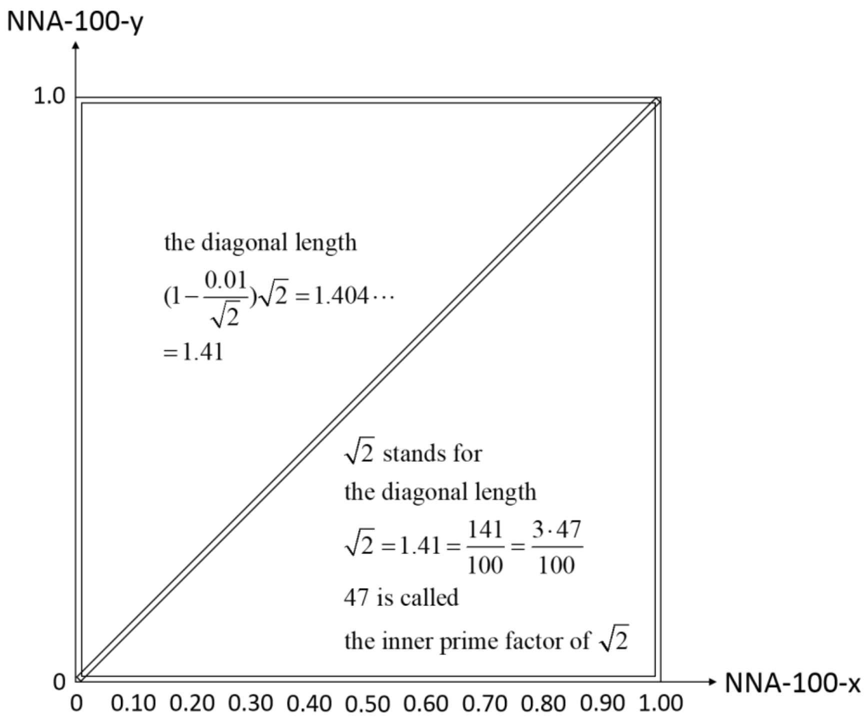

Fig. 3 A square in a natural number coordinate system (NNCS-100) with diagonal length of 1.41

So in a natural number coordinate system (NNCS), the diagonal length of a square should be a series of rational numbers according to the ratio of width to length of the square line (dl/l) as shown in **Table 1**.

Table 1 The diagonal length of a square in a natural number coordinate system (NNCS)

NNCS	dl/l	Diagonal Length	Number	Rationality	Irrationality
NNCS-10	0.1	1.4	rational	decreasing	increasing
NNCS-100	0.01	1.41			
NNCS-1000	0.001	1.414			
NNCS-∞	1/∞	1.414……	irrational		

We can define the following series numbers as $\sqrt{2}$ sequence:

$\sqrt{2}\ \{1.4,\ 1.41, 1.414,\ \cdots, 1.414\cdots\}$

dl/l increasing $\underleftrightarrow{\sqrt{2}\ \{1.4,\ 1.41, 1.414,\ \cdots, 1.414\cdots\}}$ dl/l decreasing

micro world $\underleftrightarrow{\sqrt{2}\ \{1.4,\ 1.41, 1.414,\ \cdots, 1.414\cdots\}}$ macro world

rationality increasing $\underleftrightarrow{\sqrt{2}\ \{1.4,\ 1.41, 1.414,\ \cdots, 1.414\cdots\}}$ irrationality increasing

3. The Square Root of 2 and its Relationships with Nuclides

We found that a 100-parts divided natural number coordinate system (NNCS-100) should be the applicable coordinate system in the world of nuclides because in the micro world the dl/l value of a line should not be too small or too large. It seems that the centesimal system is also applicable in the world of nuclides. And these are rules of nature or stipulated by God. So in the world of nuclides, the square root of 2 must be a rational number such as 141/100 or its good approximate rational ratios such as 140/99 or 82/58. The relationships between the square root of 2 and nuclides are shown as follows.

$$\sin\frac{\pi}{4} = \frac{\sqrt{2}}{2} = \frac{1.41}{2} = \frac{141}{2\cdot 100} \approx \frac{140}{2\cdot 99} \approx \frac{82}{2\cdot 58}$$

$^{31}_{15}P_{16}$ $^{69,71}_{31}Ga_{38,40}$ $^{45}_{21}Sc_{24}$ $^{79,81}_{35}Br_{44,46}$ $^{103}_{45}Rh_{58}$ $^{105}_{46}Pd_{59}$ $^{120}_{50}Sn_{70}$ $^{140,142}_{58}Ce_{82,84}$ $^{141}_{59}\mathrm{Pr}_{82}$

$^{173}_{70}Yb_{103}$ $^{176}_{71}Lu_{105}$ $^{200}_{80}Hg_{120}$ $^{232}_{90}Th^{*}_{142}$ $^{231}_{91}Pa^{*}_{140}$ $^{330}_{130}Ch^{ie}_{200}$ $^{6\cdot 58}_{138}Fy^{ie}_{210}$

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$^{6\cdot 59}_{141}Ch^{ie}_{3\cdot 71}$

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4. The Square Root of 3 and its Relationships with Nuclides

According to the above same reasons, in the world of nuclides, the square root of 3 must be a rational number such as 173/100 or its good approximate rational ratios such as 13/15 or 84/97. The relationships between the square root of 3 and nuclides are shown as follows.

$$\sin\frac{\pi}{3}=\frac{\sqrt{3}}{2}=\frac{1.73}{2}=\frac{173}{2\cdot 100}\approx\frac{13}{15}\approx\frac{84}{97}\approx\frac{97}{112}$$

$${}^{27}_{13}Al_{14}\ \ {}^{31}_{15}P_{16}\ \ {}^{56}_{26}Fe_{30}\ \ {}^{97}_{42}Mo_{55}\ \ {}^{69,71}_{31}Ga_{38,40}\ \ {}^{84}_{36}Kr_{48}\ \ {}^{89}_{39}Y_{50}\ \ {}^{100}_{44}Ru_{56}\ \ {}^{103}_{45}Rh_{58}\ \ {}^{112}_{48}Cd_{64}$$

$${}^{120}_{50}Sn_{70}\ \ {}^{144}_{60}Nd_{84}\ \ {}^{163}_{66}Dy_{97}\ \ {}^{168}_{68}Er_{100}\ \ {}^{173}_{70}Yb_{103}\ \ {}^{185,187}_{75}\mathrm{Re}_{110,112}\ \ {}^{200}_{80}Hg_{120}\ \ {}^{209}_{84}Po^{*}_{125}$$

$${}^{13\cdot 19}_{97}Bk^{*}_{150}\ \ {}^{262}_{103}Lr^{*}_{159}\ \ {}^{15\cdot 19}_{112}Cn^{*}_{173}\ \ {}^{24\cdot 13}_{125}Ch^{ie}_{187}\ \ {}^{330}_{130}Ch^{ie}_{200}\ \ {}^{2\cdot 173}_{137}Fy^{ie}_{209}\ \ {}^{15\cdot 29}_{173}Ch^{ie}_{262}$$

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5. 2π and its Relationships with Nuclides

According to the above same reason, in the world of nuclides, 2π must be a rational number such as 4×157/100 or its good approximate rational ratios such as 44/7 or 10×71/113. The relationships between 2π and nuclides are shown as follows.

$$2\pi=6.28=\frac{4\cdot 157}{100},\quad 2\pi=\frac{2\cdot 22}{7}=\frac{44}{7},\quad 2\pi=\frac{2\cdot 355}{113}=\frac{10\cdot 71}{113}$$

$${}^{14}_{7}N_{7}\ \ {}^{28}_{14}Si_{14}\ \ {}^{48,49,50}_{22}Ti_{26,27,28}\ \ {}^{56}_{26}Fe_{30}\ \ {}^{69,71}_{31}Ga_{38,40}\ \ {}^{75}_{33}As_{42}\ \ {}^{86,87,88}_{38}Sr_{48,49,50}\ \ {}^{100}_{44}Tm_{56}\ \ {}^{112}_{48}Cd_{64}$$

$${}^{113,115}_{49}In_{64,66}\ \ {}^{119,120,122}_{50}Sn_{69,70,72}\ \ {}^{136,137,138}_{56}Ba_{80,81,82}\ \ {}^{150}_{62}Sm_{88}\ \ {}^{157}_{64}Gd_{93}\ \ {}^{168}_{68}Er_{100}\ \ {}^{169}_{69}Tm_{100}$$

$${}^{175,176}_{71}Lu_{104,105}\ \ {}^{185,11\cdot 17}_{75}\mathrm{Re}_{110,112}\ \ {}^{188,189}_{76}Os_{112,113}\ \ {}^{209}_{83}Bi^{*}_{126}\ \ {}^{209}_{84}Po^{*}_{125}\ \ {}^{2\cdot 113}_{88}Ra^{*}_{138}\ \ {}^{257}_{100}Fm^{*}_{157}$$

$${}^{285}_{112}Cn^{*}_{173}\ \ {}^{4\cdot 71,22\cdot 13}_{113}Nh^{ie}_{171,173}\ \ {}^{312}_{125}Ch^{ie}_{11\cdot 17}\ \ {}^{2\cdot 157}_{126}Ch^{ie}_{4\cdot 47}\ \ {}^{2\cdot 173}_{137}Fy^{ie}_{209}\ \ {}^{22\cdot 17}_{148}Ch^{ie}_{2\cdot 113}\ \ {}^{400}_{157}Ch^{ie}_{243}\ \ {}^{6\cdot 71}_{169}Ch^{ie}_{257}$$

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6. The Formula of the Speed of Light in Atomic Unites and its Relationships with the square roots of 2 and 3

In our previous papers[1,2,4,7], we gave the formula of the speed of light in atomic unites as follows, and we found that there were 141=3×47 and 173 factors in the formula which should correspond to the square roots of 2 and 3.

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

c: the speed of light in vacuum

v_e: the line speed of the ground state electron of H atom in Bohr model

$^{83,84}_{36}Kr_{47,48}$ $^{100}_{44}Ru_{56}$ $^{103}_{45}Rh_{58}$ $^{107,109}_{47}Ag_{60,62}$ $^{112}_{48}Cd_{64}$ $^{126}_{52}Te_{74}$ $^{136,137,138}_{56}Ba_{80,81,82}$ $^{140,142}_{58}Ce_{82,84}$

$^{141}_{59}\mathrm{Pr}_{82}$ $^{157,158}_{64}Gd_{93,94}$ $^{168}_{68}Er_{100}$ $^{169}_{69}Tm_{100}$ $^{173}_{70}Yb_{103}$ $^{4\cdot47}_{76}Os_{112}$ $^{209}_{83}Bi^{*}_{126}$ $^{209}_{84}Po^{*}_{125}$ $^{257}_{100}Fm^{*}_{157}$

$^{262}_{103}Lr^{*}_{159}$ $^{278}_{109}Mt^{*}_{169}$ $^{285}_{112}Cn^{*}_{173}$ $^{314}_{126}Ch^{ie}_{4\cdot47}$ $^{344,2\cdot\cdot173,348}_{136,137,138}Fy^{ie}_{208,209,210}$ $^{6\cdot59}_{141}Ch^{ie}_{213}$ $^{420}_{168}Ch^{ie}_{252}$ $^{435}_{173}Ch^{ie}_{262}$

7. Explanations to the Relative Stability of Uranium (U238 and U235) and the Fission mode of U235

We know that the 92th element Uranium has two main relatively stable isotopes, i.e., U238 with radioactive half-life of $4.468(3)\times10^{9}$ y and U235 with half-life of $7.04(1)\times10^{8}$ y. Their half-lives are close to the age of the earth, so there are U238 and U235 naturally existing in the earth with natural abundance of 99.28% and 0.71% respectively. U235 is important for both nuclear reactors and nuclear weapons because it is the only isotope existing in nature to any appreciable extent that is fissile, that is, can be broken apart by thermal neutrons. U238 is also important because it absorbs neutrons to produce a radioactive isotope that subsequently decays to Pu239, which is also fissile and hence important to nuclear reactors[13]. We here try to explain the relative stability of U238 and U235 and the fission mode of U235 (**Fig. 4**).

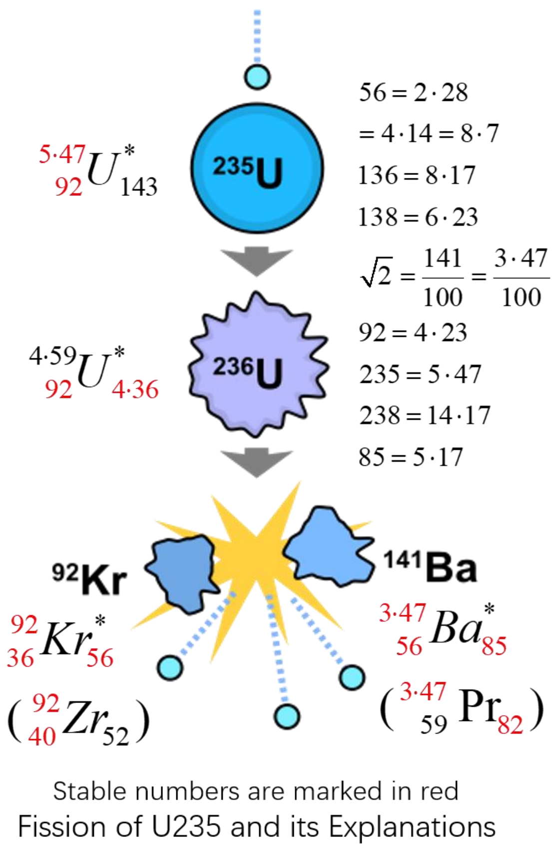

Fig. 4 Fission of U235 and its Explanations

Some stable numbers in the world of nuclides:

$56 = 2 \cdot 28 = 4 \cdot 14 = 8 \cdot 7$: the most stable number in nuclides;

136 137 138: the numbers related to the fine-structure constant α,

so 136 137 138 are called the fine-structure constant numbers,

$136 = 8 \cdot 17$, $138=6 \cdot 23$, 17 23 are called the inner prime fators of 136 138;

$92=4 \cdot 23$, so 92 is related to the fine-structure constant number 138;

$238=14 \cdot 17$, so 238 is related to the most stable number 56 and

the fine-structure constant number 136;

$85=5 \cdot 17$, so 85 is related to the fine-structure constant number 136;

141: the number related to $\sqrt{2}$ or $\sin\frac{\pi}{4} = \frac{\sqrt{2}}{2} = \frac{141}{2 \cdot 100} = \frac{3 \cdot 47}{2 \cdot 100}$,

47 is called the inner prime factor of $\sqrt{2}$;

$235 = 4 \cdot 47$, so 235 is related to $\sqrt{2}$, but should be less stable than 141;

36: a number related to the fine-structure constant α because:

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

$48=2 \cdot 24 = 2 \cdot 8 \cdot 3$, so 48 is also a stable number;

$144 = 4 \cdot 36 = 3 \cdot 48$, so 144 is also a stable number;

146: ${}^{370}_{146}Ch^{ie}_{224}$, $146=2 \cdot 73$, $224=2 \cdot 112=4 \cdot 56$, so 146 is also a stable number.

Explanations to the relative stablity of U238 and U235:

${}^{238}_{92}U^{*}_{146}$ with three stable numbers: $92=4 \cdot 23$, $238=14 \cdot 17$ and $146=2 \cdot 73$;

${}^{235}_{92}U^{*}_{143}$ with two stable numbers: $92=4 \cdot 23$, $235=5 \cdot 47$

the stability of these numbers should decrease in the above sequences

Explanations to the fission mode of U235:

${}^{235}_{92}U^{*}_{143}$ + n $\rightarrow$ ${}^{236}_{92}U^{*}_{144}$ $\rightarrow$ ${}^{92}_{36}Kr^{*}_{56}$ + ${}^{141}_{56}Ba^{*}_{85}$ + $3n$

in the first step, 144 is more stable than 143, and $236=4 \cdot 59$ with relative stability,

so there is energy releasing and make the nucleus of ${}^{236}_{92}U^{*}_{144}$ in metastable state;

in the second step, the first step released energy brokes the nucleus of ${}^{236}_{92}U^{*}_{144}$

to two pieces along with 3 neutrons;

${}^{92}_{36}Kr^{*}_{56}$ has stable numbers 56, 36 and 92;

${}^{141}_{56}Ba^{*}_{85}$ has stable numbers 56，141 and $85=5 \cdot 17$;

so they are relatively stable products.

This should be the total and exact image of U235's fission.

8. A Synthetic Route to the 126th Element: Ba141+Yb173=Ch314

In our previous papers[1-12], we predicted the ideal extended elements from 119th to 173th, and illustrated the 126th element would have the best stability among these elements and should be worthy to be synthesized preferentially. So based on our analysis for the stability of some key numbers such as 141, 173 and 314, we design the following synthetic route to the 126th element Ch314.

$${}^{235}_{92}U^{*}_{143} + \mathrm{n} \rightarrow {}^{92}_{36}Kr^{*}_{56} + {}^{141}_{56}Ba^{*}_{85} + 3n$$

$${}^{141}_{56}Ba^{*}_{85} + {}^{173}_{70}Yb_{103} \rightarrow {}^{314}_{126}Ch^{ie}_{4\cdot 47}$$

Total reaction:

$${}^{235}_{92}U^{*}_{143} + {}^{173}_{70}Yb_{103} + \mathrm{n} \rightarrow {}^{92}_{36}Kr^{*}_{56} + {}^{314}_{126}Ch^{ie}_{188} + 3n$$

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Or another route:

$${}^{238}_{92}U^{*}_{146} + {}^{76}_{34}Se_{42} \rightarrow {}^{314}_{126}Ch^{ie}_{188}$$

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However, U238 is easy to broke, so the former route is better.

A Series of synthetic routes to ${}^{314}_{126}Ch^{ie}_{188}$:

$${}^{133}_{56}Ba^{*}_{77} + {}^{181}_{70}Yb^{*}_{111} \rightarrow {}^{314}_{126}Ch^{ie}_{188}$$

$${}^{134-138}_{56}Ba_{78-82} + {}^{180-176}_{70}Yb^{*}_{110-106} \rightarrow {}^{314}_{126}Ch^{ie}_{188}$$

$${}^{139}_{56}Ba^{*}_{83-86} + {}^{175}_{70}Yb^{*}_{105} \rightarrow {}^{314}_{126}Ch^{ie}_{188}$$

$${}^{140-142}_{56}Ba^{*}_{84-86} + {}^{174-172}_{70}Yb_{104-102} \rightarrow {}^{314}_{126}Ch^{ie}_{188}$$

In total: ${}_{56}Ba + {}_{70}Yb \rightleftarrows {}^{314}_{126}Ch^{ie}_{188}$

${}^{314}_{126}Ch^{ie}_{188}$ should be produced in supernava's explosions but soon decays out.

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We know: $\sin\frac{\pi}{4} = \frac{\sqrt{2}}{2} \approx \frac{1.41}{2}$, $\sin\frac{\pi}{3} = \frac{\sqrt{3}}{2} \approx \frac{1.73}{2}$

and $1.41 + 1.73 = 3.14$, so: $\sqrt{2} + \sqrt{3} \approx \pi$

However, in the world of nuclides, especially when a natural number coordinate system (NNCS-100) is applicable,

the above $\approx$ should become $=$, So in the world of nuclides:

$$\sqrt{2} + \sqrt{3} = \pi, \text{ or } \frac{\sqrt{2}}{2} + \frac{\sqrt{3}}{2} = \frac{\pi}{2},$$

or $\sin\frac{\pi}{4} + \sin\frac{\pi}{3} = \frac{\pi}{2}$ (its geometric meaning is shown in Fig. 5)

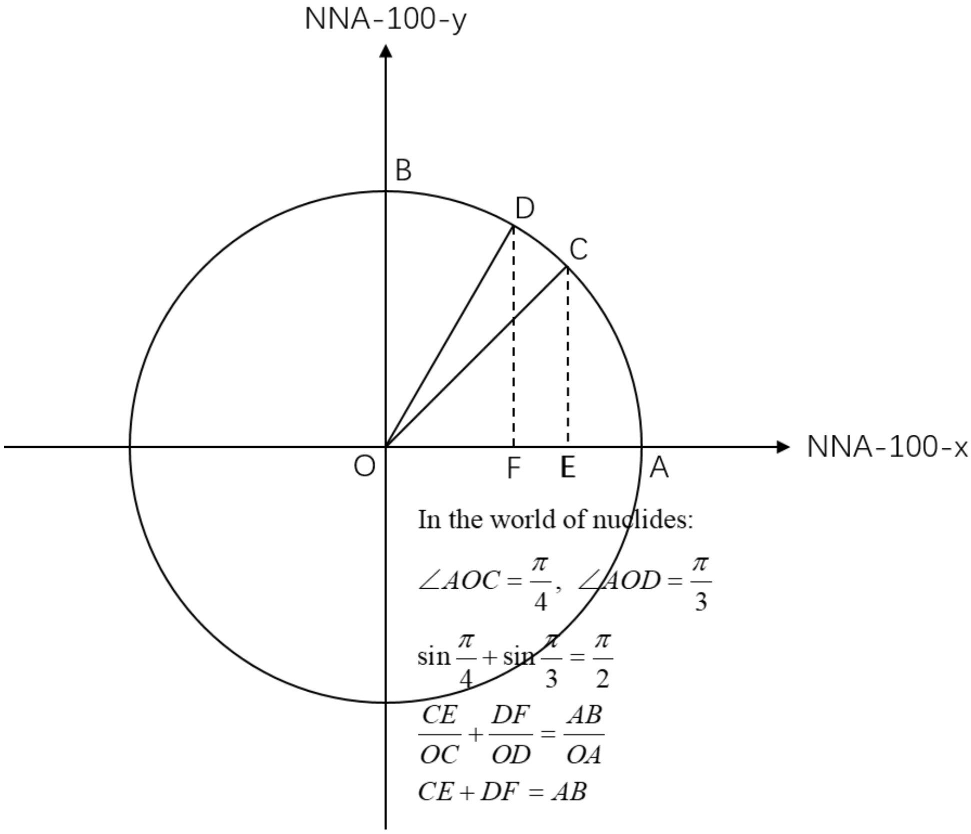

Fig. 5 In the world of nuclides the square root of 2 plus the square root of 3 is equal to π

9. Discussions and Conclusions

It seems in micro world such as the world of nuclides, God (or natural rules) prefers the natural number axis (NNA), the natural number coordinate system (NNCS) and the centesimal system. One typical proof of these preferences is that the most relatively stable isotope of the 100th element Fm has 157 (157=314/2) neutrons in its nucleus. And we apply these principles to design a synthetic route to the 126th element: Ba141+Yb173=Ch314, which corresponds to the square root of 2 plus the square root of 3 being equal to π in the world of nuclides,

How about the situations in our ordinary world? The floors of a room or a road or a plaza paved with tiles are examples of NNA and NNCS. A road in the eyes of taxi drivers is a NNA because he can only take fees according to the natural numbers of kilometers, he can't take fees according to the irrational numbers such as the square root of 2 or π. If we analyze more intensively, we can put a 1 km milestone on a road and assume the milestone itself has a length of 1 meter, then if we put 1000 such milestones within the distance of 0-1 km, this distance will become a continuous natural number axis with 1 m unite. In addition, we should remember that a milestone stands for a distance and there should be no milestone with no length itself or every dot must have a size and even a shape.

So, we can conclude this paper with the following statement which is reported to be said by German mathematician and logician Leopold Kronecker (1823-1891): God created the natural numbers, all the rest are work of man.

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Appendix I: Research and Writing History

Section	Page	Writing Period	Location	Version
whole paper	1-9	2022/8/1-5	Chengdu	viXra:2208.0020v1
whole paper	1-11	2022/8/1-8	Chengdu	viXra:2208.0020v2

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