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A Rudiment of "Three-dimensional Element Periodic Law"

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Abstract

This paper shows that Mendeleyev's 2D periodic table of elements cannot accommodate 2787 isotopic elements. Only by constructing a "three-dimensional periodic law" can cover all the isotopic elements.

Key Words: Point、1D、2D、3D ; SNP; DNP; 2D Periodic System of Elements; 3D Periodic System of Elements

Preface: As we all known, the formation and development of the periodic laws of chemical elements can be summarized into four stages: "point→1D→2D→3D"[1, 2]. The point and line stages are omitted, here's a brief statement "2D stage" and "3D type" prototype.

1. The formation and perfection of the "element 2D periodic table"

Since February 17,1869, the Russian scientist Менцелеев (Mendeleev 1834 ─ 1907) published the periodic law of the elements. It is one of the great achievements of natural science in the 19th century. The periodic law of the elements was a great discovery. Elements

are the natural products of nature, The periodic systems are a natural classification, The periodic law is a fundamental law of natural science. The periodic table forms the elements into a neat, complete "natural matrix" of elements.

There are many forms of the periodic table, including tower type (1895), long table (1905), short table (1906), fan shape and ring. Short tables are formed by combining the main and secondary families into the clan, Because their chemical properties are similar（In order to align with the long and short periods）.The long table was proposed by the Swedish chemist Werner in 1905, which is to arrange the main and secondary groups separately. That is, in a period, according to the atomic weight from small to large all the way down to class 0 inert gas elements. Make the element classification a bit more detailed. The long table is more useful, other periodic tables are just form changes and are of little use.

The vertical axis of the periodic table is arranged in periodic order, and the periodicity of the elements is essentially the structure of the electron shell outside the core. The top-down electron shell of the same group element is increasing, so the atomic radius is also increasing; and the number of electrons in the outermost electron shell is the same, so the chemical properties of the same group are the same.

The horizontal axis of the periodic table is arranged from small to large in order by atomic weights, and is later found to be essentially arranged by atomic numbers. The atomic number is the number of protons in the nucleus of an element, so it can be said that the horizontal axis of the "periodic table of elements" is arranged in order of the number of protons in the nucleus from small to large.

Менцелееь (Mendeleev) with only 63 elements in a short order of periodicity, After a century and a half of discoveries, by the 21st century there were 112 elements, Among them, there are 83 stable elements (from 1 to 83, of which 43 and 61 have no stable elements, and 90 and 92 have stable elements); There are 29 radioactive elements. Of the 112 elements, 94 are natural; 18 man-made species. Among them, there are 90 kinds of metal elements (Chinese names are named with the radicals of the word "gold", except for a metal element "mercury", all are solid, because "mercury" is liquid at room temperature); There are 22 kinds of non-metallic elements (including 10 kinds of solid elements, whose Chinese names are named after the radical of "stone", the 11 kinds of gaseous elements are named after the radicals of the word "gas", and the liquid element of "bromine" is named after the radicals of "three drops water in Chinese"). Most metallic elements are in the bottom left of the periodic table, most

non-metallic elements are in the top right of the periodic table. The dividing line is the semiconductor element. Elements 110 Ds and 111 Rg are still unnamed in Chinese, and element 112 is still not named.

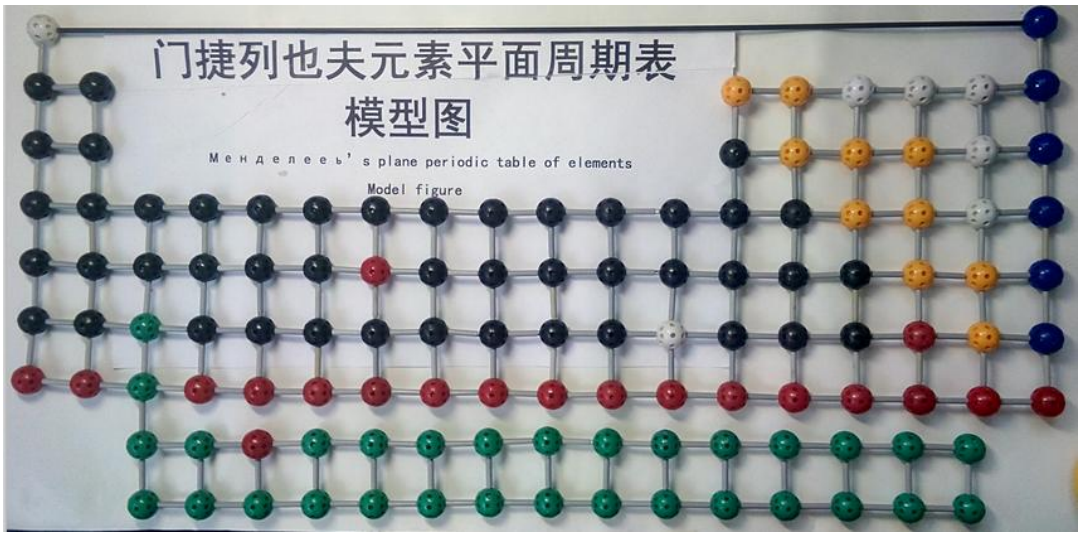
Until December 30, 2015, IUPAC (International Union of Pure and Applied Chemistry) confirmed the synthesis of four new elements 113, 115, 117 and 118. Subsequently, the 7th cycle of the periodic table fills up. Since then, "the element 2D periodic table" has drawn a successful full stop.

门捷列也夫元素平面周期表

（原子序、中质和、中质差）

族 周期 类	ⅠA	ⅡA	ⅢB	ⅣB	ⅤB	ⅥB	ⅦB	Ⅷ	ⅠB	ⅡB	ⅢA	ⅣA	ⅤA	ⅥA	ⅦA	0
1	1 氢 H 1 0															2 氦 He 4 0
2	3 锂 Li 17 1	4 铍 Be 9 1									5 硼 B 11 1	6 碳 C 13 1	7 氮 N 15 1	8 氧 O 17 1	9 氟 F 19 1	10 氖 Ne 21 1
3	11 钠 Na 23 1	12 镁 Mg 25 1									13 铝 Al 27 1	14 硅 Si 29 1	15 磷 P 31 1	16 硫 S 33 1	17 氯 Cl 35 1	18 氩 Ar 38 2
4	19 钾 K 40 2	20 钙 Ca 43 3	21 钪 Sc 45 3	22 钛 Ti 48 4	23 钒 V 50 4	24 铬 Cr 52 4	25 锰 Mn 55 5	26 铁 Fe 57 5	27 钴 Co 59 5	28 镍 Ni 61 5	29 铜 Cu 63 5	30 锌 Zn 67 7	31 镓 Ga 69 7	32 锗 Ge 73 9	33 砷 As 75 9	34 硒 Se 78 10	35 溴 Br 81 11	36 氪 Kr 83 11
5	37 铷 Rb 85 11	38 锶 Sr 87 11	39 钇 Y 89 11	40 锆 Zr 91 11	41 铌 Nb 93 11	42 钼 Mo 96 12	43 锝 Tc 98 12	44 钌 Ru 100 12	45 铑 Rh 103 13	46 钯 Pd 106 14	47 银 Ag 109 15	48 镉 Cd 112 16	49 铟 In 115 17	50 锡 Sn 118 18	51 锑 Sb 121 19	52 碲 Te 124 20	53 碘 I 127 21	54 氙 Xe 130 22
6	55 铯 Cs 133 23	56 钡 Ba 136 24	57 镧 La* 139 25	72 铪 Hf 178 34	73 钽 Ta 181 35	74 钨 W 183 35	75 铼 Re 185 35	76 锇 Os 188 36	77 铱 Ir 191 37	78 铂 Pt 194 38	79 金 Au 197 39	80 汞 Hg 200 40	81 铊 Tl 203 41	82 铅 Pb 206 42	83 铋 Bi 209 43	84 钋 Po 209 41	85 砹 At 210 40	86 氡 Rn 222 50
7	87 钫 Fr 223 49	88 镭 Ra 226 50	89 锕 Ac** 227 49	104 𬬭 Rf 265 57	105 𨧀 Db 268 58	106 𨭆 Sg 266 54	107 𨨏 Bh 267 53	108 𨭉 Hs 277 61	109 鿏 Mt 276 58	110 𫟼 Ds 281 61	111 𬬬 Rg 280 58	112 鿔 Cp 285 61	113 鿭 Nh 284 58	114 𫓧 Fl 289 61	115 镆 Mc 288 58	116 𫟷 Lv 293 61	117 石田 Ts 293 59	118 氿 Og 293 57

*镧系元素	57 镧 La 139 25	58 铈 Ce 140 24	59 镨 Pr 141 23	60 钕 Nd 144 24	61 钷 Pm 145 23	62 钐 Sm 150 26	63 铕 Eu 153 27	64 钆 Gd 156 28	65 铽 Td 159 29	66 镝 Dy 162 30	67 钬 Ho 165 31	68 铒 Er 167 31	69 铥 Tm 169 31	70 镱 Yb 172 32	71 镥 Lu 175 33
**锕系元素	89 锕 Ac 227 49	90 钍 Th 232 52	91 镤 Pa 231 49	92 铀 U 238 54	93 镎 Np 237 51	94 钚 Pu 244 56	95 镅 Am 243 53	96 锔 Cm 247 55	97 锫 Bk 247 53	98 锎 Cf 251 55	99 锿 Es 252 54	100 镄 Fm 257 57	101 钔 Md 258 56	102 锘 No 259 55	103 铹 Lr 262 56



The completion of the "2D periodic law" has also laid the foundation for exploring the "3D periodic law"! The 2D periodic table of elements can only accommodate 118 "chemical elements" (including 287 nuclides with natural abundance). Hold no less than 2,787 "isotopic elements", only by constructing a "3D periodic law" can we cover all the elements of the same position (Including, of course, the stabilization and emission of all isotopes).

"2D Element's periodic table" is the ranking rule of "chemical elements" (118 kinds);

The "3D periodic law of elements" is the ranking rule of "isotopic elements**" (2787).**

2. Three practical basic parameters for the isotopes

The analysis of elements before the early 19th century, because it was considered one by one, individual elements, so the parameters of the element are also more and more complicated and miscellaneous. There are solids, liquids, gases; There are black, white, colored; There are tasteless, smelly, strange taste;……. The Parameters are haphazard and messy, that is, there are no parameters.

After the exploration of the "linear periodic law of elements" in the first half of the 19th century, the parameters of elements were basically arranged in the order of atomic weight. therefore, the use parameter of the "linear periodic law of elements" has only one "atomic weight".

After the discovery of the "2D periodic law of the element" in the second half of the 19th century, the basic parameters used for elements are "atomic number" and "atomic weight" two parameters.

After the construction of the "3D periodic law of elements" in the second half of the 20th century, The atomic number of an element is the number of protons in the nucleus, which remains constant, so "atomic number" is still one of the basic parameters of an elements. But instead of the atomic weight of the element in the "3D periodic law," is gone, instead by the "isotope atomic weight", Therefore, the "isotope atomic weight" is replaced by "the sum of the number neutrons and protons numbers" (Use SNP as code).

Two more things to note here: the "natural abundance" of the element should be renamed "Earth abundance". Because abundance refers to the percentage of an isotope occupying that element on the Earth, the proportion of isotopes (including stable and radioactive elements) to the elements on Earth is called the Earth abundance. It can't be called the abundance of the solar system or the Milky Way. Nor the abundance of the universe, and therefore it cannot be called natural abundance. And the atomic weight is the mass number of atoms of a stable

element. It is the average mass of the isotopes of the element on Earth. So we try to replace the "atomic weight" with the "SNP". On other planets and interstellar species, the abundance of isotopes is a variable, Therefore, the "atomic weight" of the element is not quantitative, and the atomic weight is derived from the "abundance of the Earth" (For example, the star and the sun are basically all thermonuclear (He) reactions. Some planets are made up of hydrogen H. There are also "water balloons" that are all H_2O with an abundance of ○ other elements. And so on). Therefore, "SNP" is the second basic parameter of isotope use.

The parameter corresponding to "SNP" is the new parameter of "DNP". "DNP" is the third basic parameter used for isotopes (space limited, omitted).

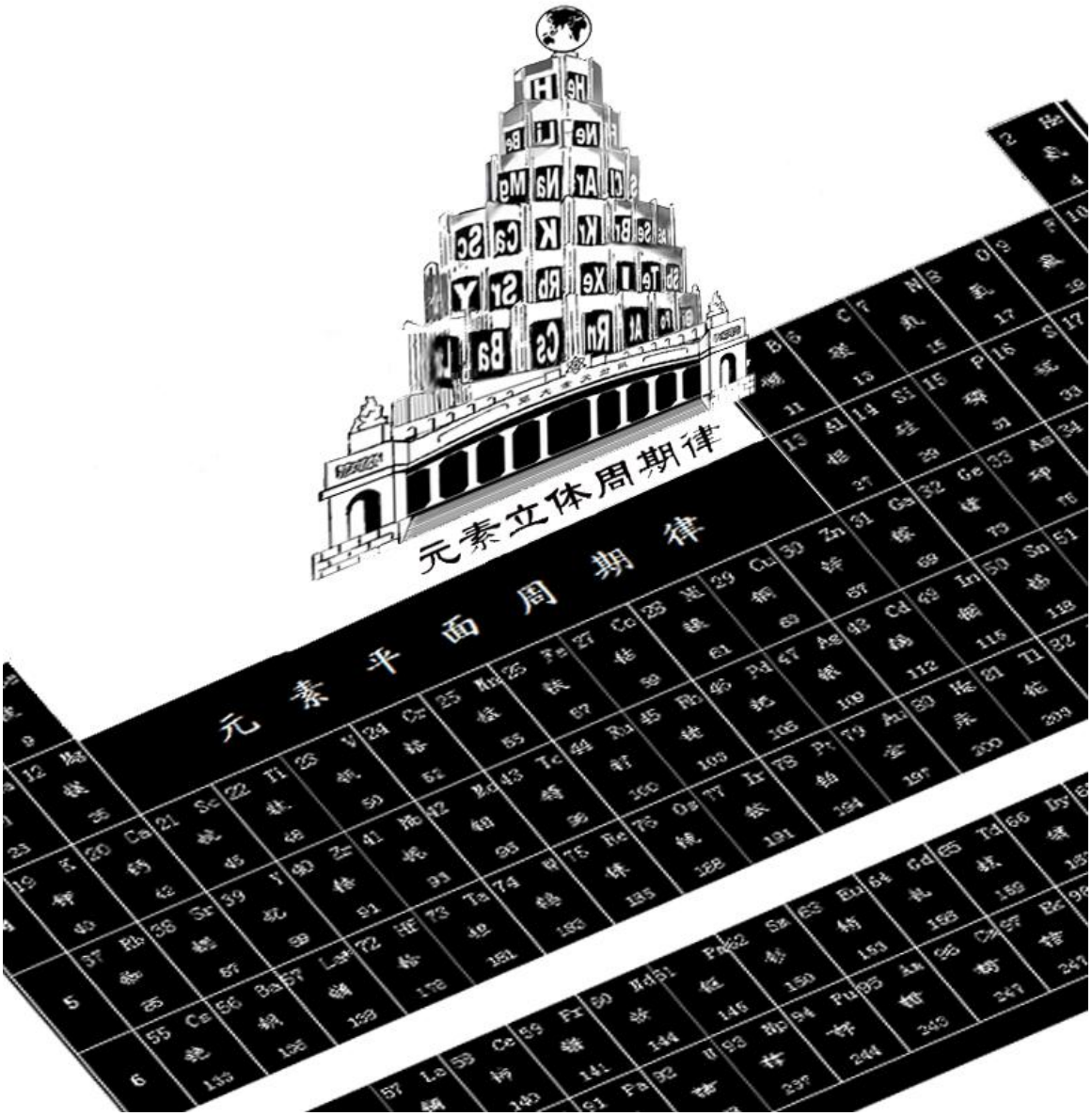
The three basic parameters are: atomic number (basic parameter), SNP (derived parameter) and DNP(derived parameter). All the other parameters are derived from these three basic parameters, for example, the number of neutrons is "SNP-atomic number" or "Atomic number + DNP".

3. A Rudiment of “3D Element Periodic Law”

In the mid-20th century, it was found that there were more than 1,500 kinds of isotopic elements, and it was found that the "2D periodic table of elements" could not cover all the 1,500 kinds of isotopes in nature. Mendelleeuv is arranged in order from small to large atomic weights, but arranged isotope elements with different atomic weights in the same position, this in itself violates the periodic order of the periodic law by atomic size. For example, U235 and U238, one atomic weight is 235, one atomic weight is 238, the atomic weight is different, only the chemical properties are the same, Everything else is different in nature, and it is ranked in the same position as number 92. That is, different atomic weights come together, and that's the contradiction of the periodic table, That's where the periodic table falls short. The "2Dperiodic law of the element plane" is closely related to the outer shell structure of the nucleus, but has no connection with the inner structure of the nucleus, which is its deficiency. The inversion of some atomic weights in the planar periodic table is a drawback (but not an error).

By the second half of the 20th century, a total of 2,500 isoelements had been discovered, of these, 287 are stable isotopes, and the remaining 2,300 are all radioisotopes. The 2D "periodic law of the element" simply cannot cover the more than 2,500 isotopic elements[5-11]. So the periodic law of the elements should expand from the point, 1D, 2D, to the 3D. To overcome

the limitations, deficiencies, and shortcomings (but not errors)[3-4] of the "2Dperiodic law of the element".



However, any development of the periodic law cannot change the original periodicity, which is where the "2D periodic law" is more successful than the "linear periodic law". The "3D periodic law of elements" is also an exception, and cannot change the original periodicity of elements.

The method of constructing "3D periodic law of elements" remains unchanged on the 2D basis of traditional "Mendeleyev 2D periodic law of elements" and adds the 3rd D vertical axis. That is, the X-axis (horizontal column) is arranged from left to right by the atomic number of elements from small to large; The Y-axis (vertical column) is arranged by period;

The Z axis (vertical column) is added, and the difference between the neutron number and the proton number (referred to as the new parameter of "DNP") is arranged from small to large. Namely, X, Y, Z, vertical, horizontal, vertical three-dimensional number axis, is "three-dimensional". In addition to the original X and Y axes retained, a vertical Z-axis is added to form a three-dimensional space, that is, to build the "3D periodic law of elements". So that to leave a list of the isotopes. This is also the past has said: "Would we build enough buildings so that all the poor people can live in!" This is the rudiment of the "3D periodic law of elements".

The "3D periodic law of elements" also has three stages: germination, formation and expansion (to be continued).

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