Atomic Structure Possibly in between Models of Thomson and Rutherford

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Evidences from physics and chemistry implies that atoms likely can gradually grow out, on their core (Z = 1-2 that will expand in Z = 27-28 and 45-46), vertical 4 a ($Z \geqq 1$, representative), 4 b ($Z \geqq 21$, transition), and 8 c ($Z \geqq 57$, inner transition) α clusters bonding with valence neutrons that electron and proton distributions seem similar — all of electrons of inner shells following protons in nuclei, which means that most of atomic space was occupied by electrons of outermost shell only and experimental results of Geiger and Moseley could not completely exclude a possibility that atomic nuclei contain electrons. In other words, atomic structures — foldable — corresponded to Thomson's model, but distributing distances of outer and inner electrons were very different, not uniform as in Rutherford's model to some degree, which could pave a promising way to clarify or integrate structures of atoms and atomic nuclei.

Key words: foldable atom, nuclear structure and fission, nuclear core, valence and pair neutron, electronic configuration and periodic table

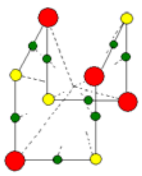
1. Introduction

Since subatomic particle — electron — was firstly discovered[1] by Thomson in 1897, then in 1904 he postulated an atomic structure[2], which known as the plum pudding model. But in 1909 Geiger's gold foil experiments show that a few alpha particles were deflected by angles greater than 90°, which was supposed to be impossible according to Thomson's model. To explain this, Rutherford proposed that the positive charge of the atom is concentrated in a tiny nucleus at the center of the atom[3]. Up to now, atomic theories generally follow this planetary model. Nevertheless, electronic motioning images or electronic configurations of Z 1-118 atoms remain unclear, at least not tangible, which a tangible proton distribution of Z 1-118 atoms likely could offset the insufficiency. Thus in this paper electrons are following protons to fit, now that first is to describe proton distributions, that is, nuclear structure, including its fission, as it will direct reveal some information about. In addition, notices that words "atomic" and "nuclear" are indistinct to use occasionally here.

2. Nuclear structure and fission

Nuclear structure has some theories[4-6] that a simplest one[7] implied atomic nuclei being foldable, which are in between two and three dimensions (2-3D, Fig. 1a-c and Table 1) to motion. It was observed in analysis molecular structure starting from a curiosity that whether an atomic mass has an influence upon molecular bond energy or not about in the summer of 1987. Because an element occurs some isotopes and then had no intention of taking their relative mass what want to see nucleons how to distribute in a molecule (atom), every element is represented by its maximal abundant isotope selected from a handbook. Accordingly, it was mainly based on Lewis's dot structures[8] and alpha model[4] adapted to atomic and nuclear skins, and nuclear middle and core (in a range Z = 3-26), respectively, which has actually begun to integrate structures of atoms and atomic nuclei, though at that time is not deliberate.

a)



b)

	2B				1C	2C		1A	2A		3C	4C				3B	
1B		112			103	104		87	88		89	90			105		4B
	111		80		71	72		55	56		57	58		73		106	
		79		48				37	38				39		74		
			47		30			19	20			21		40			
16C	102	70		29				11	12				22		59	91	5C
15C	101	69						3	4						60	92	6C
								1									
8A	118	86	54	36	18	10	2	27	28		5	13	31	49	81	113	3A
7A	117	85	53	35	17	9		45	46		6	14	32	50	82	114	4A
										1							
14C	100	68						8	7	2					61	93	7C
13C	99	67		26				16	15	3			23		62	94	8C
			44		25			34	33	4		24		41			
		78		43				52	51	5			42		75		
	110		77		66	65		84	83	6	64	63		76		107	
8B		109			98	97		116	115	7	96	95			108		5B
	7B				12C	11C		6A	5A		10C	9C				**6B**	

c)

	1A	2A	3B	4B	5B	6B	7B	8B	9B	10B	1B	2B	3A	4A	5A	6A	7A	8A
1	1																	2
2	3	4											5	6	7	8	9	10
3	11	12											13	14	15	16	17	18
4	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
5	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54
6	55	56	73	74	75	76	77	78			79	80	81	82	83	84	85	86
7	87	88	105	106	107	108	109	110			111	112	113	114	115		117	118
															116			

3C	4C	5C	6C	7C	8C	9C	10C	11C	12C	13C	14C	15C	16C	1C	2C
57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
89	90	91	92	93	94	95	96	97	98	99	100	101	102	103	104

Fig. 1 Atomic folded and unfolded frames. (a) Red, yellow, and green are 4 *a*, 4 *b*, and 8 *c* axes (α-clusters), where are p_l (last proton, added the proton to the fore element) locations of representative, transition, and inner transition elements, respectively. **(b)** If folded, it is a cubic *Z*, i.e. atomic number, or proton distributions. Four p_l (Z = 27, 28, 45, and 46) were sunk into the 1st period in old group 8B (American convention; groups 8-10, modern form), which was revised into groups 8-10B. **(c)** As 8 *c* α-clusters occupy 16 p, inner transition elements were suggested to increase from 2×14 to 2×16, then groups 8-10B only leave $_{78}$Pt and $_{110}$Ds in the 6-7 periods. $_{71}$Lu and $_{72}$Hf of group 1-2C into inner transition is following $_{29}$Cu and $_{30}$Zn of group 1-2B into transition, though inner transition shell has been closed at $_{70}$Yb in Table 1.

Table 1 A periodic growth of *Z* 1-118 atoms

Subscript, left and right superscript of periodic number are the numbers of n_v, n_p (see Fig. 2) and p respectively, and skin is 4 *a*, 4 *b*, and 8 *c* axes in 7 codes: 1, proton (p); 2, deuteron (d); 3, triton (t); 4, alpha particle (α); $\underline{1}$, neutron (n); $\underline{2}$, di-neutron; $\underline{3}$, ^{3}He ion. Single hyphen (-) is the same as upside. Valency is in the 2nd period and in the 3rd period is nucleon increased number between these nuclei. There will be a fluctuation only if ^{58}Ni (67.88%) and ^{106}Pd (27.33%) in group 10B are listed that all of the others is maximal isotopes. Electron and proton distributions were similar in this paper, so the former was omitted.

nucleus	nucleon distribution				valency (p, d, or t)	nucleon increased	abundance (%) / half-life ($T_{1/2}$)
$_1{}^1H$	1^1						99.9
$_2{}^4He$	$1^{1\underline{1}1\underline{1}}$						100
$_3{}^7Li$	-	$2^{1\underline{11}}$			1		92.4
$_4{}^9Be$	-	$2^{2\underline{1}1\underline{1}}$			2		100
$_5{}^{11}B$	-	$2^{222\underline{1}}$			3		80.1
$_6{}^{12}C$	-	2^{2222}			4		98.9
$_7{}^{14}N$	-	2^{4222}			3		99.6
$_8{}^{16}O$	-	2^{4242}			2		99.7
$_9{}^{19}F$	-	2^{4443}			1		100
$_{10}{}^{20}Ne$	$^21^2$	2^{4444}			0		90.4
$_{11}{}^{23}Na$	-	-	$3^{1\underline{11}}$			3	100
$_{12}{}^{24}Mg$	-	-	$3^{1\underline{1}1\underline{1}}$			1	78.9
$_{13}{}^{27}Al$	-	-	$3^{222\underline{1}}$			3	100
$_{14}{}^{28}Si$	-	-	3^{2222}			1	92.2
$_{15}{}^{31}P$	-	-	3^{4232}			3	100
$_{16}{}^{32}S$	-	-	3^{4242}			1	94.9
$_{17}{}^{35}Cl$	-	-	3^{4443}			3	75.7
$_{18}{}^{40}Ar$	$^21^2$	2^{4444}	$_43^{4444}$			5	99.6
$_{19}{}^{39}K$	-	-	$^83^8$	$4^{\quad 1\underline{11}}$			93.3
$_{20}{}^{40}Ca$	-	-	-	$4^{\quad 1\underline{1}1\underline{1}}$			96.9
$_{21}{}^{45}Sc$	-	-	$_4{}^83^8$	$4^{111\underline{2}}$			100
$_{22}{}^{48}Ti$	-	-	-	4^{2222}			73.7
$_{23}{}^{51}V$	-	-	-	4^{4232}			99.7
$_{24}{}^{52}Cr$	-	-	-	4^{4242}			83.7
$_{25}{}^{55}Mn$	-	-	-	4^{4443}			100
$_{26}{}^{56}Fe$	-	-	-	4^{4444}			91.7
$_{27}{}^{59}Co$	$^41^3$	-	-	$4^{\ -}$			100
$_{28}{}^{60}Ni$	$^41^4$	-	-	$4^{\ -}$			26.2
$_{29}{}^{63}Cu$	-	-	-	$4^{\ -\ 1\underline{11}}$			69.1
$_{30}{}^{64}Zn$	-	-	-	$4^{\ -\ 1\underline{1}1\underline{1}}$			49.1
$_{31}{}^{69}Ga$	-	-	-	$_44^{\ -\ 111\underline{2}}$			60.1
$_{32}{}^{74}Ge$	-	-	-	$_44^{\ -\ 3232}$			36.5
$_{33}{}^{75}As$	-	-	-	$_44^{\ -\ 4232}$			100
$_{34}{}^{80}Se$	-	-	-	$_84^{\ -\ 4242}$			49.6
$_{35}{}^{79}Br$	-	-	-	$_44^{\ -\ 4443}$			50.6
$_{36}{}^{84}Kr$	$^41^4$	2^{4444}	$_43^{4444}$	$_84^{4444\ 4444}$			56.9

$_{37}^{85}\mathrm{Rb}$	-	-	-	-	5	1					72.1
$_{38}^{88}\mathrm{Sr}$	-	-	-	-	5	1111					82.5
$_{39}^{89}\mathrm{Y}$	-	-	$^{8}3^{8}$	-	5^{1112}	1111					100
$_{40}^{90}\mathrm{Zr}$	-	-	-	-	5^{1212}	-					51.4
$_{41}^{93}\mathrm{Nb}$	-	-	-	-	5^{4221}	-					100
$_{42}^{98}\mathrm{Mo}$	-	-	-	-	5^{4343}	-					24.3
$_{43}^{99}\mathrm{Tc}$	-	-	-	-	5^{4443}	-					2.1×10^{5}yr
$_{44}^{102}\mathrm{Ru}$	$^{6}1^{4}$	-	-	-	5^{4444}	-					31.5
$_{45}^{103}\mathrm{Rh}$	$^{6}1^{5}$	-	-	-	5^{-}	-					100
$_{46}^{104}\mathrm{Pd}$	$^{6}1^{6}$	-	-	-	5^{-}	-					11.1
$_{47}^{107}\mathrm{Ag}$	-	-	-	-	5^{-}	1222					51.8
$_{48}^{114}\mathrm{Cd}$	-	$_{4}{}^{8}2^{8}$	$_{4}{}^{8}3^{8}$	-	5^{-}	1122					28.7
$_{49}^{115}\mathrm{In}$	-	-	-	-	5^{-}	2221					95.7
$_{50}^{120}\mathrm{Sn}$	-	-	-	-	5^{-}	3333					32.5
$_{51}^{121}\mathrm{Sb}$	-	-	-	-	5^{-}	4333					57.2
$_{52}^{130}\mathrm{Te}$	-	-	-	-	$_{8}5^{-}$	4343					34.08
$_{53}^{127}\mathrm{I}$	-	-	-	-	$_{4}5^{-}$	4443					100
$_{54}^{132}\mathrm{Xe}$	$^{6}1^{6}$	$_{4}2^{4444}$	$_{4}3^{4444}$	$_{8}4^{4444}$	$_{8}5^{4444}$	4444					26.9
$_{55}^{133}\mathrm{Cs}$	-	-	-	-	-		6			1	100
$_{56}^{138}\mathrm{Ba}$	-	-	-	-	-		6			1122	71.6
$_{57}^{139}\mathrm{La}$	-	-	-	-	$^{16}5^{16}$		$6^{1111\text{-}111}$		1111	1111	99.9
$_{58}^{140}\mathrm{Ce}$	-	-	-	-	-		$6^{1111\text{-}1111}$		-	-	88.4
$_{59}^{141}\mathrm{Pr}$	-	-	-	-	-		$6^{1111\text{-}1112}$		-	-	100
$_{60}^{142}\mathrm{Nd}$	-	-	-	-	-		$6^{1112\text{-}1112}$		-	-	27.1
$_{61}^{145}\mathrm{Pm}$	-	-	-	-	-		$6^{2121\text{-}2122}$		-	-	17.7yr
$_{62}^{152}\mathrm{Sm}$	-	-	-	-	-		$6^{3232\text{-}3232}$		-	-	26.7
$_{63}^{153}\mathrm{Eu}$	-	-	-	-	-		$6^{4232\text{-}3232}$		-	-	52.1
$_{64}^{158}\mathrm{Gd}$	-	-	-	-	-		$6^{4333\text{-}4333}$		-	-	24.8
$_{65}^{159}\mathrm{Tb}$	-	-	-	-	-		$6^{4343\text{-}4333}$		-	-	100
$_{66}^{164}\mathrm{Dy}$	-	$^{8}2^{8}$	-	-	$_{8}{}^{16}5^{16}$		$6^{4343\text{-}4343}$		-	-	28.2
$_{67}^{165}\mathrm{Ho}$	-	-	-	-	-		$6^{4443\text{-}4343}$		-	-	100
$_{68}^{166}\mathrm{Er}$	-	-	-	-	-		$6^{4443\text{-}4443}$		-	-	33.5
$_{69}^{169}\mathrm{Tm}$	-	-	-	-	-		$6^{4444\text{-}4443}$		1122	-	100
$_{70}^{174}\mathrm{Yb}$	-	$_{4}{}^{8}2^{8}$	-	-	-		$6^{4444\text{-}4444}$		-	-	32.02
$_{71}^{175}\mathrm{Lu}$	-	-	-	-	-		6	-	1222	-	97.4
$_{72}^{180}\mathrm{Hf}$	-	-	-	-	-		6	-	2222	2222	35.08
$_{73}^{181}\mathrm{Ta}$	-	-	-	-	-		6	-	3222	-	99.9
$_{74}^{184}\mathrm{W}$	-	-	-	-	-		6	-	3333	-	30.6
$_{75}^{187}\mathrm{Re}$	-	-	-	-	-		$_{2}6$	-	4333	-	62.6
$_{76}^{192}\mathrm{Os}$	-	-	-	-	-		$_{6}6$	-	4343	-	40.7
$_{77}^{193}\mathrm{Ir}$	-	-	-	-	-		$_{6}6$	-	4443	-	62.7
$_{78}^{194}\mathrm{Pt}$	-	-	-	-	-		$_{6}6$	-	4444	-	32.8
$_{79}^{197}\mathrm{Au}$	-	-	-	-	-		$_{10}6$	-	-	1222	100
$_{80}^{202}\mathrm{Hg}$	-	-	-	-	-		$_{16}6$	-	-	1122	29.8

$_{81}^{205}$Hl	-	-	-	-	-	$_{16}6$ - - $322\underline{2}$		70.4
$_{82}^{208}$Pb	-	-	-	-	-	$_{16}6$ - - 3333		52.4
$_{83}^{209}$Bi	-	-	-	-	-	$_{16}6$ - - 4333		100
$_{84}^{209}$Po	-	-	-	-	-	$_{16}6$ - - 4342		102yr
$_{85}^{210}$At	-	-	-	-	-	$_{16}6$ - - 4442		8.1h
$_{86}^{222}$Rn	$^{6}1^{6}$	$_{4}2^{4444}$	$_{4}3^{4444}$	$_{8}4^{4444\ 4444}$	$_{8}5^{4444\ 4444}$	$_{16}6^{4444-4444\ 4444\ 4444}$	$7^{\underline{111}-\underline{111}}$ $\underline{1111}$	3.82d
$_{87}^{223}$Fr	-	-	-	-	-	-	7 - - 1	22min
$_{88}^{226}$Ra	-	-	-	-	-	-	7 - - $1\underline{1}1\underline{1}$	1600yr
$_{89}^{227}$Ac	-	-	-	-	-	-	$7^{1\underline{1}1\underline{1}-1\underline{11}}$ - $\underline{1111}$	21.77yr
$_{90}^{232}$Th	-	-	-	-	-	-	$7^{11\underline{22}-11\underline{22}}$ - -	1.4×10^{10}yr
$_{91}^{231}$Pa	-	-	-	-	-	-	$7^{111\underline{2}-11\underline{22}}$ - -	3.3×10^{4}yr
$_{92}^{238}$U	-	-	-	-	-	-	$7^{333\underline{2}-333\underline{2}}$ - -	99.2
$_{93}^{237}$Np	-	-	-	-	-	-	$7^{2223-222\underline{2}}$ - -	2.1×10^{6}yr
$_{94}^{244}$Pu	-	-	-	-	-	-	$7^{3333-3333}$ - -	8.0×10^{7}yr
$_{95}^{243}$Am	-	-	-	-	-	-	$7^{4323-3332}$ - -	7370yr
$_{96}^{247}$Cm	-	-	-	-	-	-	$7^{4323-4322}$ $\underline{2222}$ -	1.56×10^{7}yr
$_{97}^{247}$Bk	-	-	-	-	-	-	$7^{4242-4322}$ - -	1.38×10^{3}yr
$_{98}^{251}$Cf	-	-	-	-	-	-	$7^{4343-4342}$ - -	898yr
$_{99}^{252}$Es	-	-	-	-	-	-	$7^{4443-4342}$ - -	471.7d
$_{100}^{257}$Fm	-	-	-	-	-	-	$7^{4443-4442}$ - $\underline{2222}$	100.5d
$_{101}^{258}$Md	-	-	-	-	-	-	$7^{4444-4442}$ - -	51.5d
$_{102}^{259}$No	-	-	-	-	-	-	$7^{4444-4444}$ $\underline{1222}$ -	58min
$_{103}^{260}$Lr	-	-	-	-	-	-	7 - $2\underline{222}$ -	3min
$_{104}^{261}$Rf	-	-	-	-	-	-	7 - $32\underline{22}$ -	1.9s
$_{105}^{262}$Db	-	-	-	-	-	-	7 - $332\underline{2}$ -	35s
$_{106}^{265}$Sg	-	-	-	-	-	-	$_{1}7$ - 3333 -	16.2s
$_{107}^{272}$Bh	-	-	-	-	-	-	$_{7}7$ - 4333 -	10s
$_{108}^{275}$Hs	-	-	-	-	-	-	$_{9}7$ - 4343 -	0.15s
$_{109}^{276}$Mt	-	-	-	-	-	-	$_{9}7$ - 4443 -	0.72s
$_{110}^{281}$Ds	-	-	-	-	-	-	$_{16}7$ - 4444 $\underline{2111}$	20s
$_{111}^{281}$Rg	-	-	-	-	-	-	$_{16}7$ - 4444 $2\underline{111}$	26s
$_{112}^{285}$Cn	-	-	-	-	-	-	$_{16}7$ - - $32\underline{22}$	30s
$_{113}^{286}$Nh	-	-	-	-	-	-	$_{16}7$ - - $323\underline{2}$	20s
$_{114}^{288}$Fl	-	-	-	-	-	-	$_{16}7$ - - 3333	0.52s
$_{115}^{289}$Mc	-	-	-	-	-	-	$_{16}7$ - - 4333	0.22s
$_{116}^{290}$Lv	-	-	-	-	-	-	$_{16}7$ - - 4343	15ms
$_{117}^{291}$Ts	-	-	-	-	-	-	$_{16}7$ - - 4443	
$_{118}^{292}$Og	$^{6}1^{6}$	$_{4}2^{4444}$	$_{4}3^{4444}$	$_{8}4^{4444-4444}$	$_{8}5^{4444-4444}$	$_{16}6^{4444-4444\ 4444\ 4444}$	$_{16}7^{4444-4444\ 4444\ 4444}$	

Foldable nuclei, it seems, can own a core expanding in $_{27}$Co, $_{28}$Ni, $_{45}$Rh, and $_{46}$Pd that is different from other nuclear theories, and grow out vertical 4 *a* ($Z \geqq 1$, representative), 4 *b* ($Z \geqq 21$, transition), and 8 *c* ($Z \geqq 57$, inner transition) α clusters bonding with valence neutrons (Fig. 2, Table 1), which not only construct atoms, but also take them apart, such as nuclear fission and α cluster decay[9-11]. That is to say, in these α clusters of atoms can draw one line of binary fission structures (Figs. 2 and 3a-b) from symmetric to far asymmetric (e.g. α–decay)[12], and two lines of ternary fission[13], what even an atom can fragmentate into several (>3) fragments[14], implying that a nuclear fission appears to like breaks a crystal, not liquid.

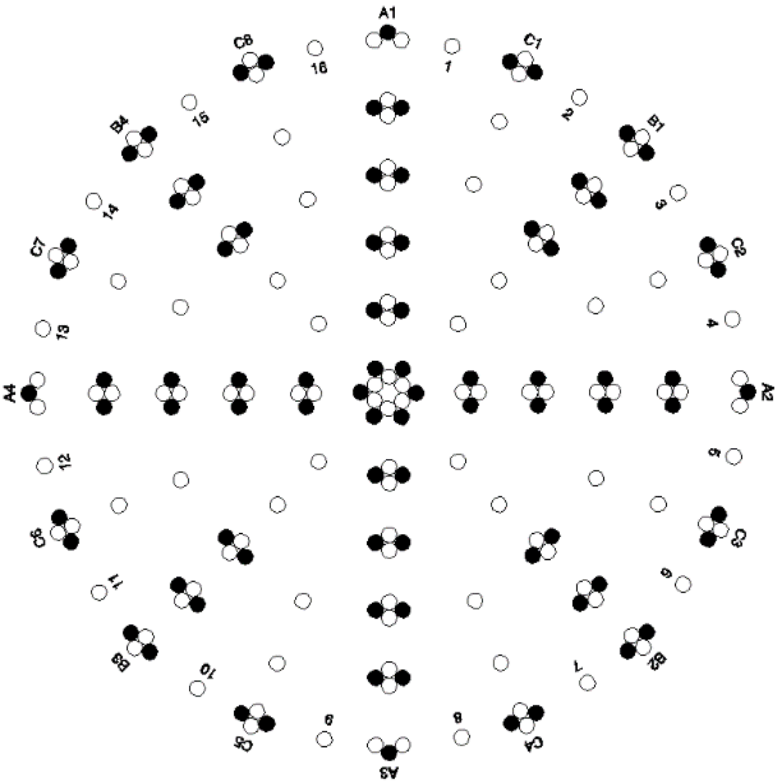
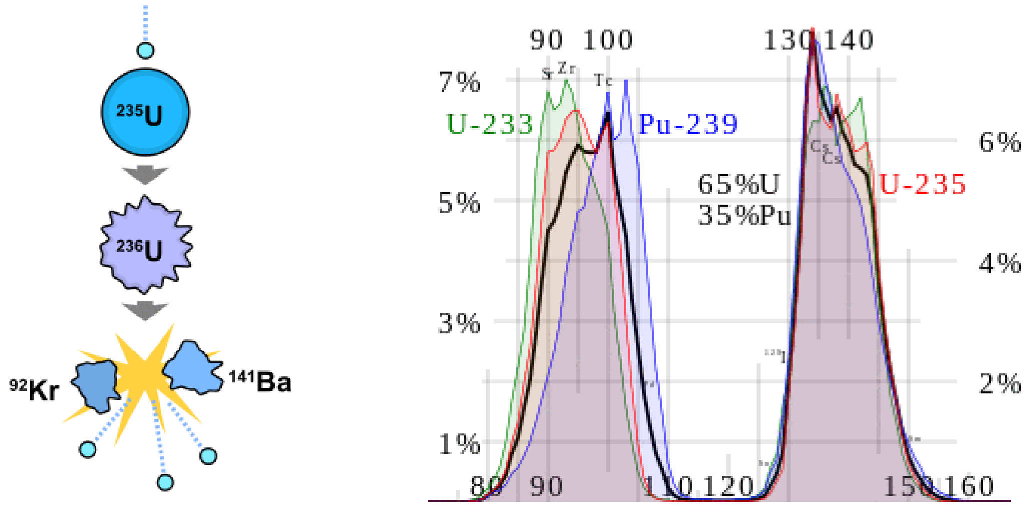


Fig. 2 A crystal images of ^{208}Pb (unfolded). Closed and open circles are protons and neutrons, respectively, and its 82 electrons are not marked. In $^{208}_{82+86+40}\mathrm{Pb}_{c-6+6,v-4,4,8,8,16}^{c-4444-4444,b-4444,a-3333}$, right superscript is skin configuration, subscript c-6+6 is core (n+p), v-4,4,8,8,16 is n_v number in the 2-6 layers, and 82+86+40 is $Z+n_p+n_v$, where n_p is pair neutron, and n_v is valence neutron (single open circles) to fill gaps in axes and layers that will firstly become prompt neutrons in atomic (nuclear) fission.

Commonly, asymmetry only occur in low energy or spontaneous fissions in a range $Z \sim 94 \pm 6$ ($_{88}$Ra-$_{100}$Fm)[15-16] and mass A ~ 226-256 that skin particles of these nuclei may be able to slide or mix, and most fissions of other nuclei are symmetry[17-19]. In asymmetric fission, heavy fragments (Figs. 3a-b) were predominantly explained near Z-50 and N-82 double magic shells, which seems dim to some extent. It is likely that light and heavy fragments result from that 16 (4a+4b+8c) α-clusters split, such as ^{235}U+n that a possible structure of ^{235}U was $^{6}1^{6},{}^{8}_{4}2^{8},{}^{8}_{4}3^{8},{}^{16}_{8}4^{16},{}^{16}_{8}5^{16},{}^{32}_{16}6^{32},7^{c-222\underline{2}-221\underline{2},b-\underline{1111},a-\underline{1111}}$, into 7 : 9, i.e. $1^a2^b4^c : 3^a2^b4^c$ (see Fig. 2). Also in Fig. 2, if takes outermost 16 valance neutrons from ^{208}Pb, it is ^{192}Pb that will occur α–decay, i.e. far asymmetric fission. Generally, α–decay only happen in insufficient neutron nuclei (in the vicinity of $Z = 82$, or $N < 126$) that may lack valance neutrons to bind α particles. In Table 2, any tin ($Z = 50$) isotopes without α–decay, this likely is that inner transition elements (c-α-clusters) have not arisen. However, it suggests that in different conditions, ^{208}Pb in Fig. 2 can be fictitiously drawn many fission lines, the number of fragments to be from 2 up to 16 (16 α-clusters, exclusive of valence neutron fragments).



(a) (b)

Fig. 3 **(a)** An ^{235}U + n $\rightarrow$ ^{92}Kr + ^{141}Ba + 3n asymmetric fission, ^{92}Kr and ^{141}Ba are light and heavy fragments respectively, corresponding to that 16 (4*a*+4*b*+8*c*) α-clusters split into 7 : 9 (i.e. $1^a2^b4^c$: $3^a2^b4^c$), and 3n are prompt neutrons that would come from valence neutrons in the fission line (see Fig. 2). **(b)** A typical asymmetric fission of ^{235}U+n that light and heavy fragment masses are ~ 90-100 and ~ 130-140, respectively. In center is symmetric fission that its yield is low in fragment mass range ~ 110-120. In Y-axis is yield (%) and X-axis is mass (u). These figures take from wikipedia.

3. Valence and pair neutron

Valance neutrons not only bind 16 α-clusters, but will become 3 (average 2.5 per fission) prompt neutrons[20] in nuclear fission as in Fig. 3a. In nuclear fission, another type is delayed neutrons when two fragments were restructured into two daughter atoms (not two nuclei) about several minutes after fission to release[21].

Also, occurrence of valance neutrons that the number are 2^3, 2^4, 2^5 in the 2-3, 4-5, and 6-7 periods will give rise to beta stable line deviating from $Z = N$ line as atoms grow to heavier and heavier (see Fig. 4). Therefore, an atomic mass roughly can be expressed:

$$A = Z + n_p + n_v. \tag{1}$$

For instance,

$$^{132}\mathrm{Xe} = 54 + 54 + (2^3+2^4), \tag{2}$$

also, the number of n_y and α are approximate in most stable heavy nuclei, e.g.

$$^{132}\mathrm{Xe} = 24(n_v+\alpha) + {}_{6}12, \tag{3}$$

where ${}_{6}12$ is its core in ${}_{Z}A$ that the number of protons and neutrons is the same as a ${}^{12}_{6}$C atom, but the both structures is very different.

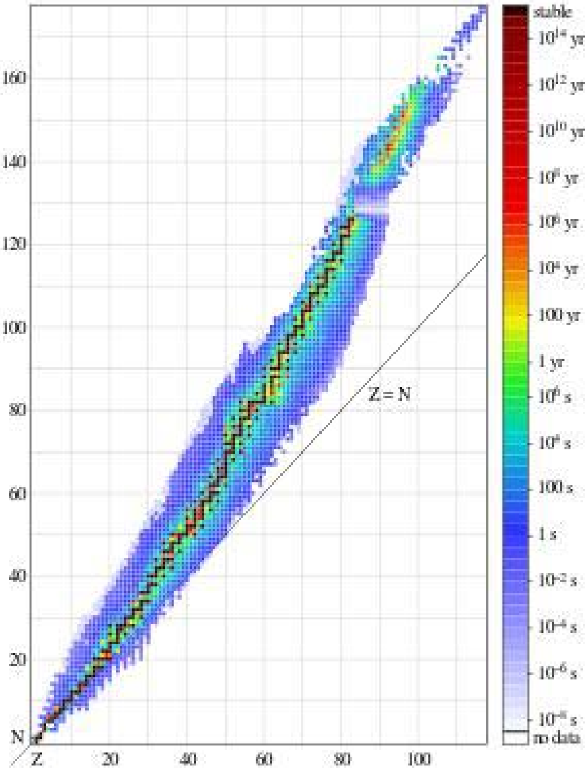


Fig. 4 Beta stable line deviating from $Z = N$ line could contribute to emergence of valence neutrons as atoms grow to heavier and heavier. This figure takes from wikipedia.

Generally, an element will occur some isotopes[22] that leading to isotope change in light elements were pair neutrons on that nuclear skin makes p, d or t particles to change, such as $^{12}C^{2222}$, $^{13}C^{3222}$, and $^{14}C^{3232}$, and $^{16\text{-}18}O$ in later Fig.7, and in heavy elements both valance and pair neutrons will change, e.g. $^{100\text{-}138}Sn$ in Table 2. Also in Table 2, it seems that a neutron in a nucleus in different places that is not resemble protons having fixed places can result in different isomers[23], e.g. ^{119m}Sn and ^{121m}Sn, which is estimated to happen many that have not been identified today. In addition, in the lower right of beta stable line (Fig. 4), i.e. $Z > N$, ^{3}He was estimated to generate in skins of neutron-deficient light nuclei, e.g. $^{17}Ne_{c\text{-}2+2}^{4\underline{333}}$ (109.2 ms) and $^{19}Ne_{c\text{-}2+2}^{444\underline{3}}$ (17.22 s).

In addition, on nuclear skin, configuration 4443 is mostly in tri-group 7 (7A, 7B, 13-14C), e.g., *a*-4443 in ^{19}F, ^{35}Cl, ^{79}Br, and ^{127}I, *b*-4443 in ^{55}Mn and ^{99}Tc, and *c*-4443-4443 in $^{165}Ho^{c\text{-}4443\text{-}4343}$ and $^{166}Er^{c\text{-}4443\text{-}4443}$. Moreover, a dineutron[24] (a neutron pair that is to take two protons from an alpha particle) may serve as a proton in nuclear skins to form a tetrahedron, e.g. ^{40}Ar+*b*-111$\underline{2}$ (^{45}Sc, 100%) and ^{84}Kr+*b*-111$\underline{2}$ (^{89}Y, 100%) in group 3B of periodic table (Table 1) that *b*-111$\underline{2}$ is a *b*-tetrahedron similar to *b*-2222 in $^{48}Ti^{2222}$ what is different with skin *a*-2222 in $^{12}C^{2222}$ and $^{28}Si^{2222}$ that is an *a*-tetrahedron. In stable nuclei (~ 300) ^{45}Sc is likely emerging a dineutron for the first time, which seems a unique structure that its proton distribution differs with current electron one. In Table 1 atomic grown masses show a regular phenomenon that 3, 1, 3, 1, 3, 1, 3, and 5 in the 3rd period, when grow from odd to even *Z*, only fill 1 p_l ($^{23}Na^{111} \rightarrow {}^{24}Mg^{1\underline{1}1\underline{1}}$) or with 4 n_v ($^{35}Cl^{4443} \rightarrow {}^{40}Ar_{v\text{-}4}^{4444}$), but 1 p_l is often accompanied by 2 n_p ($^{28}Si^{2222} \rightarrow {}^{31}P^{4232}$) from even to odd *Z*. At the 2-3 periods end, nuclei begin to grow n_v that first clearly to emerge 4 n_v will be in $^{40}Ar_{v\text{-}4}^{4444}$ (99.59%; $^{38}Ar_{v\text{-}2}^{4444}$, 0.063%; $^{36}Ar^{4444}$, 0.337%) in natural nuclei, where the 4 position is to grow 4 *b* α-clusters.

Table 2 A tentative nucleon arrangement of $^{100\text{-}138}$Sn

In 38 neutrons (138 - 100), n_v ~ 20, n_p ~ 8, and 10 n in the 6th layer is neutron skin (halo). Valence neutrons in the 2-6 layers are compiled in a column. Decay modes: ε, electron capture; p, proton emission; IT, isomeric transition; β^-, beta-minus decay; n, neutron emission.

Sn nuclide	core + middle	n_v	skin configuration b	a	abundance (%) / $T_{1/2}$
100	$_{38+38}$76	0, 0, 4	4444	1111	0.86 s (ε,εp)
101	-	0, 0, 5	-	-	1.7 s (ε, εp)
102	-	0, 0, 6	-	-	3.8 s (ε)
103	-	0, 0, 7	-	-	7.0 s (ε, εp)
104	-	0, 0, 8	-	-	20.8 s (ε)
105	-	0, 0, 8	-	2111	32.7 s (ε, εp)
106	-	0, 0, 8	-	2211	115 s (ε)
107	-	0, 0, 8	-	2221	2.90 min (ε)
108	-	0, 0, 8	-	2222	10.30 min (ε)
109	-	0, 1, 8	-	-	18.0 min (ε)
110	-	0, 2, 8	-	-	4.11 h (ε)
111	-	0, 3, 8	-	-	35.3 min (ε)
112	-	0, 4, 8	-	-	0.96
113	-	0, 4, 8	-	3222	115.09 d (ε)
114	-	0, 4, 8	-	3322	0.66
115	-	0, 4, 8	-	3332	0.34
116	-	0, 4, 8	-	3333	14.54
117	-	1, 4, 8	-	-	7.68
118	-	2, 4, 8	-	-	24.22
119	-	3, 4, 8	-	-	8.59
119m	-	4, 4, 8	-	3332	291.1 d (IT)
120	-	4, 4, 8	-	3333	32.58
121	-	4, 4, 8, 1	-	-	27.03 h (β^-)
121m	-	3, 4, 8, 2	-	-	43.9 yr(IT)
122	-	4, 4, 8, 2	-	-	4.72
123	-	4, 4, 8, 3	-	-	129.2 d (β^-)
124	-	4, 4, 8, 4	-	-	5.94
125	-	4, 4, 8, 5	-	-	9.64 d (β^-)
126	-	4, 4, 8, 6	-	-	2.3×10^5 yr
127	-	4, 4, 8, 7	-	-	2.10 h (β^-)
128	-	4, 4, 8, 8	-	-	59.07 min (β^-)
129	-	4, 4, 8, 8, 1	-	-	6.9 min (β^-)
130	-	4, 4, 8, 8, 2	-	-	3.72 min (β^-)
131	-	4, 4, 8, 8, 3	-	-	56.4 s (β^-)
132	-	4, 4, 8, 8, 4	-	-	39.7 s (β^-)
133	-	4, 4, 8, 8, 5	-	-	1.46 s (β^-, β^-n)
134	-	4, 4, 8, 8, 6	-	-	1.05 s (β^-, β^-n)
135	-	4, 4, 8, 8, 7	-	-	530 ms (β^-, β^-n)
136	-	4, 4, 8, 8, 8	-	-	0.25 s (β^-, β^-n)
137	-	4, 4, 8, 8, 9	-	-	190 ms (β^-, β^-n)
138	-	4, 4, 8, 8, 10	-	-	~ 408 ns

4. Foldable atoms

4.1 Atomic structures

Modern atomic theory is based on planetary model similar to the solar system. It comes from that according to some alpha particles reflected angles greater than 90° in Geiger's experiment, in order to explain this, Rutherford inferred that atomic positive charges are concentrated in its centre — nucleus, which is disagreement with Thomson's plum pudding model.

To balance this, it is possible that in Geiger's gold foil experiment, gold atomic nucleus was $^{197}{}_{79}Au^{25+}$ also able to deflect alpha particles (Fig. 5), likely not $^{197}{}_{79}Au^{79+}$. After all, up to now any elements have not been reported that could be fully ionized, except H and He atoms in the first period, to the best of the author's knowledge. What is more, in ^{238}U + 400Gev protons fragmentation[14], 23 products from ^{47}Ca to ^{143}Ce were atoms, not bare nuclei that only contain nucleons and via various kinds of decay can fast turn into atoms; because if electrons were in outside of nuclei, under such high incident energy, all of they will be firstly knocked off, or how 92 electrons of $^{238}{}_{92}U$ can precisely allocate to every daughter nucleus in this case. Thus here atomic ionized number was roughly evaluated to be: *Z* 1-18, ≦ 8+; *Z* 19- 54, ≦ 16+; *Z* 55-118, ≦ 32+. On the other side, if electrons were too much in between atoms of lattices, in terms of Rutherford's atomic model, metal elements (e.g. gold) might be like inert gases without solid state under normal temperature and pressure, since repelling force will be too strong, which is to think.

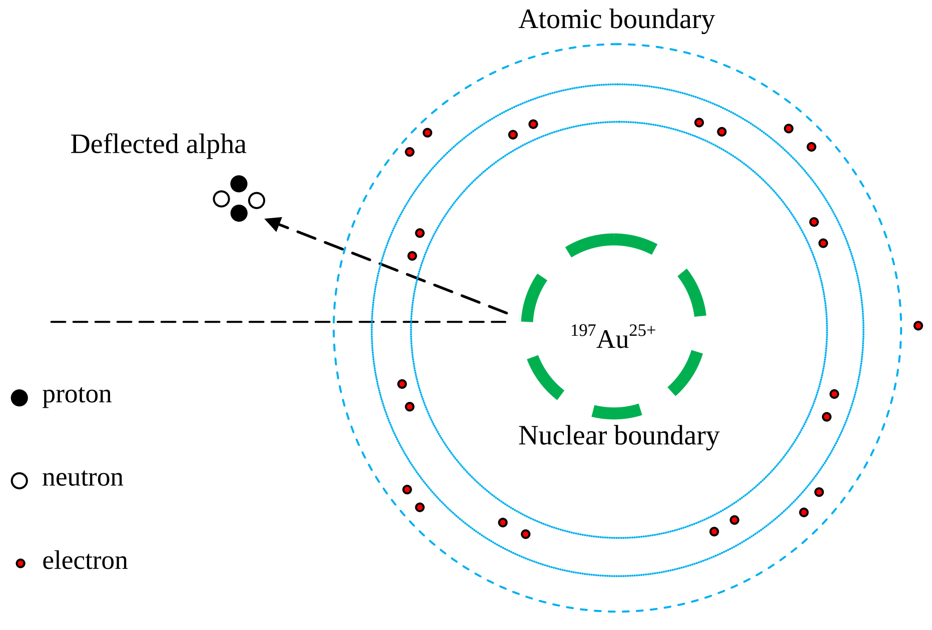


Fig. 5 Atomic ^{197}Au that in center was its nucleus $^{197}{}_{79}Au^{25+}$ likely also able to deflect alpha particles and in between atomic and nuclear boundaries were 25 electrons that they configuration was $6c^{16}6b^{8}6a^{1}$, although Au is in group 1B (see later electron configurations).

In addition, Moseley's X-ray spectra experiment[25] only confirmed in an atom contain how much protons, i.e. atomic number, which cannot clarify the details of electron distributions.

In addition, in $^{235}U + n \rightarrow {}^{92}Kr + {}^{141}Ba + 3n$ reaction (Fig.3), an atom ^{235}U + n splits practically into $^{92}Kr + {}^{141}Ba$ two atoms, not ${}_{36}{}^{92}Kr^{36+} + {}_{56}{}^{141}Ba^{56+}$ two nuclei. However, it is difficult to imagine that how 92 electrons of $_{92}U$ atom could split quickly into 36 and 56 two electron clouds. If atomic nuclei contain innate electrons, apart from outermost electrons, it will become easy to explain.

In nuclei, p + e system (Fig.6) might be in a state between a natural hydrogen atom and a neutron. That is to say, it is tighter than a hydrogen atom, but is looser than a neutron. Please see also Santilli's an attempt p + e system model[26]. However, although the author hesitates somewhat, he remains to think that this possibly was a way out.

In this work, atomic "dynamic diagram" was that atoms were in a phase between flat (2D) and cubic (3D) to vibrate that was temporarily called atomic foldable model and like a butterfly to wing somewhat, which is different with planetary model of atoms. Nevertheless, there a problem will arise that in a p + e system, an electron in a balance point how to move and unable to fall into the proton. One of possibilities was that the influencing distance and strength of repelling and attracting forces might be very subtly different and that a proton was supposed to be:

$$p = {}_{n}e^{+} + {}_{n-1}e^{-}. \quad (4)$$

where n is an unknown number today; otherwise a free neutron that was assumed to be:

$$n = {}_{n}e^{+} + {}_{n}e^{-} \quad (5)$$

will be not to decay. Anyways, on the other hand, this atomic foldable structure could lend support to simplify molecular structures.

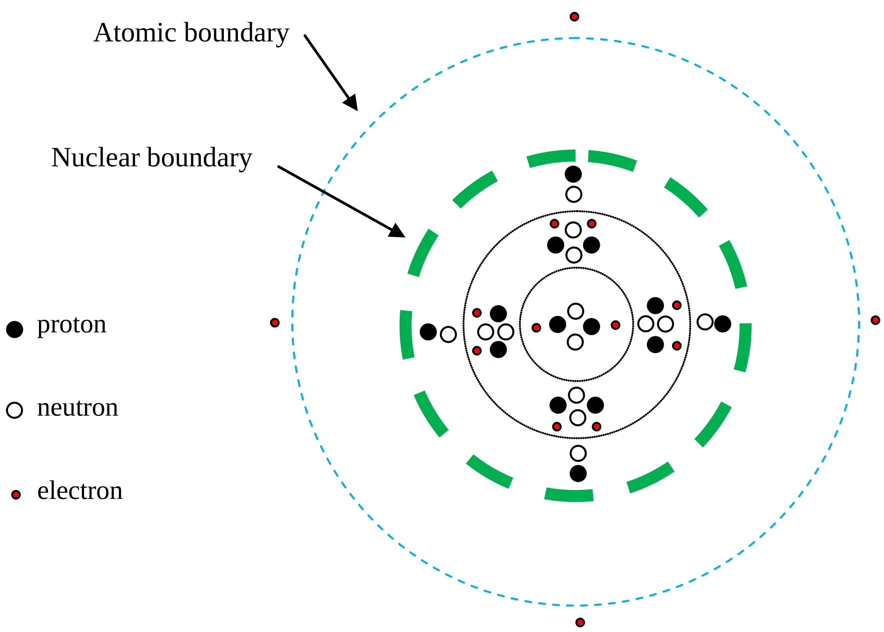


Fig. 6 ^{28}Si atomic structure. ^{28}Si nucleus shows a $^{28}_{14}Si^{4+}$ that 4 electrons were out of the nucleus to form an a-tetrahedron. Electrons of inner layers are in a uniform sea of positive charge, which displays a Thomson's model at a glance.

4.2 Molecular structures

The shapes and structures of some simple molecules appear to result directly from atomic tetrahedral 4 *a* axes (α-clusters), such as valency and bonding angle of atoms (Fig. 7 and Supplementary figs. 119-125). For example, a single, double, and triple bond in F_2, O_2, and N_2 molecules coincided with a pair of t in $(^{19}F^{4443})_2$, two pairs of d in $(^{16}O^{4242})_2$, and three pairs of d in $(^{14}N^{4222})_2$. In other words, from Fig. 7 and Supplementary figs. 119-125 it suggests that valency electrons will reciprocate only at extended lines of atomic tetrahedral 4 *a* axes to give rise to a definite molecular image. In contrast, planetary model of atoms seems relative hard to do by electron cloud.

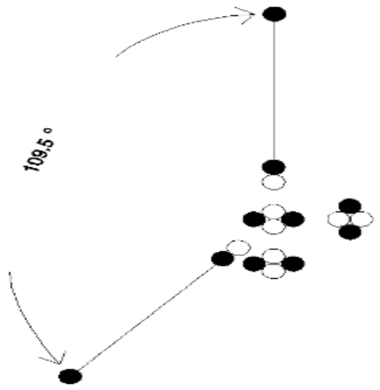


Fig. 7 A water molecular $^1H_2{}^{16}O$ structure. In the center is a $^{16}O_{c-2+2}{}^{4242}$ and the farthest are 2 ^1H, suggesting that its valency and angle are rooted in the 2 d. If 2 d of $^{16}O^{4242}$ (99.757%) were replaced by 1 or 2 t, it is $^{17}O^{4342}$ (0.038%) or $^{18}O^{4343}$ (0.205%). Note that 2 + (2+6) electrons of $^1H_2{}^{16}O$ are not marked.

By the way, Lewis has found[27] that O_4 molecules were formed. If indeed occurred, its structure might be a square planar; also, an ozone[28] structure was not impossible to be a plane triangle (Fig. 8), which is a bit like a benzene ring (Supplementary fig. 125) and different with the current theory. Modern molecular structural theory relies mainly on electron configurations.

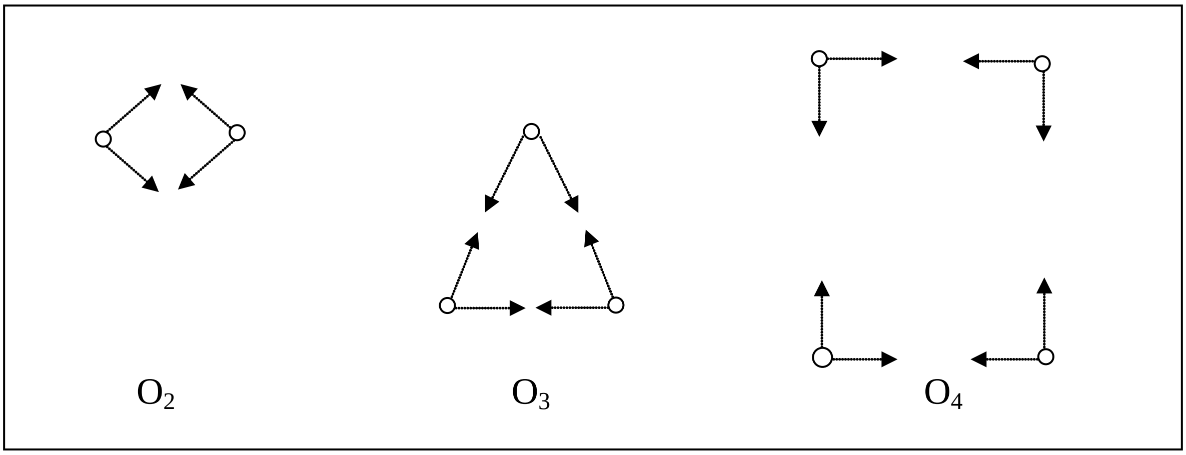


Fig. 8 A possible molecular structure of O_2, O_3, and O_4.

4.3 Electronic configurations and periodic table

Electron configurations are coming from Bohr's electron shell[29] that only outermost electron distributions can alter, which is somewhat dim or difficult to understand on the whole. As a contrast, proton (nucleon) distributions not only skin, but also core will alter that last protons of Co, Ni, Rh, and Pd four elements will sink into it, which could solve a wonder thing that the four elements are in a specific position of the periodic table to differ with other elements. In order to eliminate the inconformity of the both, electron configurations then may be analogous to proton distributions as noble gases in Table 3, which in fact the inward of electron configurations cannot alter to impel this change. However, it is thought in that an atom protons and electrons play leading and supporting roles, individually.

Table 3 Electron configurations of noble gases

a, *b*, *c* are 4+4+8 axes of atoms and $a = s + p$, $b = d$, $c = f$.

period	element	configuration
1	He	$1a^2$
2	Ne	$1a^2 2a^8$
3	Ar	$1a^2 2a^8 3a^8$
4	Kr	$1a^4 2a^8 3a^8 4b^8 4a^8$
5	Xe	$1a^6 2a^8 3a^8 4b^8 4a^8 5b^8 5a^8$
6	Rn	$1a^6 2a^8 3a^8 4b^8 4a^8 5b^8 5a^8 6c^{16} 6b^8 6a^8$
7	Og	$1a^6 2a^8 3a^8 4b^8 4a^8 5b^8 5a^8 6c^{16} 6b^8 6a^8 7c^{16} 7b^8 7a^8$

Admittedly, on the other hand, Bohr's electron configurations has been unconsciously to study the nature of the periodic table, even can go back to earlier, such as Mendeleev and so on according to elements found to arrange[30]. Actually, to study the nature of the periodic table is to do atomic and nuclear structures.

In addition, from proton distributions it suggests that current the periodic table should moderate a bit that the number of inner transition elements may need to increase from 14 × 2 to 16 × 2 (Fig. 1c). Accordingly, taken together to consider, the periodic table was a magnifying composite photograph of *Z* 1-118 atomic structures to some degree; in other words, the periodic table has actually been a growing route chart of *Z* 1-118 atoms.

5. Discussion and conclusion

In Bohr's atomic model, only skin electron distributions are change. In contrast, proton distributions not only skin, but also core, according to the shape of the current periodic table to deduce, can change, which appears easier to understand. In addition, it seems that, in the light of Rutherford' electron locations, all of electrons is in outside of atomic nuclei, it is difficult to describe in $^{235}U + n \rightarrow {}^{92}Kr + {}^{141}Ba + 3n$ reaction, outside 92 electrons of $_{92}U$ how to spilt into 36 ($_{36}Kr$) and 56 ($_{56}Ba$) two electron groups. If $_{92}{}^{236}U$ nucleus was $_{92}{}^{236}U^{6+}$ (not $_{92}{}^{236}U^{92+}$) that exists innate 86 electrons, as in Thomson' plum pudding model to some extent, which likely remains able to deflect alpha particles, it will become relative simple to explain. However, atomic planetary model was felt less promising than atomic foldable model, which not only involves electron distributions in and out of atomic nuclei, but also nuclear structures as well that is beneficial to further clarify fission phenomena.

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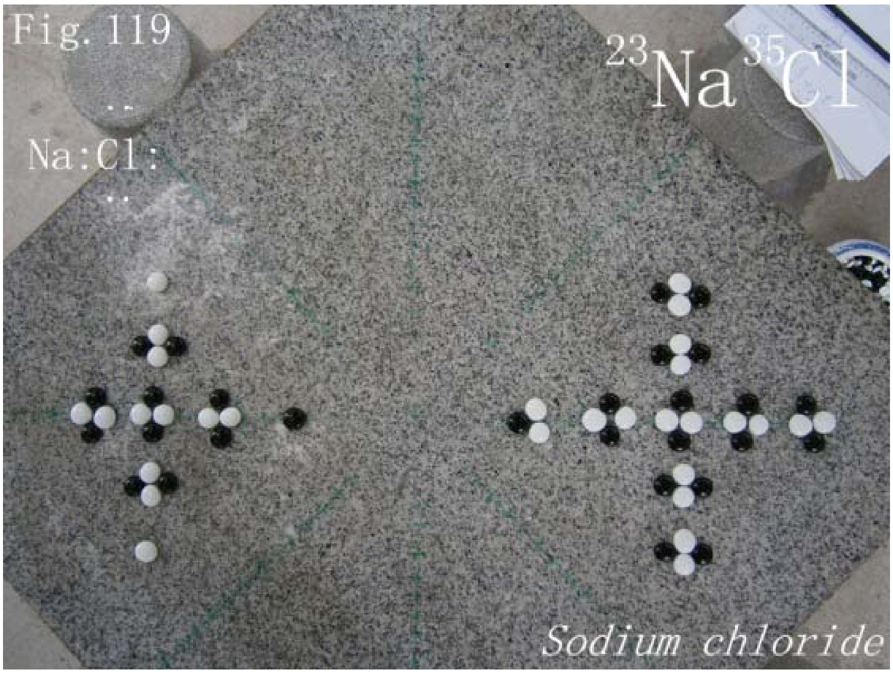
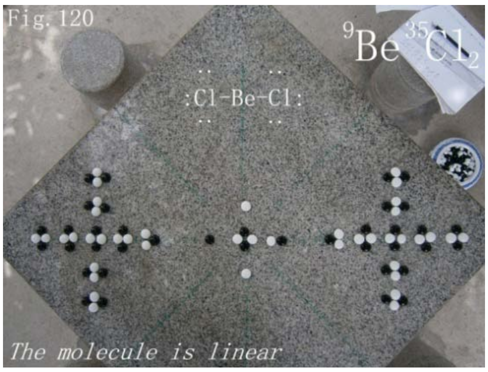
Supplementary figs. 119-125





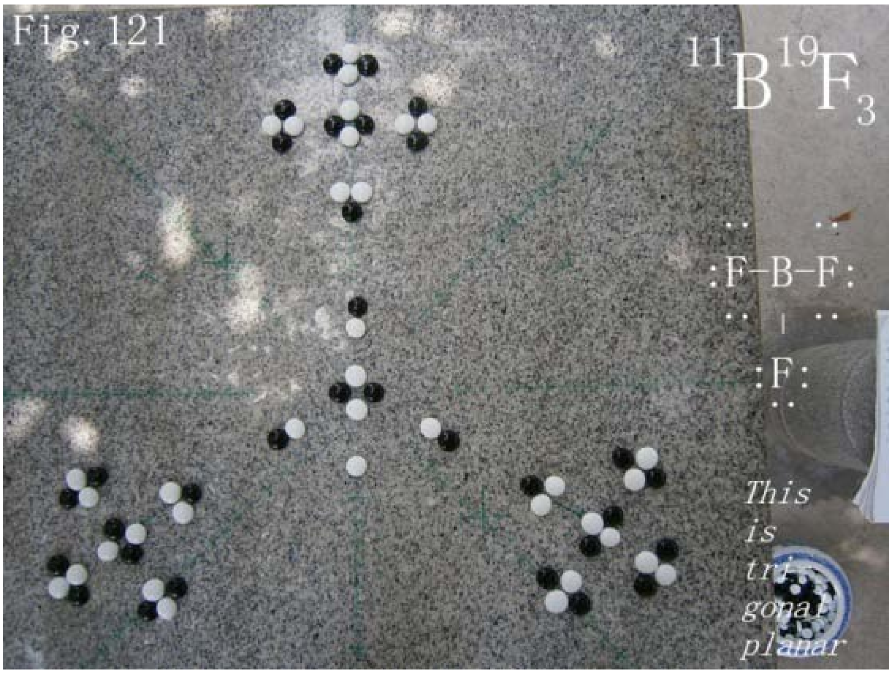


Fig. 121
$^{11}B^{19}F_3$
:F–B–F:
:F:
This
is
tri-
gonal
planar


Fig. 122
$^{12}C\ ^{1}H_4$
A
tetrahedral
structure
of
methane
is
shown
to
root
in
a
basal
alpha
particle

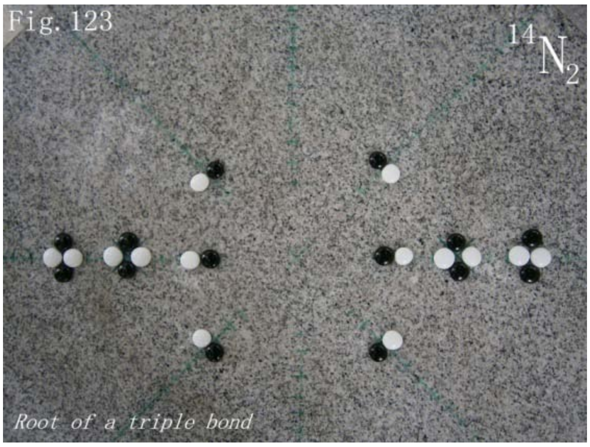


Fig. 123
$^{14}N_2$
Root of a triple bond

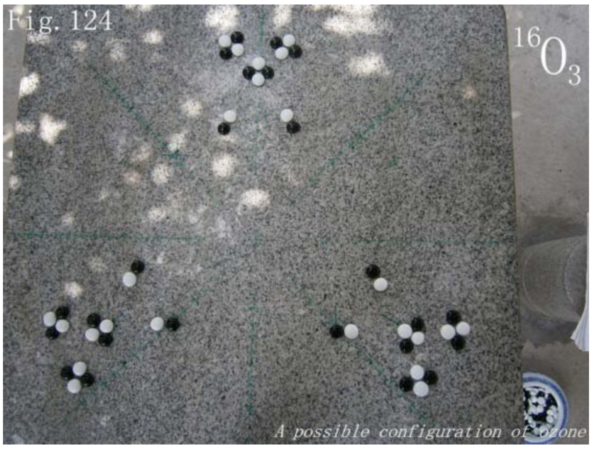


Fig. 124
$^{16}O_3$
A possible configuration of ozone


Fig. 125
$^{12}C_6\,^{1}H_6$
The structure of benzene is shown a closed ring of six carbon nuclei