Zhongsheng Lee. International Journal of Engineering Research and Applications
www.ijera.com
ISSN: 2248-9622, Vol. 12, Issue 7, (Series-I) July 2022, pp. 194-200

RESEARCH ARTICLE OPEN ACCESS

A Briefly Talk on Four Stages of Formation and Development of the Periodic Table of Chemical Elements

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ABSTRACT:
The isotopic elements obviously have no location in "the Periodic Table of the Chemical Elements". To resolve the ranking location of isotopes' place in the periodic table, to Constructing "Element's Periodic Law of Three-dimensional (solid)" becomes inevitable. The author summarizes the formation and development of the periodic law of chemical elements forms four stages: single→1D→2D→3D.

Key Words: Chemical element periodic table in plane; SNP; DNP; Isotopic center; 3DPeriodic System of Elements

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Date of Submission: 17-07-2022 Date of Acceptance: 01-08-2022

I. INTRODUCTION:

Since the beginning of mankind, people pay attention to the study of the "elements" which are closely related to human beings and accompany them throughout their lives and cannot be separated from every moment. In ancient times, people had long had a certain degree of the most primitive and simple perceptual understanding of the elements. Several ancient civilizations in BC, such as Egypt, India, China and Greece, all had a variety of classification methods for elements. In chronological order, ancient Egypt believed that the material that made up the world was water. Ancient India believed that "water, fire, land, wind" constitute the world. The ancient China during ChunQiu(B.C.770–B.C.476) Period Warring States (B.C.770-B.C.481) divided matter into the "five elements" of "metal、wood、water、fire and earth". It's called "theory of the five elements". In the 6th century BC, the ancient Greek philosopher Heraclitus (B.C.540-480) argued that the source of all things was fire. The 4th century BC, the ancient Greek scholar Aristotle (B.C.384-322) put forward the "four elements" theory: water, fire, gas, earth constitute the world of all things. Up until a single "element" was found. Until a single "element" was found.

1. **The discovery history and development rule of the chemical periodic table** are divided into four stages **-- point, line, plane and volume**

1.1 The "point" stage

From remote ancient times "Fe" was found in "Iron Age", the Bronze Age discovered "Cu". In the 16th century, with the rise of medicinal chemistry, medical chemists believed that the three basic elements, "S、Hg and salt", make up everything. In 1789, the elements number increased to more than 20, French chemist Antoine.L.Lavoisier (1743-1794) was a great scientist in the history of chemistry, he began to classify chemical elements. He created inorganic chemistry. It was not until the end of the 18th century that 33 elements, such as Au、Ag、Cu、Fe、Co、Sn、Pb、Sb、Bi、W、Mn、Ni、Pt、Zn、Hg、As、C、S、P、Mo and so on, were recognized (Some are simple substances and compounds mistaken for elements) [1]. Due to the limitation of the development of science and technology, there is not much connection between elements by element. Therefore, people's understanding of elements is isolated and they made study of single "point" element. All of these laid the foundation for the "linear periodic law of one-dimensional elements".

1.2 The 1D stage[2]

From October 13,1803, British chemist J.Dalton(1766-1844) presented a paper on atomic weights at the Institute of Literary and Philosophical Sciences in Manchester, published the New System of Principles of Chemistry, systematically published atomic theories, and discovered the law of multiple proportions. After the 1830s, new research results appeared in succession, such as the German chemist Johann W. De Dobereiner's "trielement group" (1829), the French geologist Alexandre-Emile Beguyer de Chancortois, in "The Spiral diagram" (1862), the British chemist William Odling's "Table of elements" (1864), German chemist Julius. Lothar. Meyer's "six element table"(1864)，Young British chemist J.A.R.Newlands's "Octave" (1866) and so on. But all these are exploration on element law "horizontal" or "vertical", the Study on the Linear Law of "One-dimensional" Space. These are the linear periodic laws of one-dimensional elements. Meanwhile they also laid the foundation for the "plane periodic law of 2D elements".

1.3 The 2D stage[3]

On February 17, 1869, Russian scientists Д. И. Менделеeь(1834 — 1907) published a periodic trends. It is one of the major achievements of natural science in the nineteenth century. The periodic law is a great discovery. Elements are natural products of nature. The periodic system is a natural classification. The periodic law is the basic law in natural science. The periodic table forms a neat, complete "natural matrix" of elements.

In the years that followed, German chemist J.L.Meyer (1830-1895) and Менделеeь worked tirelessly to finally arrange 63 elements in the periodic table..... After the second half of the 19th century and the first half of the 20th century, the exploration of the periodic law of elements is "two-dimensional" in plane. On December 30, 2015, IUPAC (International Union of Pure and Applied Chemistry) confirmed the artificial synthesis of four new elements, 113, 115, 117 and 118. And then, the seventh period of the periodic table is completely filled. Since then, the element plane periodic table has drawn a satisfactory end.

However, people's exploration and research will always be endless. The periodic table is not so perfect, has not reached the "peak" and still development forward [4]. The author has collected 118 tables of chemical elements in plane from around the world. The 2 D periodic table of elements in plane has 13 flaws, limitations and defects (but not errors). It's unable to hold thousands of "Isotopic Elements". The traditional periodic table of chemical elements is introduced with two new parameters, "SNP" and “DNP”, draw up a "2DPeriodic Table of Elements" (Fig.1), in order to lay the foundation for the construction of "3DPeriodic Law of Elements".

The "SNP" is the Sum of the number of Neutron and Proton in Nuclear (SNP=n+p),
The "DNP" is the Difference between the number of Neutrons with Protons (DNP =n-p).

门捷列也夫元素平面周期表
（原子序、中质和、中质差）

族类 / 周期	IA	IIA	IIIB	IVB	VB	VIB	VIIB	VIII			IB	IIB	IIIA	IVA	VA	VIA	VIIA	O
1	1 氢 H 1 0																	2 氦 He 4 0
2	3 锂 Li 7 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 𬬻 Rf 265 57	105 𬭊 Db 268 58	106 𬭳 Sg 266 54	107 𬭛 Bh 267 53	108 𬭶 Hs 277 61	109 鿏 Mt 276 58	110 𫟼 Ds 281 61	111 𬬭 Rg 280 58	112 鎶 Cp 285 61	113 鿭 Nh 284 58	114 𫓧 Fl 289 61	115 镆 Mc 288 58	116 𫟷 Lv 293 61	117 鿬 Ts 293 59	118 鿫 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

Fig.1 "Periodic table of elements in plane" with two new parameters of "SNP" and "DNP"

Notes to the Periodic Table of Chemical Elements:

79 金 Au 197 39	**Black represents 46 metallic elements**	15 磷 P 31 1	**Orange indicates 11 nonmetallic elements**
8 氧 O 17 1	**The white color represents 7 gases or liquids**	88 镭 Ra 226 50	**The red color indicates 18 radioactive**
2 氦 He 4 0	**Blue indicates 7 inert gases**	89 锕 Ac 227 49	**Green indicates 29 lanthanum and scandium**

A total of 118(lanthanum, rubidium repeat 2 have 120), rubidium display chemical elements part of the intuitive physical properties

Legend:

Atomic number	82	铅	The element's name
Elemental		Pb	symbol
SNP	206	42	DNP

Features of this color "Periodic Table of Elements" displays "family", "period", "name", "symbol", "ordinal", "SNP", "DNP", part of "physical properties", "metal ", "non-metal", "semiconductor", "gaseous", "inert gas", "stable element", " radioactive element", "the Lanthanum and Actinium two lines" and so on. This "Periodic Law of the Plane of Elements" includes all 118 elements, including 117 and 118.

1.4 The 3D stage[4]

In the mid-20th century, it was found that there were more than 1,500 "isotopic elements", which were randomly stacked in the positions of the same element in the "Periodic Table of Elements", which is also the origin of the term "isotope". As isotopes were discovered, they multiplied hundreds of times and studied further, deficiencies, limitations, defects and disadvantages of "the plane periodic law of elements" are revealed (but not mistakes). It is inevitable, necessary, sufficient and feasible to construct the element stereoscopic model. Only by expanding the establishment of the "3D periodic law of elements", can 2,787 isotopes be accommodated (details omitted), can it be complement, make up for, perfect it, and can thousands of isotopes be sequenced.

In short, through the analysis of "point, line, plane, solid", the exploration history of the periodic law of the elements shows that before the early 19th century the exploration of the periodic law of the elements is point-by-point type. In the first half of the 19th century, the exploration of periodic law was linear and one-dimensional. From the second half of the 19th century to the first half of the 20th century, the exploration of the periodic law of the elements was planar and two-dimensional. In the second half of the 20th century, the exploration of the periodic law of elements is three-dimensional. This is the development history of point, line, surface and body of periodic law. This is the development history of the four stages of "points, 1D, 2D and 3D" of the periodic law of elements. [5]

2 There are three stages: germination, formation and expansion of the "3D periodic law of elements"

2.1 Budding stage

At present, there are a lot of efforts made by chemists in the United States, Japan and other countries listed by Mr. Changhai Liu of China in the embryonic stage of research on "3D periodic law of elements" in the world. For example:

At the University, Roy Alexander, designer of a science exhibition at the South Carolina State University, has designed "Alexander's Array of Elements" (see Fig.2) for "3d teaching AIDS". This "Alexander arrangement of elements" is like a conjoined three buildings. The first to the third short period and the fourth to the seventh long period, as well as lanthanide and actinide are placed on different buildings. The hierarchy proximity and basic symmetry of periodic law are presented.

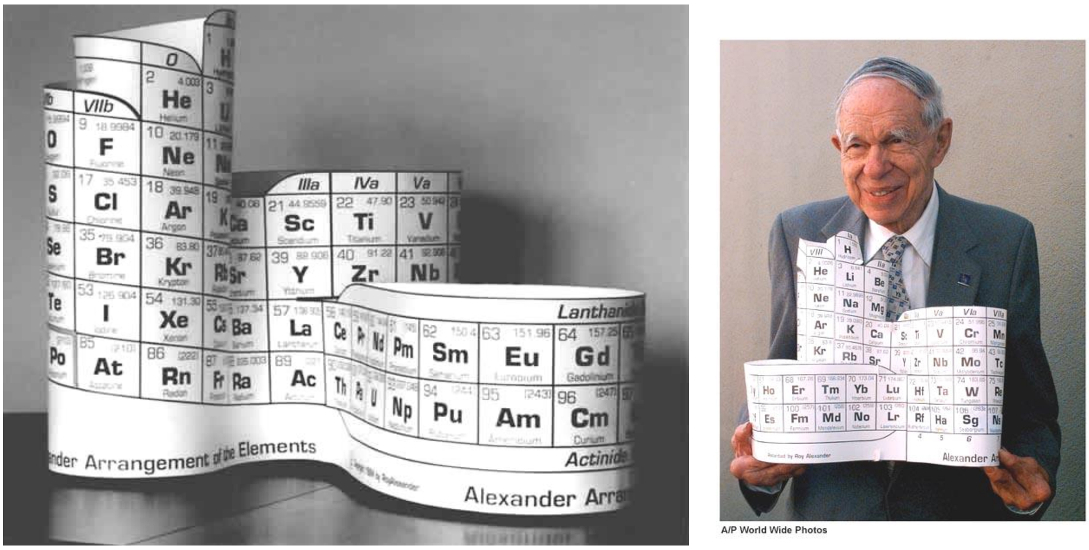

Fig.2 American University of South Carolina ," The Array of Alexander Elements "

In 2003, Professor Yoshiteru Maeno, a superconductive physicist at Kyoto University in Japan, invented a "circle spring element table" like a penholder (see fig.3). It is like a "pen container" with decorations. He rolled the "flat periodic table" into a cylinder, then pulled the fourth to seventh long periods into a circle, pulling the lanthanide and actinide series out of an eccentric cylinder at the same center of the circle.

Fig.3 The "coil spring element Table" invented by Yoshiteru Maeno, a physicist specializing in superconductivity at Kyoto University, Japan, looks like a "pencil cylinder"

Recently, a nuclear periodic table (Elementouch is still a flat table) created by Kyoto University, Japan, K. Hagino & Y. Maeno and transformed into a paper model called "NucleTouch"[6] (see fig.4).

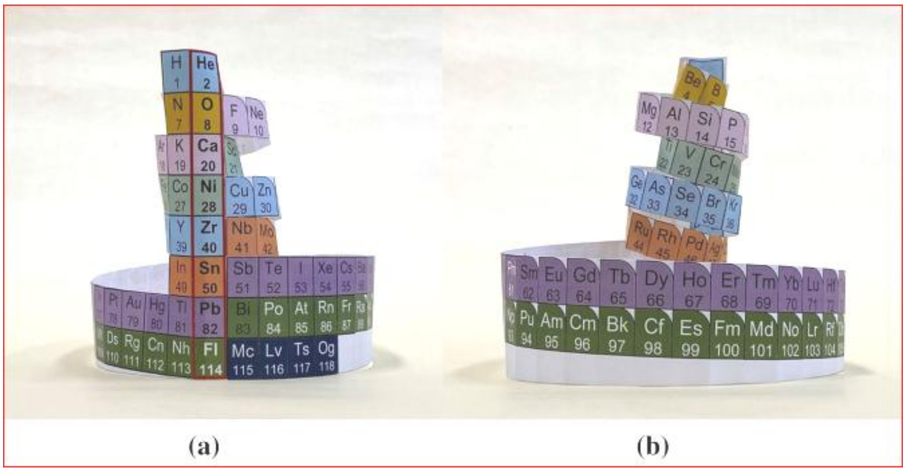

Fig.4 The Japanese Nuclear Periodic Table (ElementTouch) is transformed into a paper model (NucleTouch)

Among these "dioramas" of many countries, some are undeniable deformation of the "element plane periodic table". Some are teaching AIDS or toys for "periodic tables of elements"（see Fig.5）. But they are also attempts to explore the "3D periodic law".

Fig.5 The 3Dperiodic Law of Elements designed by other countries

The author constructs the "3Dperiodic law of elements "(see Fig.6). A new Vertical shaft (Z-axis) was added to the original 2Dperiodic table with the horizontal column (X-axis) and the longitudinal column (Y-axis). The Z-axis vertical shaft is arranged in ascending order from top to bottom according to "DNP" (n-p, Difference between the Neutrons with the number of Protons). The "relative atomic mass of elements" in the original "2D table of elements" is replaced by the "SNP of isotopes (Sum of Neutron number and Proton number)".

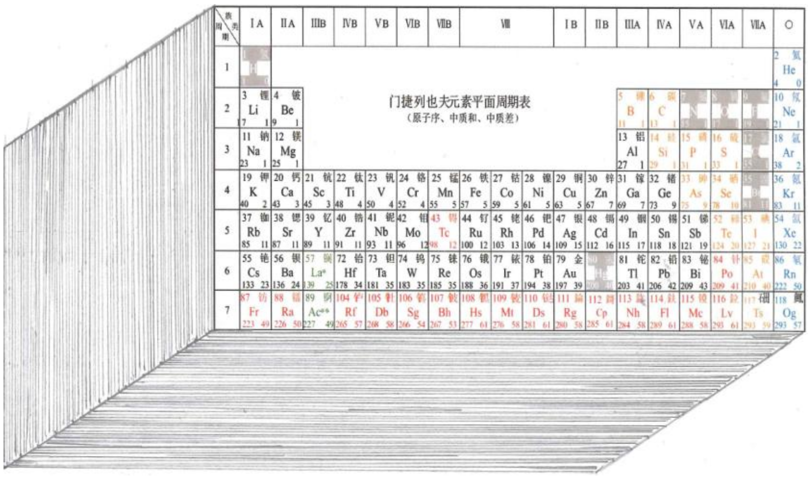

Fig.6 Schematic diagram of the three-dimensional periodic law of elements

It is most well-known that, Professor Shanyu Cai says on page 22 of his book <The Man-Made Elements>：The Mendeleyev periodic law has been studied for a long time since the 1970s. It is considered that the element "2Dperiodic table" has its limitations. The biggest disadvantage is that isotopes of each element are concentrated in the same grid. There are no separate locations for isotopes. Therefore, the idea of "three-dimensional periodic table of elements" is put forward.

According to a report in the American journal Science in early 1998：Fernando Dufour, professor of chemistry emeritus at the Ahuntsic College in Montreal. Duffer and William B. Johnson of the University of Cincinnati proposed a "three-dimensional periodic table". （However, only stable isotopes are included in the content, so the limitation is too great to generalize all 2,500 isotopic elements in nature, including radioactive elements.）[7]

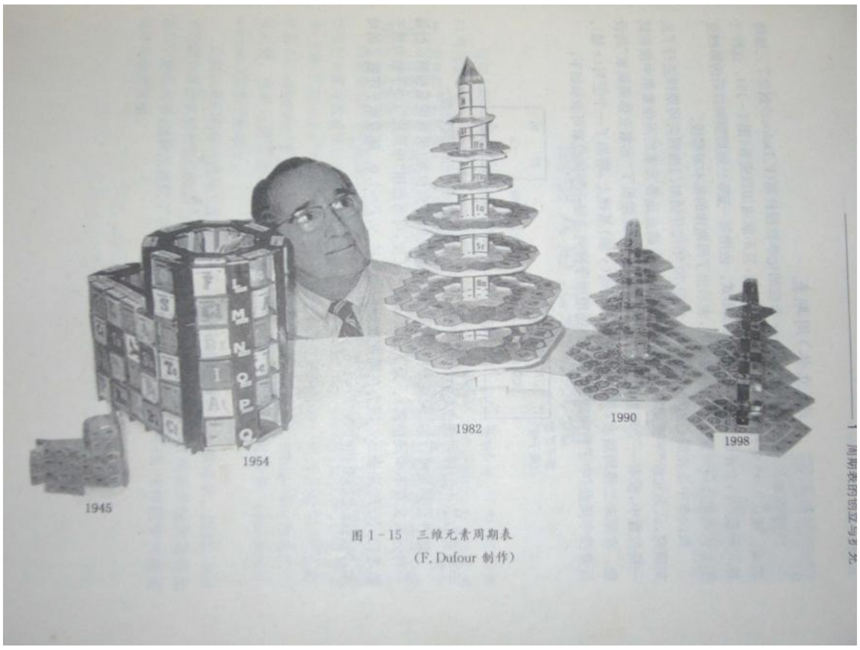

Fig.7 Professor of Chemistry, Montreal Ahuntsic College, Canada Fernando.Dufour created the "3D Periodic Table"

Since 1945, he has made a variety of three-dimensional models and constantly improved them (See Fig.7). This three-dimensional periodic table is different from an ordinary 2D periodic table in representation. He placed the first to third short period and the fourth to seventh long period respectively on different levels, representing the basic symmetry of the periodic law (See Shanyu CAI. <The Man-Made Elements> [M].

Shanghai Science Popularization Press, February 2006) [14]。

The author began to study the "3D model" covering all 2,787 isotopes in the 1960s (Fig.8) [3].

The **2D** periodic **table** of elements is arrange **chemical** elements in a sequence（**118**）**;**

The **3D** periodic **model** of elements is arrange **isotopic** elements in a sequence（**2,787**）**.**

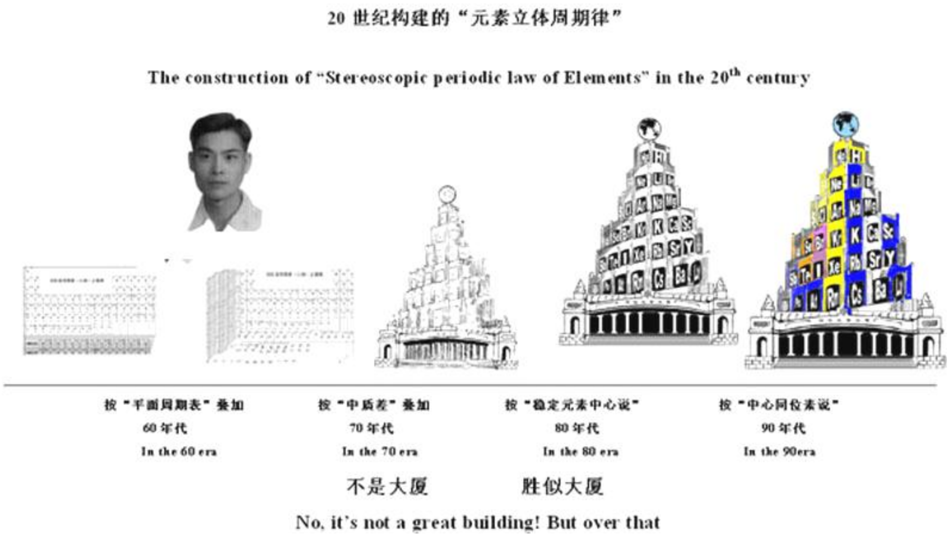

Fig.8 is a schematic diagram of the "3D periodic law of elements" constructed by the author year by year [3]

The above is the primary stage of "Constructing the 3D Periodic Law of Elements".

2.2 Formation stage

In 2009, the author arranges, sorted out and statistics the parameters of seven authoritative reference books (in the order of publication date) [8-14], and participated in repeated proofreading, screening and arrangement of each other. The total number of isotopes is 2,786. Among them, there are 287 stable isotopes and 2499 radioisotopes.

At the formative stage, the author found two important laws of isotopic sequencing, Therefore, <the Central Isotope Hypothesis> was proposed. (To be continued).

2.3 Development stage, the space is limited, can only be reproduced next time.

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