

Atlas of Atomic Nuclear Structures according to the Basic Structures of Matter theory

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Abstract The Atlas of Atomic Nuclear Structures (ANS) is one of the major output results of the Basic Structures of Matter (BSM) theory, based on an alternative concept of the physical vacuum. The atlas of ANS contains drawings illustrating the structure of the elementary particles and the atomic nuclei. While the physical structures of the elementary particles obtained by analysis according to the BSM theory exhibit the same interaction energies as the Quantum Mechanical models, they allow unveiling the spatial configurations of the atomic nuclei, atoms and molecules. The unveiled structural features appear useful for a theoretical structural analysis and modeling of chemical compounds. In such aspect the proposed models could find applications in different fields, such as the inorganic and organic chemistry, the nanotechnology and the biomolecules.

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Table 1. The elements are referenced by their Z number

Z	Page	Z	Page
1 - 2	II-1	53 - 56	II-11
3 - 7	II-2	57 - 61	II-12
8 - 13	II-3	62 - 67	II-13
14 - 18	II-4	68 - 72	II-14
19 - 24	II-5	73 - 78	II-15
24 - 29	II-6	79 - 84	II-16
30 - 35	II-7	85 - 89	II-17
36 - 40	II-8	90 - 95	II-18
41 - 46	II-9	96 - 101	II-19
47 - 52	II-10	102 - 103	II-20

Notes:

The symbols used in the atlas for notation of the particles and their connections are given in Page II-0.

Notations:

Z – number of protons in the nucleus
N – number of neutrons in the nucleus

For electronic version of the atlas, use Acrobat reader 4.0 or later version with a magnification option

References:

S. Sarg, *Basic Structures of Matter*, monograph, <http://www.helical-structures.org> (2001) also in electronic archive of National Library of Canada, <http://www.nlc-bnc.ca/amicus/index-e.html> (AMICUS No. 27105955), (2002)

S. Sarg, New approach for building of unified theory about the Universe and some results, <http://lanl.arxiv.org/abs/physics/0205052>

S. Sarg, Brief introduction to BSM theory and derived atomic models, *Journal of Theoretics*, January 2003. <http://www.journaloftheoretics.com/Links/Papers/Sarg.pdf>

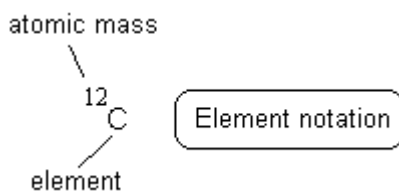
Introduction

The Atlas of Atomic Nuclear Structures (ANS) is one of the major output results of the Basic Structures of Matter (BSM) theory, based on an alternative concept of the physical vacuum. While the physical structures of the elementary particles obtained by analysis according to the BSM theory exhibit the same interaction energies as the Quantum Mechanical models, they allow unveiling the spatial configurations of the atomic nuclei, atoms and molecules. The unveiled structural features of the atomic nuclei provide explanation about the particular angular positions of the chemical bonds. Such features are in good agreement with the VSEPR model used in the chemistry. Number of other intrinsic features defined by the structural composition of the nuclei provides strong evidence that the proposed models are real physical atomic structures. The arguments for this claim are presented in the BSM theory and more particularly in Chapter 8. The proposed physical models could find applications in different fields, such as the inorganic and organic chemistry, the nanotechnology and the biomolecules. Some of the potential applications are demonstrated in section BSM Applications [1].

The atlas of ANS contains two parts. Part I illustrates the geometry and the internal structure of the basic atomic particles, built of helical structures. (The helical structures have common geometrical features and they are implemented in all kind of real elementary particles). Part II illustrates the three dimensional atomic nuclear structures of the elements in a range of $1 < Z < 103$, where Z is the number of protons in the nucleus. Only the stable isotopes given in the Periodic table are shown. In order to simplify the complex views of the nuclei they are shown as plane projections of symbols. For this purpose two types of symbols are used: symbols for hadron particles (proton, neutron and He nucleus) and particle bonding symbols. The real three-dimensional structures could be easily obtained from such the two-dimensional drawings. Page 21 illustrates sectional views of nuclei of some selected elements in order to obtain more realistic vision about their three-dimensional configurations.

The rules upon which the protons and neutrons are arranged in shells in the nuclei are discussed in Chapter 8 of BSM. The trend of consecutive nuclear building by Z -number follows a shell structure that complies strictly with the row-column pattern of the Periodic table. The periodic law of Mendeleev appears to reflect not only the Z -number, but also the shell structure of the atomic nuclei. The latter becomes apparent in the BSM analysis. The protons (deuterons) shells get stable completion at column 18 (noble gases). The separate rows of the Lanthanides and the Actinides are characterised by a consecutive grow and completion of different shells. The nuclear structures of all stable elements (isotopes) possess clearly identified polar axis of rotational symmetry. One or more He nuclear structures are always positioned along this axis. The most abundant sub-nuclear compositions are deuterons, tritium and protons. They are hold strongly by different type of bonds shown in the Atlas by symbolic notations and described in Chapter 8 of BSM. The conditions for instability of the short-lived isotopes are also discussed in Chapter 8. They are partly apparent from the Atlas drawings – especially for the alpha decay. The growing limit for stable high Z -number elements is apparent from the shelf completion and the obtained nuclear shape.

The electronic orbits are not shown in the nuclear drawings, but their positions are defined (and consequently identifiable) by the spatial positions of the protons (or deuterons). The Hund's rules and Pauli exclusion principle are both identifiable features related respectively to the available positions and mutual orientations of the quantum orbits. The length trace of the quantum orbits are defined by the quantum speed of the oscillating electron. The possible quantum numbers for the different orbitals in any element are restricted by the spatial positions mainly of the protons (and partly of the neutrons) in the nucleus.



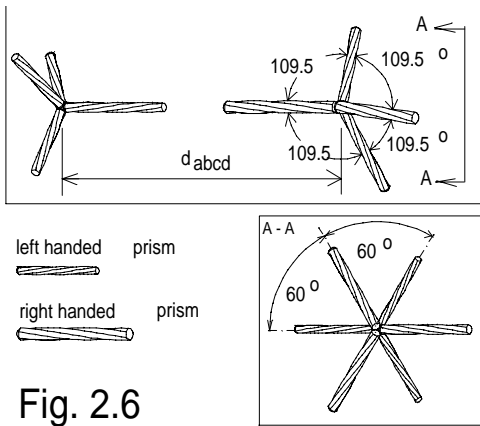


Fig. 2.6

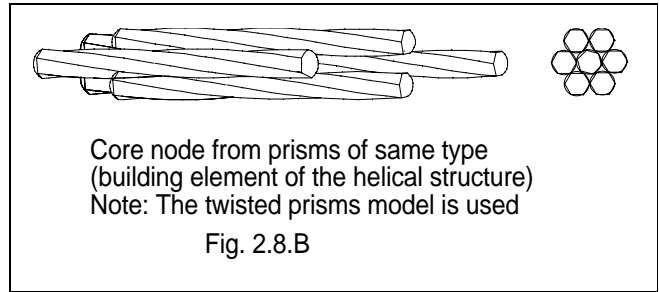
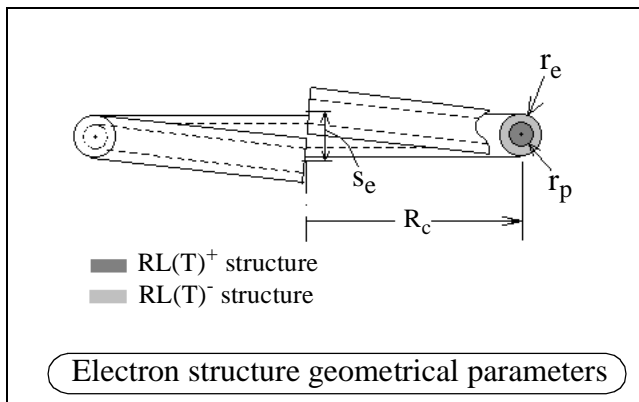
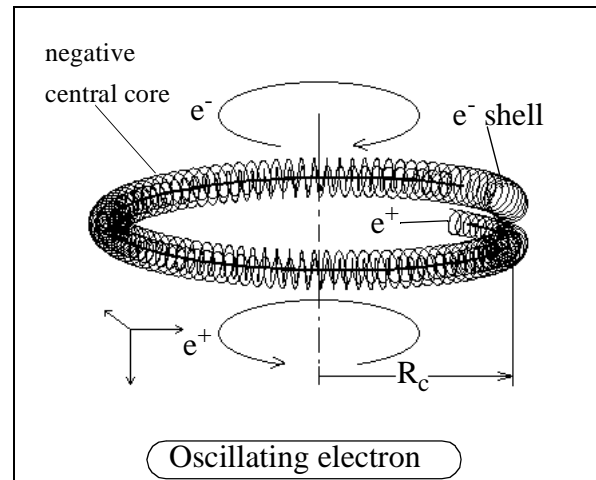


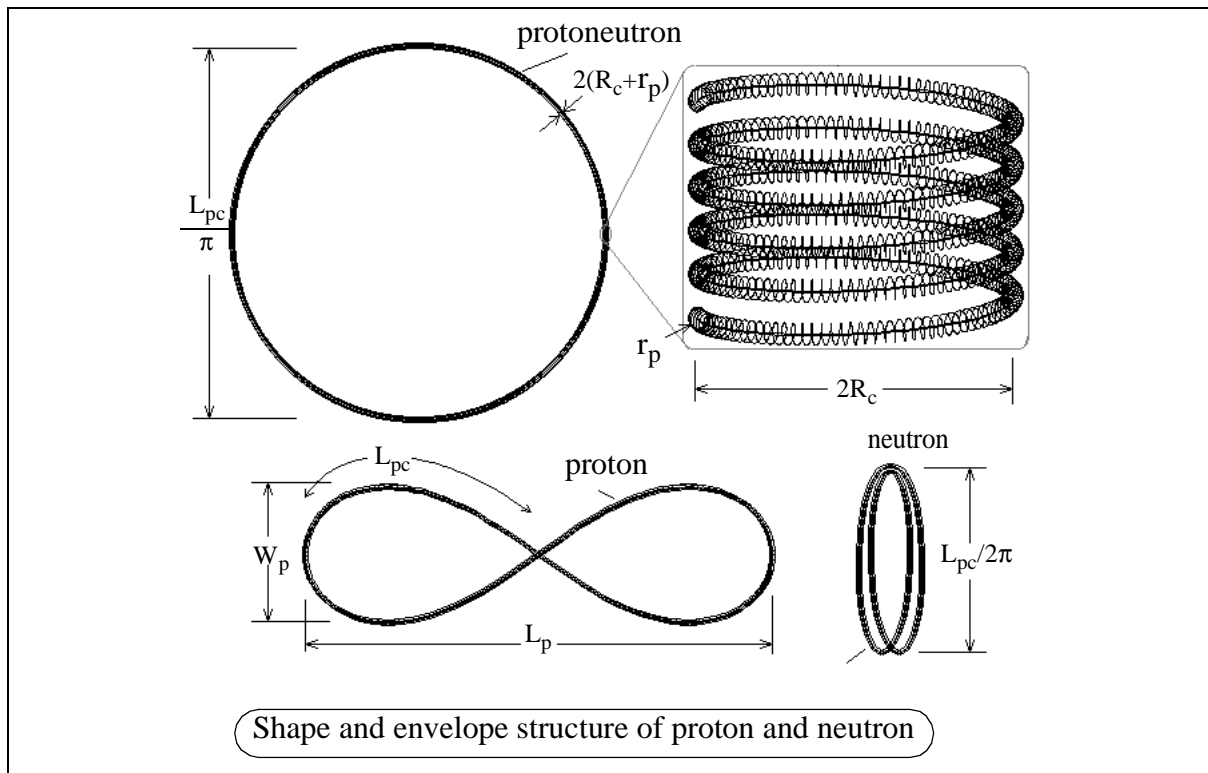
Fig. 2.8.B



Electron structure geometrical parameters



Oscillating electron



Shape and envelope structure of proton and neutron

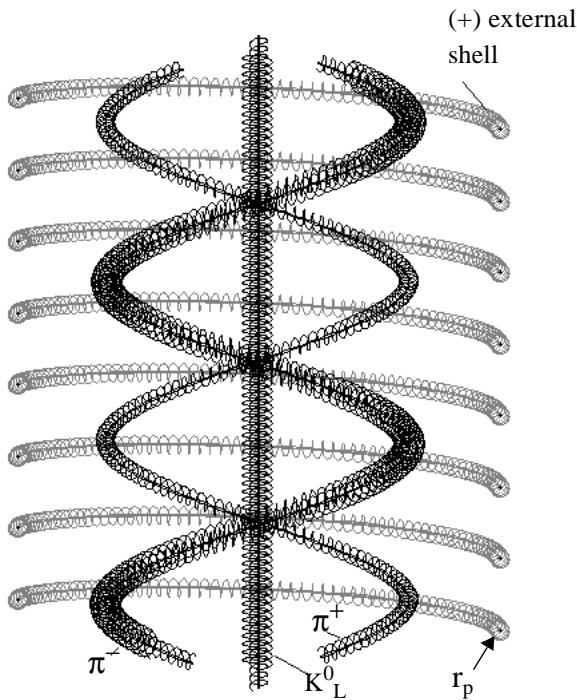


Fig. 2.15.B. Axial sectional view of proton (neutron) showing the external positive shell (envelope) and the internal subatomic particles. All of them are formed by helical structures with internal RL structures (not shown).

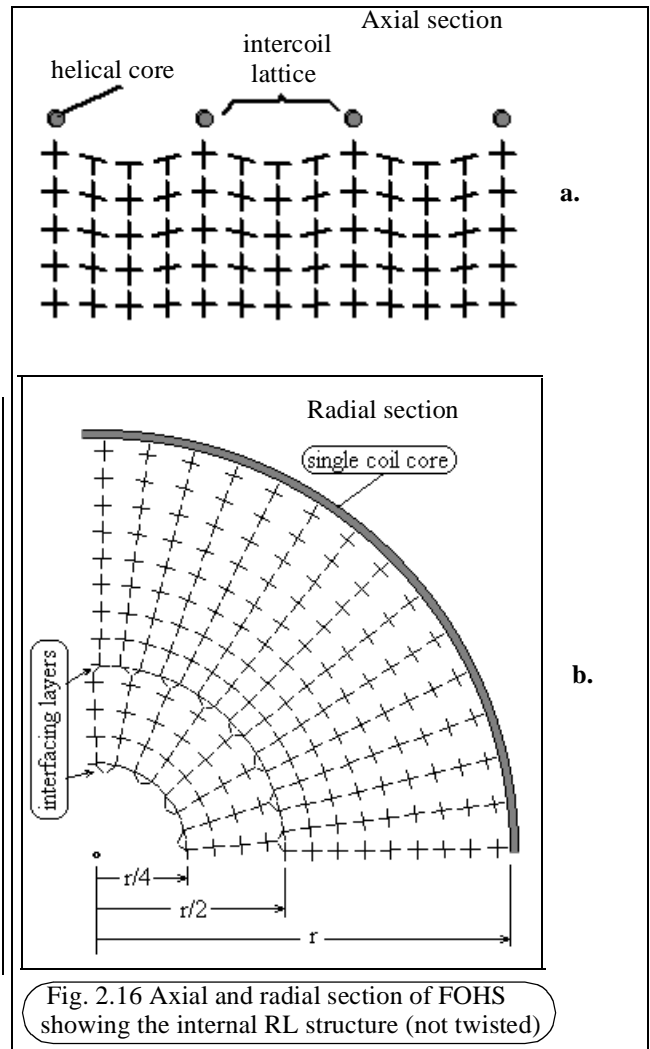


Fig. 2.16 Axial and radial section of FOHS showing the internal RL structure (not twisted)

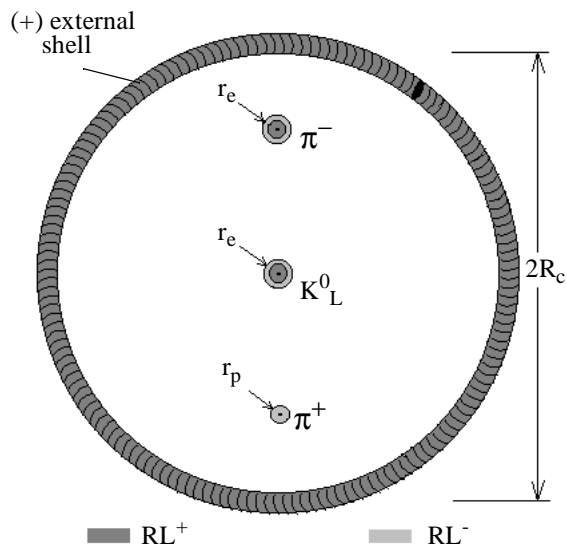


Fig. 2.15.A. Radial sectional view of proton (neutron) core with internal subatomic particles and their internal RL structures. The RL structures are not twisted for the kaon, partly twisted for the pions and fully twisted for the external shell.

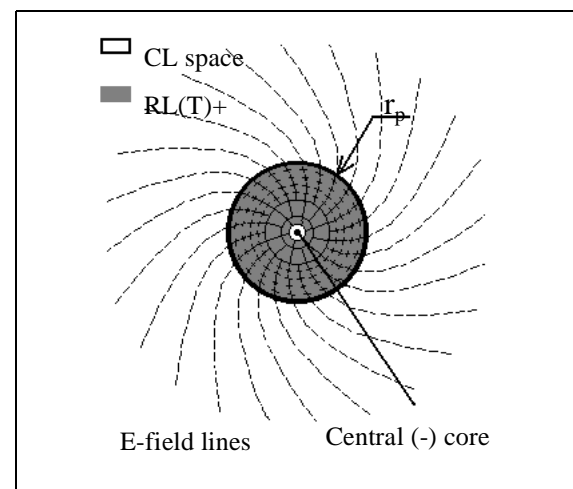
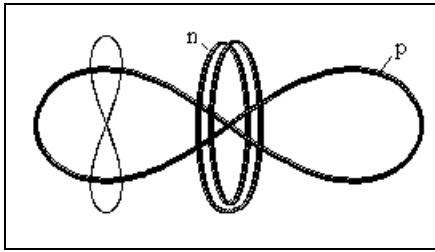
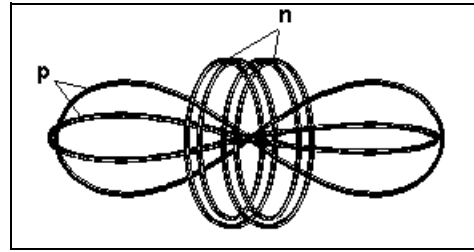


Fig. 2.29.E. Radial section of positive FOHS with twisted internal RL(T)⁺ structure generating E-field in CL space. The radial section of the FOHS envelope core and the

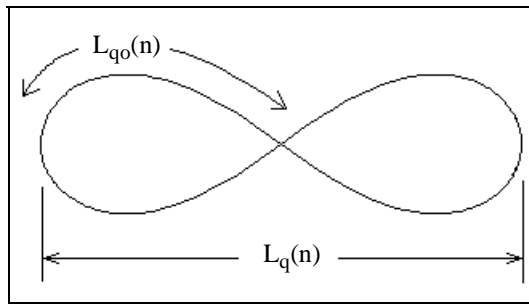
central core is formed of 7 prisms. r_p - is a radius of the FOHS envelope.



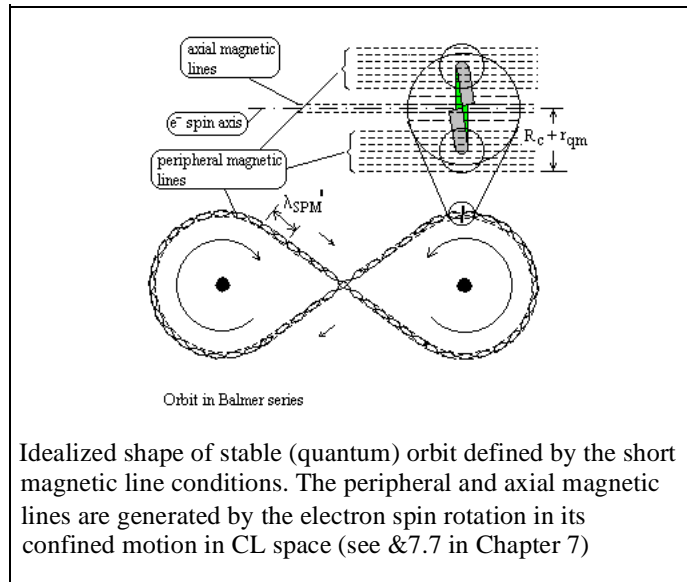
Deuteron with Balmer series orbital



He nucleus



Simple quantum orbit (n - is the subharmonic number)



Idealized shape of stable (quantum) orbit defined by the short magnetic line conditions. The peripheral and axial magnetic lines are generated by the electron spin rotation in its confined motion in CL space (see &7.7 in Chapter 7)

The equation of the quantum orbit trace length, L_{qo} is derived in &3.12.3 (Chapter 3).

$$L_{qo}(n) = \frac{2\pi a_o}{n} = \frac{\lambda_c}{\alpha n} \quad (3.43.i)$$

where: n is the subharmonic number of the quantum orbit; λ_c - is the Compton wavelength; α - is the fine structure constant; $2\pi a_o$ - is the length of the boundary orbit (a_o - is the Bohr model radius)

The shape of the orbit is defined by the proximity E-field of the proton. The most abundant quantum orbit has a shape of Hippoped curve with parameter $a = \sqrt{3}$. Orbits of such shapes are also used as electronic bonds connecting atoms in molecules (see Chapter 9).

The trace length L_{qo} and the long axis length L_q of the possible simple quantum orbits (formed by single quantum loops) are given in Table 1.

The estimated distance between the CL nodes in abcd axis is: $d_{abcd} \approx 0.549 \times 10^{-20}$ (m).

Table 1:

n	L_{qo} [A]	L_q [A]	e^- energy [eV]
1	3.3249	1.3626	13.6
2	1.6625	0.6813	3.4
3	1.1083	0.4542	1.51
4	0.8312	0.3406	0.85
5	0.665	0.2725	0.544
6	0.5541	0.2271	0.3779

The calculated geometrical parameters of the stable atomic particles: proton, neutron, electron and positron are given in **Table 2**. The last reference column points to the BSM chapters mostly related to the calculations and cross validations of the parameters.

Table 2:

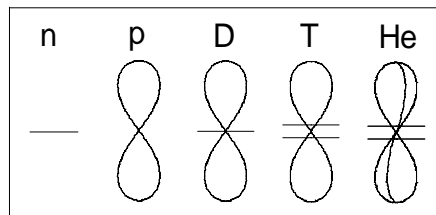
Parameter	Value	Description	Calculations and cross validations in:
L_{PC}	1.6277 (A)	proton (neutron) core length	Chapters 5 and 6
L_p	0.667 (A)	proton length	Chapters 6, 7, 8, 9
W_p	0.19253 (A)	proton (neutron) width	Chapters 6, 7, 8, 9
r_e	8.8428E-15 (m)	small radius of electron	Chapters 3, 4, 6
s_e	1.7706E-14 (m)	electron(positron) step	Chapter 3
r_p	5.8952E-15 (m)	small radius of positron	Chapters 3, 4, 6
$2(R_c + r_p)$	7.8411E-13 (m)	thickness of proton (neutron)	Chapters 6, 7, 8, 9

Notes:

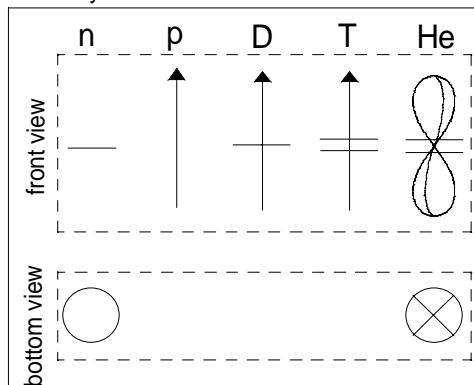
(1) $R_c = 3.86159 \times 10^{-13}$ (m) is the Compton radius of electron.

(2) $1A = 10 \times 10^{-10}$ (m) is the Amstrong unit for length

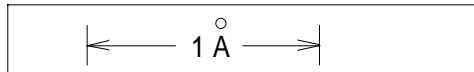
Shape symbols of nuclear atomic structures



Sketch symbols of nuclear atomic structures



scale for structures and quantum orbits

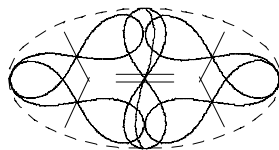


Notations:

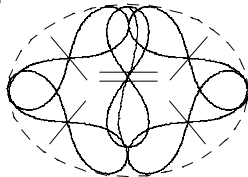
n - neutron
 p - proton
 D - deuteron
 T - Tritii
 He - Helium
 Ar - Argon

EB - electronic bond (weak)
 GB - (intrinsic) gravitational bond (strong)
 GBclp - (proton) club proximity GB
 GBpc - polar clamped GB
 PC - polar connection or clamp for Ar polar GB

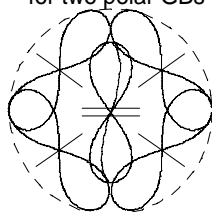
Polar section of Ar



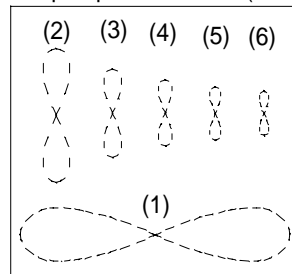
Polar section of Ar for a polar GB in the bottom



Polar section of Ar for two polar GBs

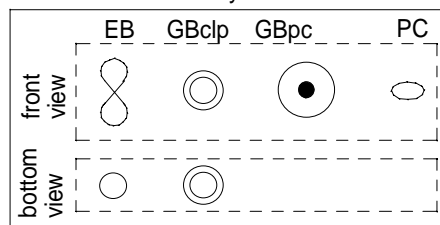


Simple quantum orbits (QOs)

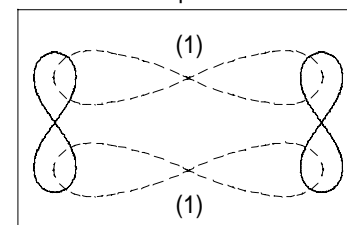


- (1) first harmonic QO (13.6 eV)
- (2) second subharmonic QO (3.4 eV)
- (3) third subharmonic QO (1.51 eV)
- (4) fourth subharmonic QO (0.85 eV)
- (5) fifth subharmonic QO (0.544 eV)
- (6) sixth subharmonic QO (0.377 eV)

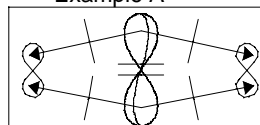
Connection symbols



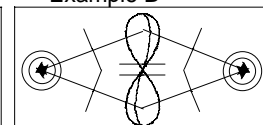
H2 - para state



Example A

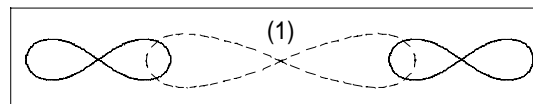


Example B

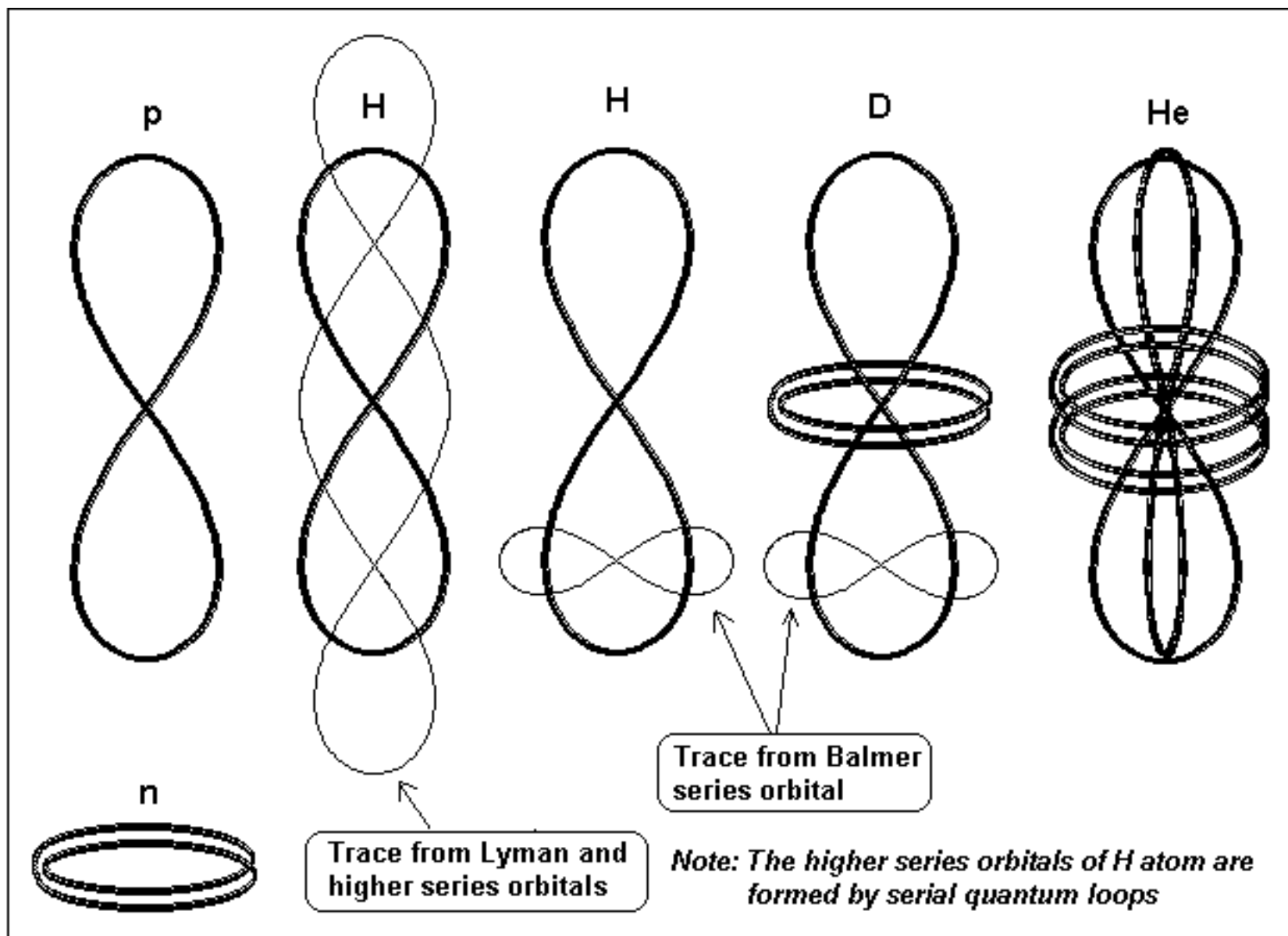


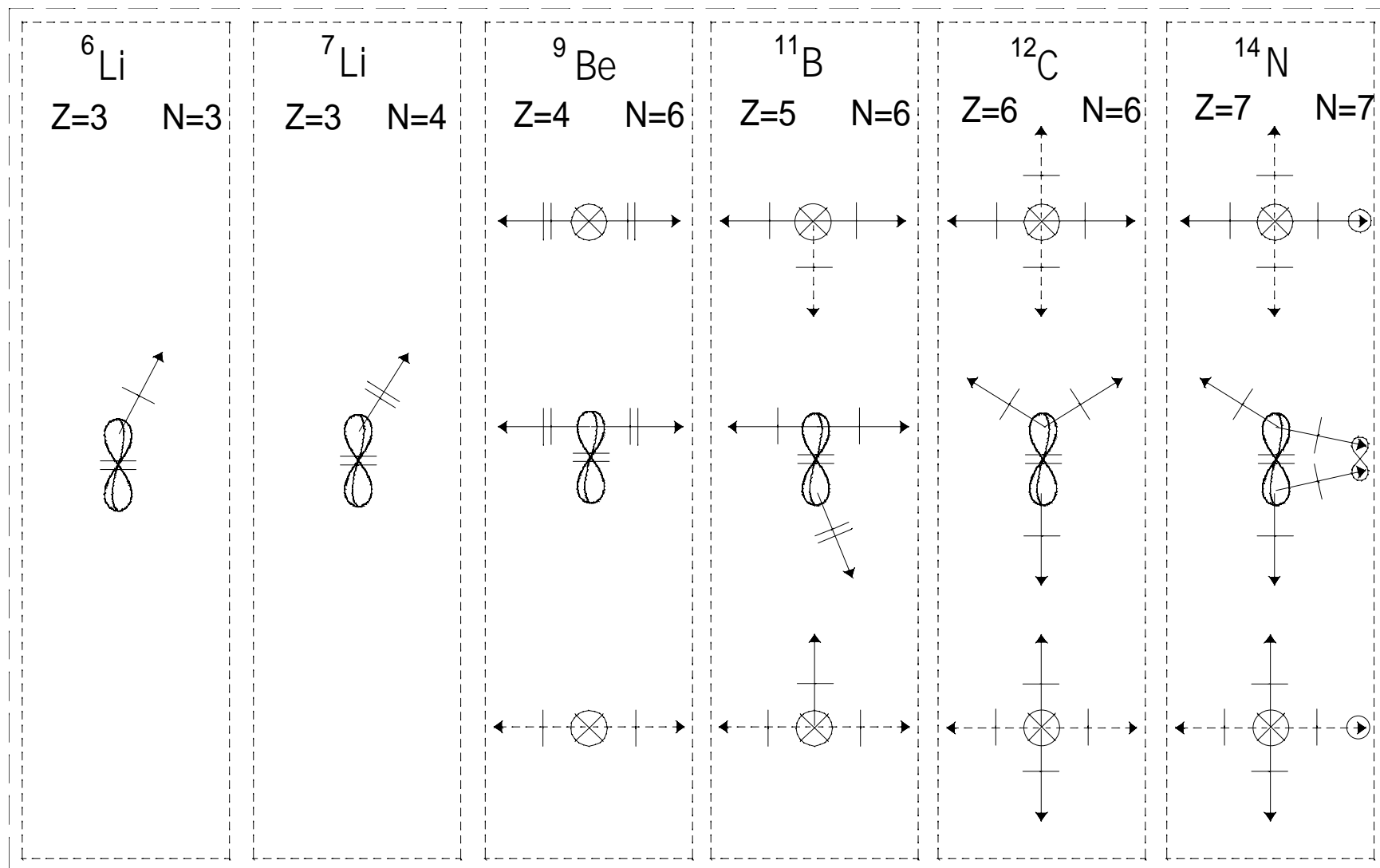
Example A: Two pairs of Ds connected by EB bonds
 Example B: Two pairs of Ds connected by GBclp bonds

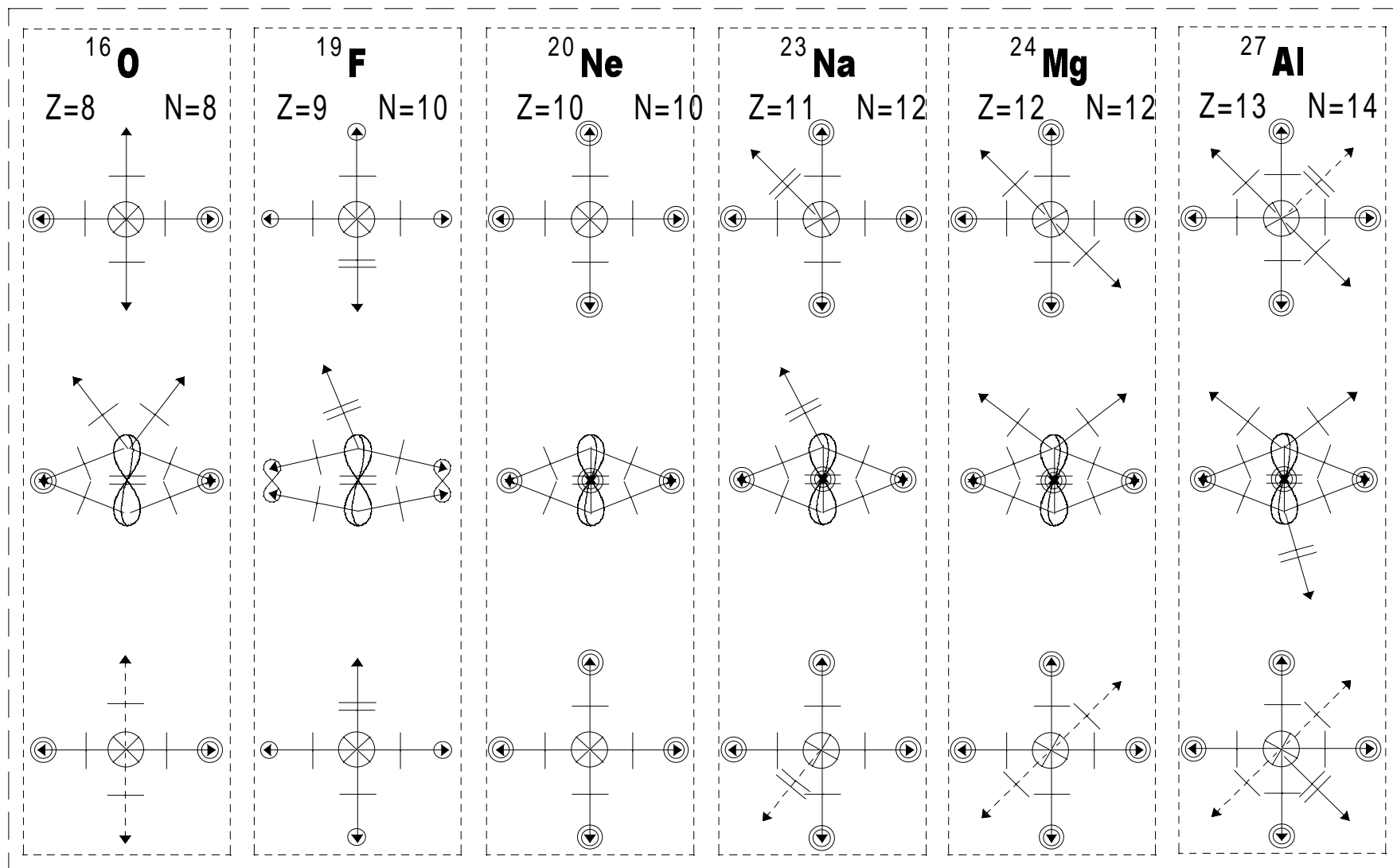
H2 - ortho state (2 e- with opposite spins in respect to the proton twisting)

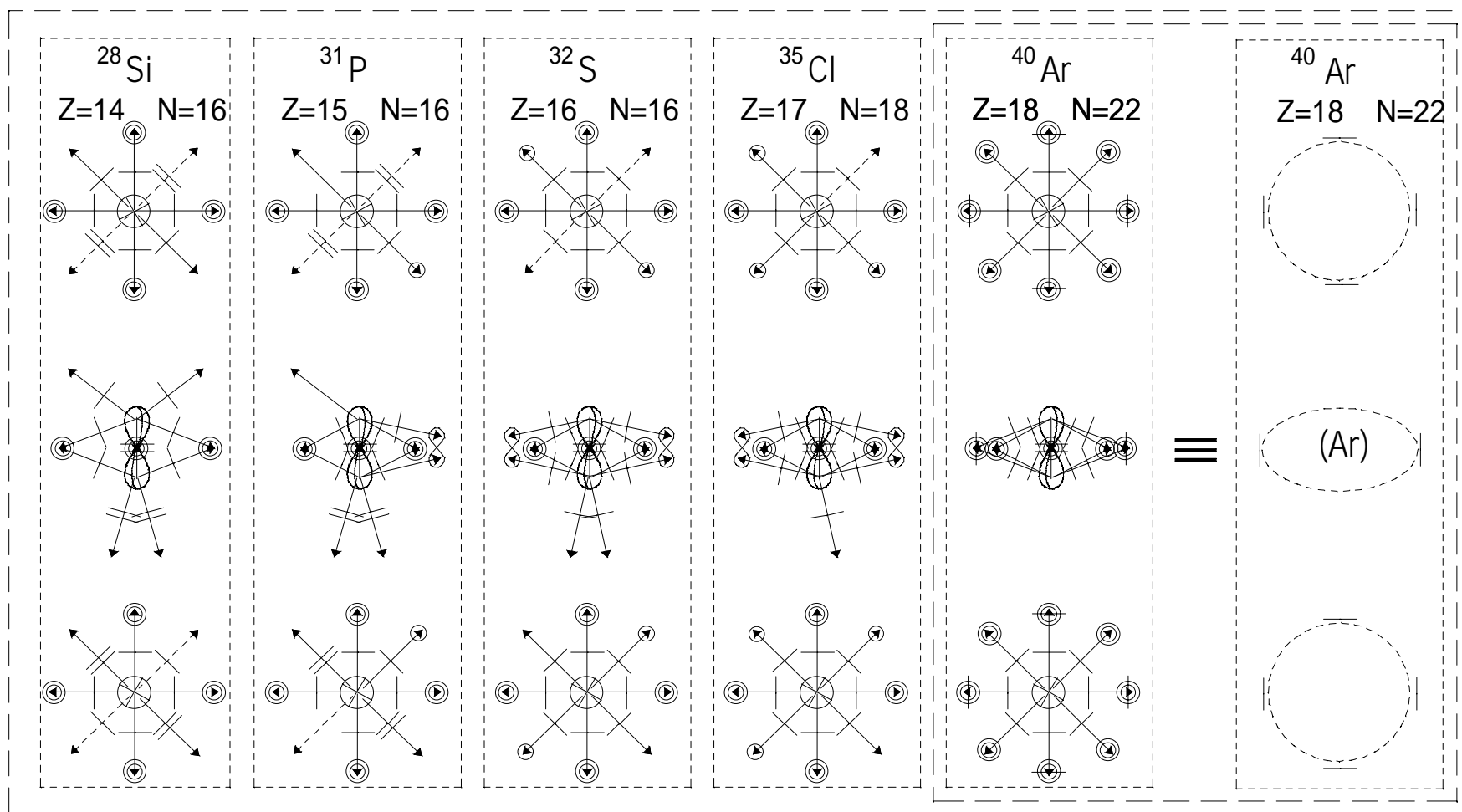


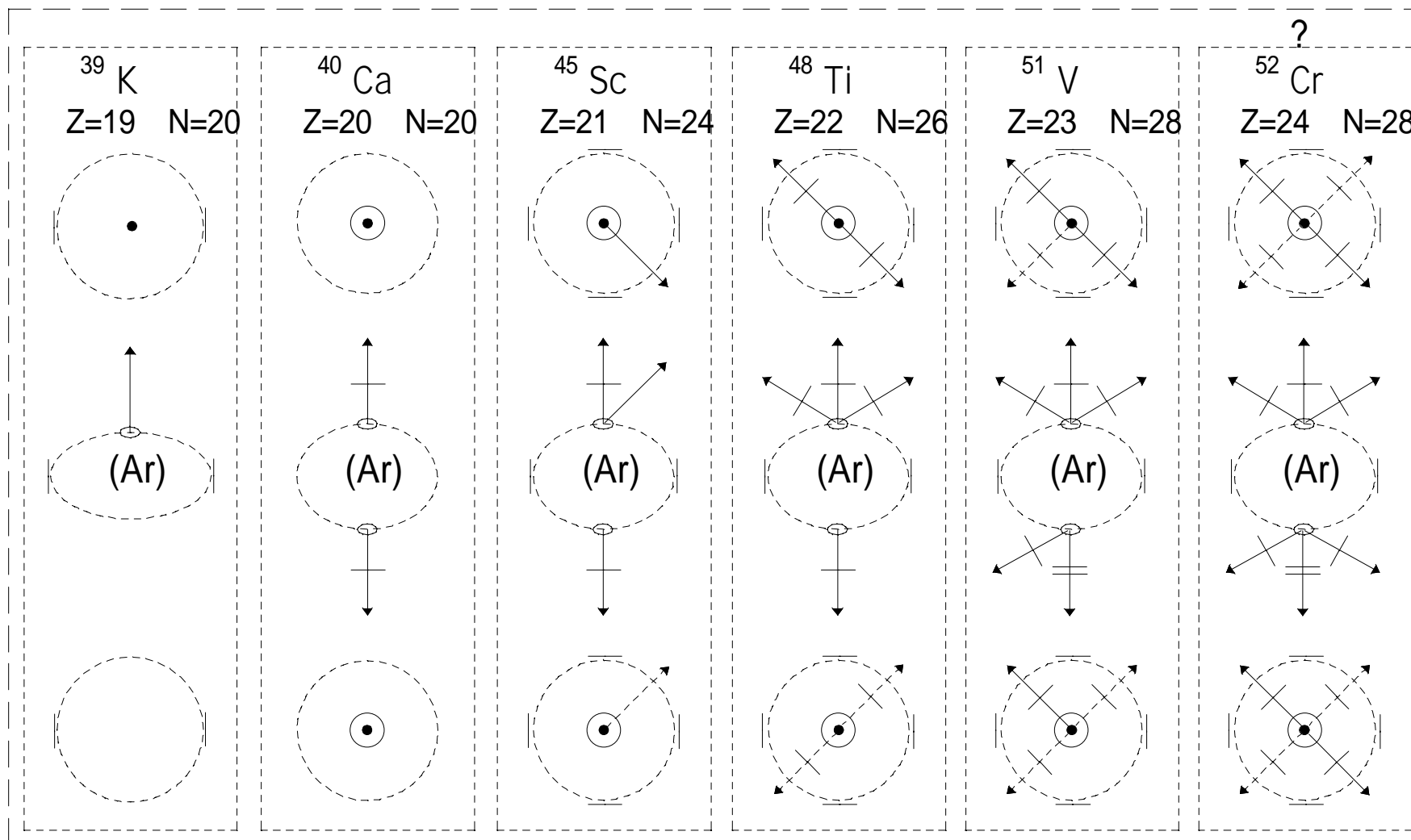
Note: QOs for para and ortho states of H2 are normal to the proton's quasiplanes

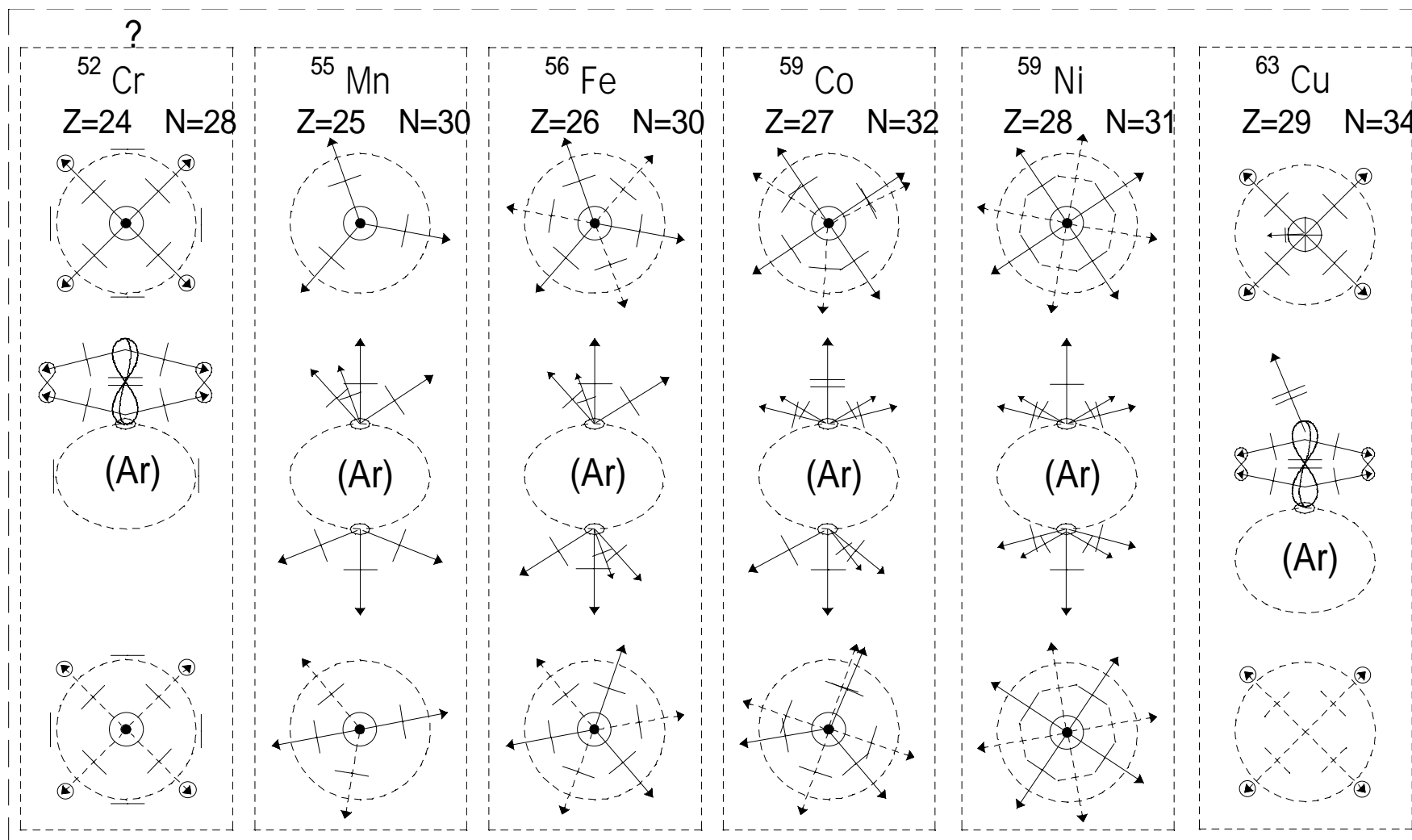


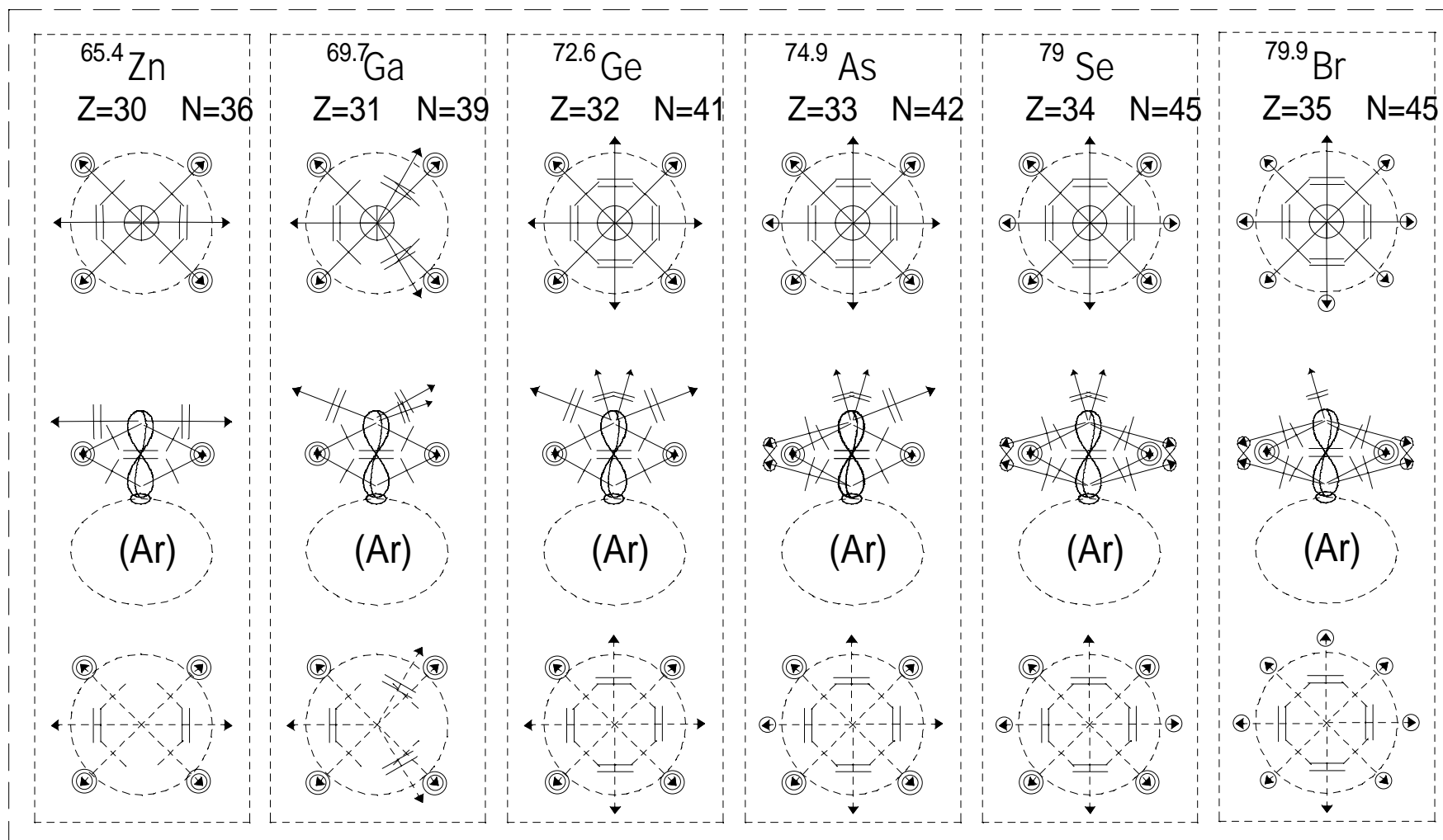


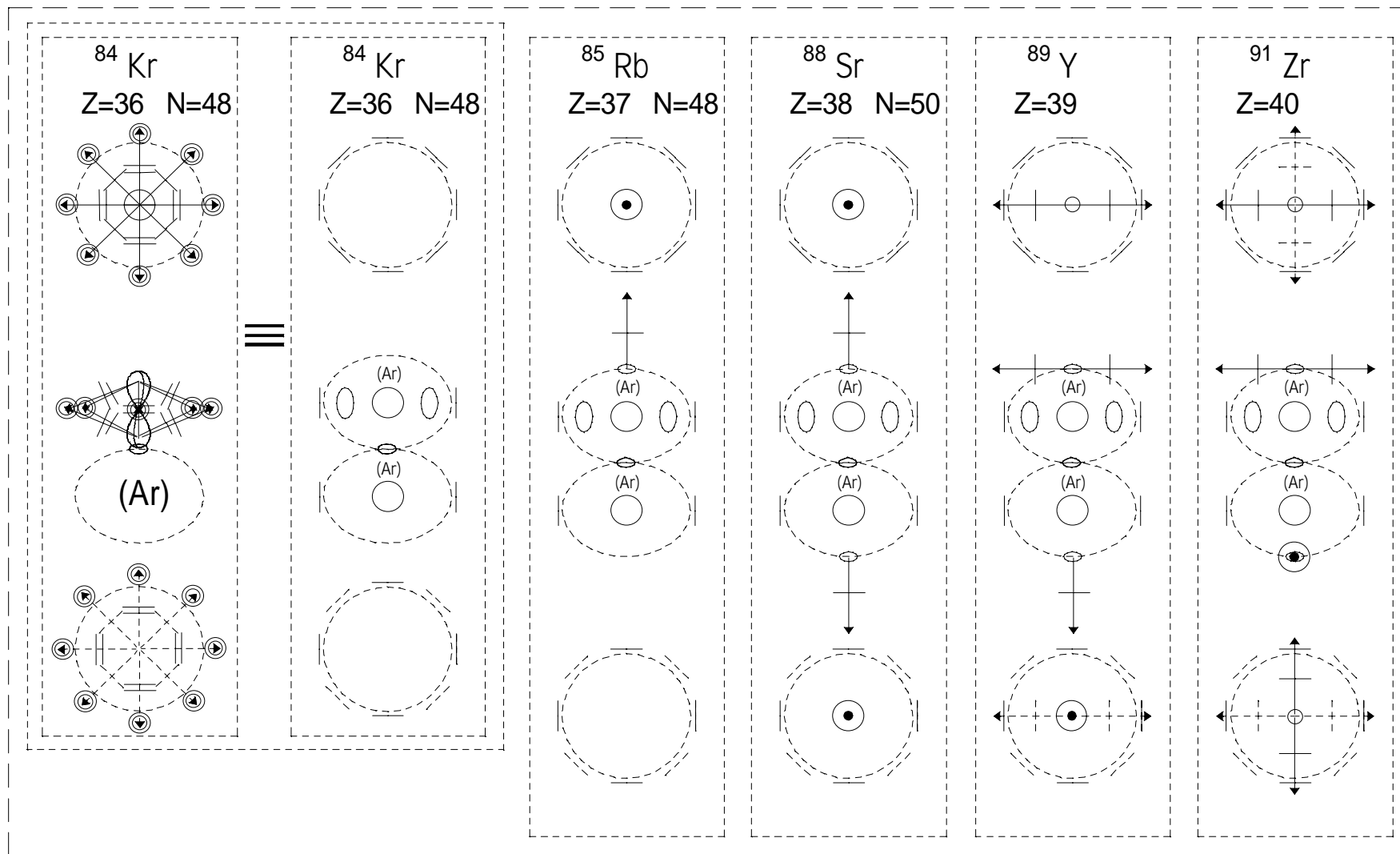


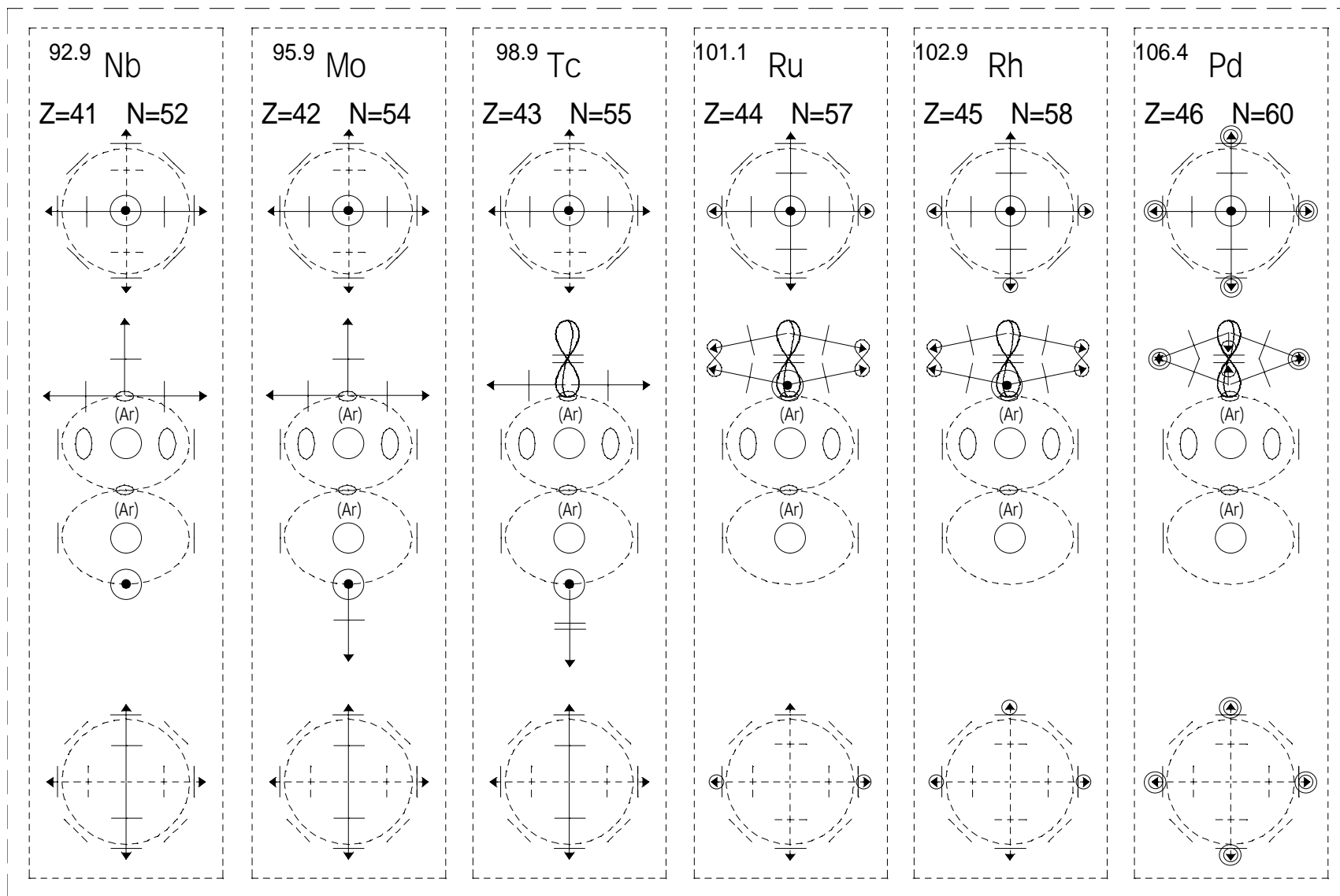


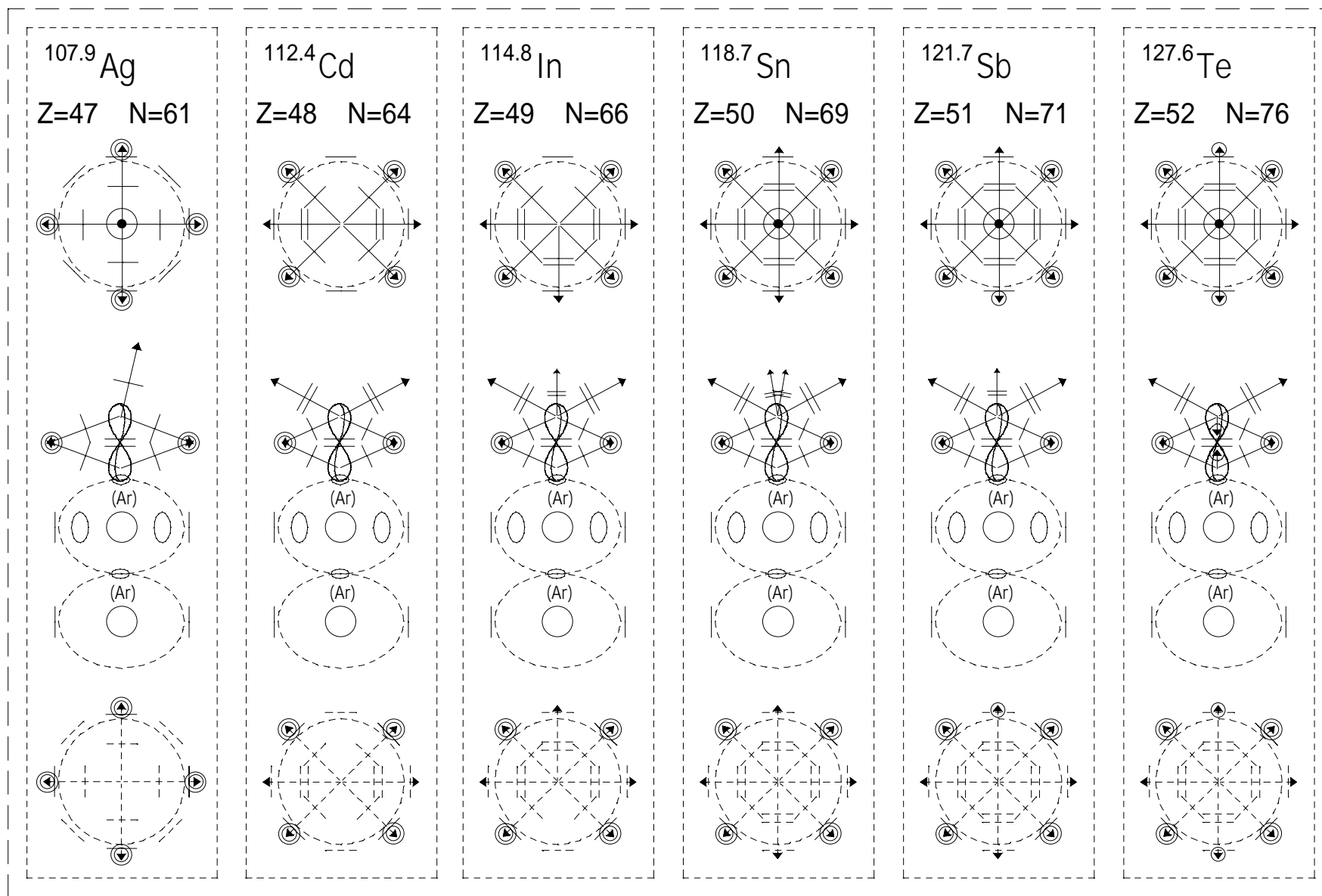


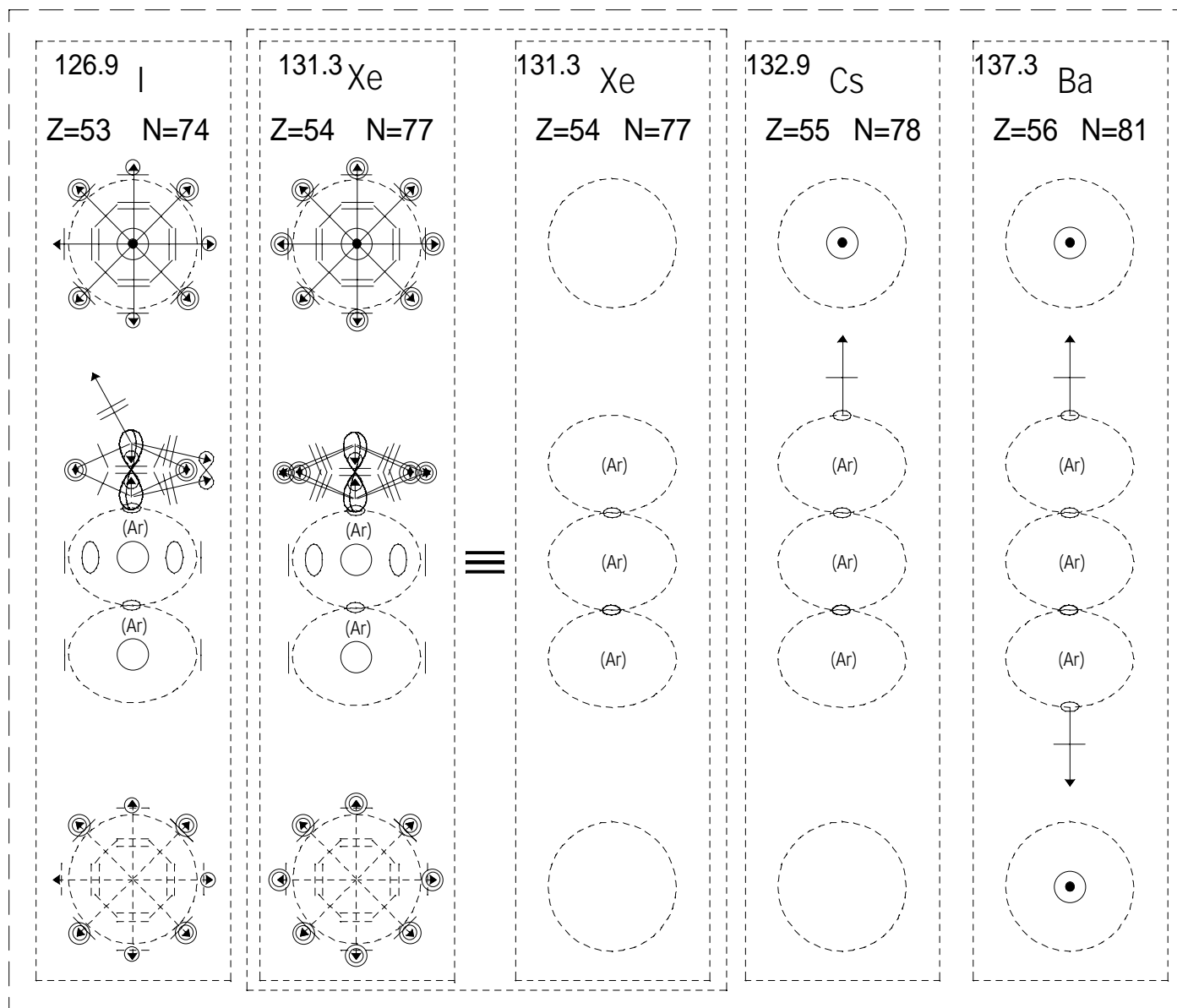


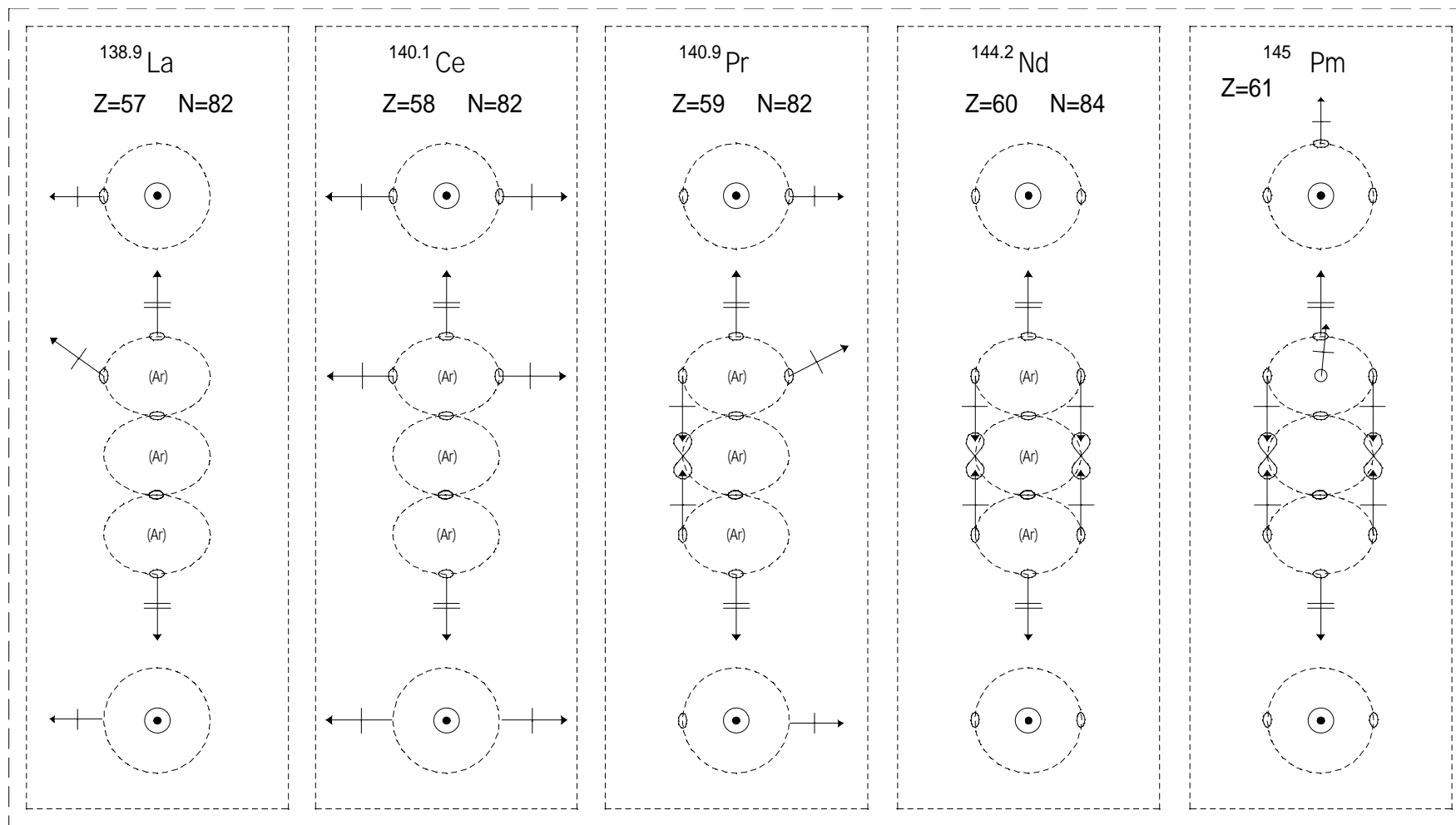


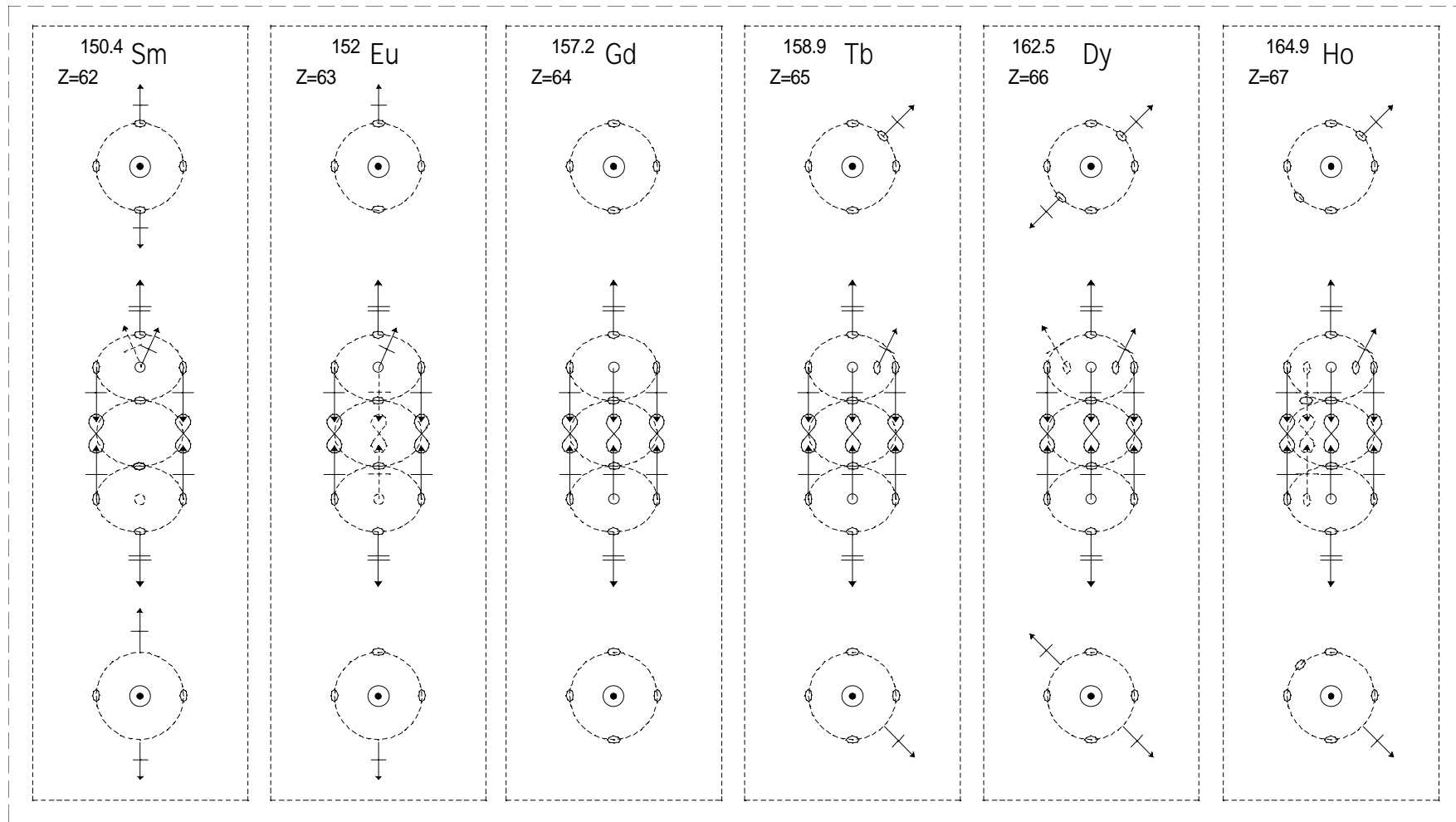


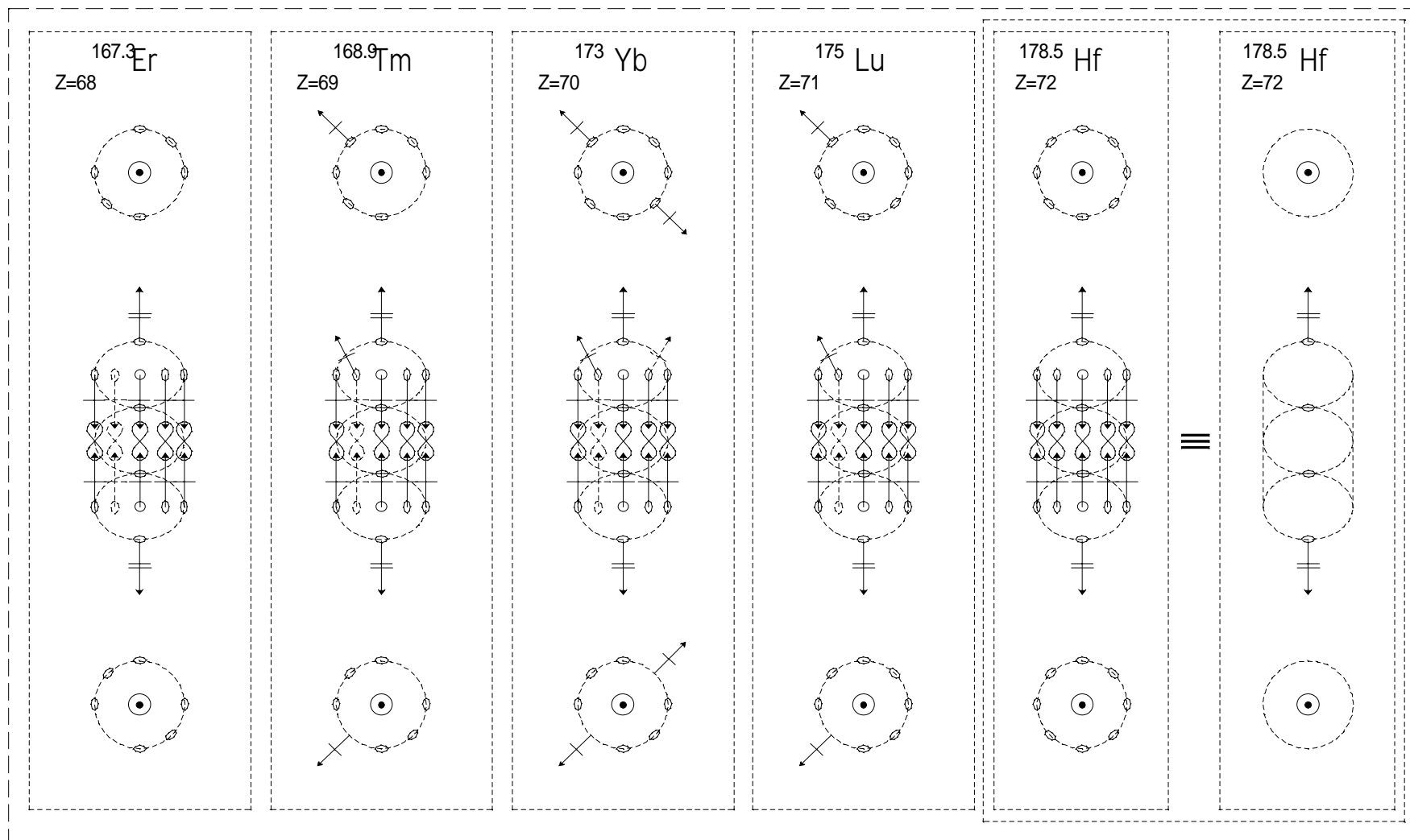


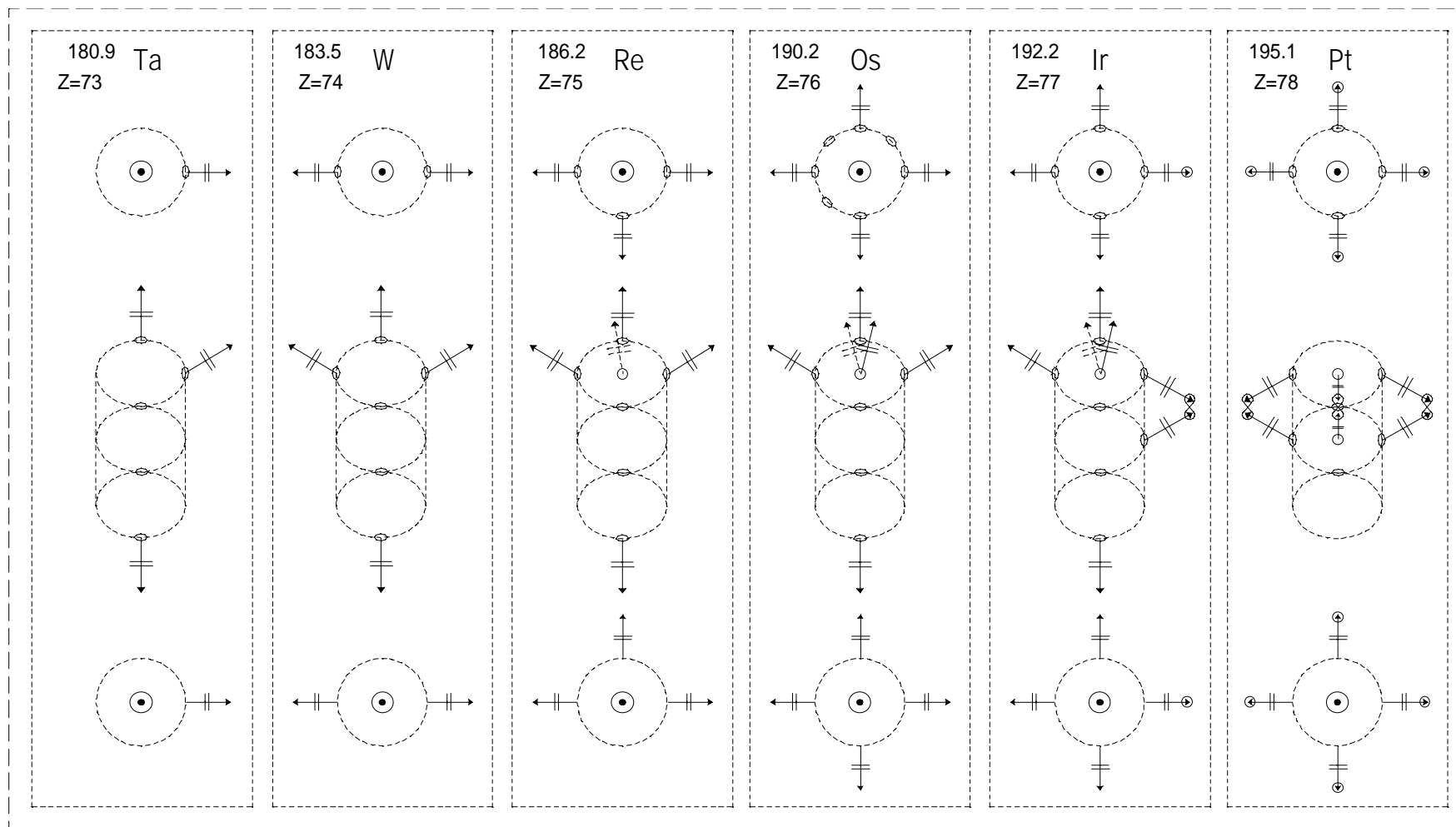


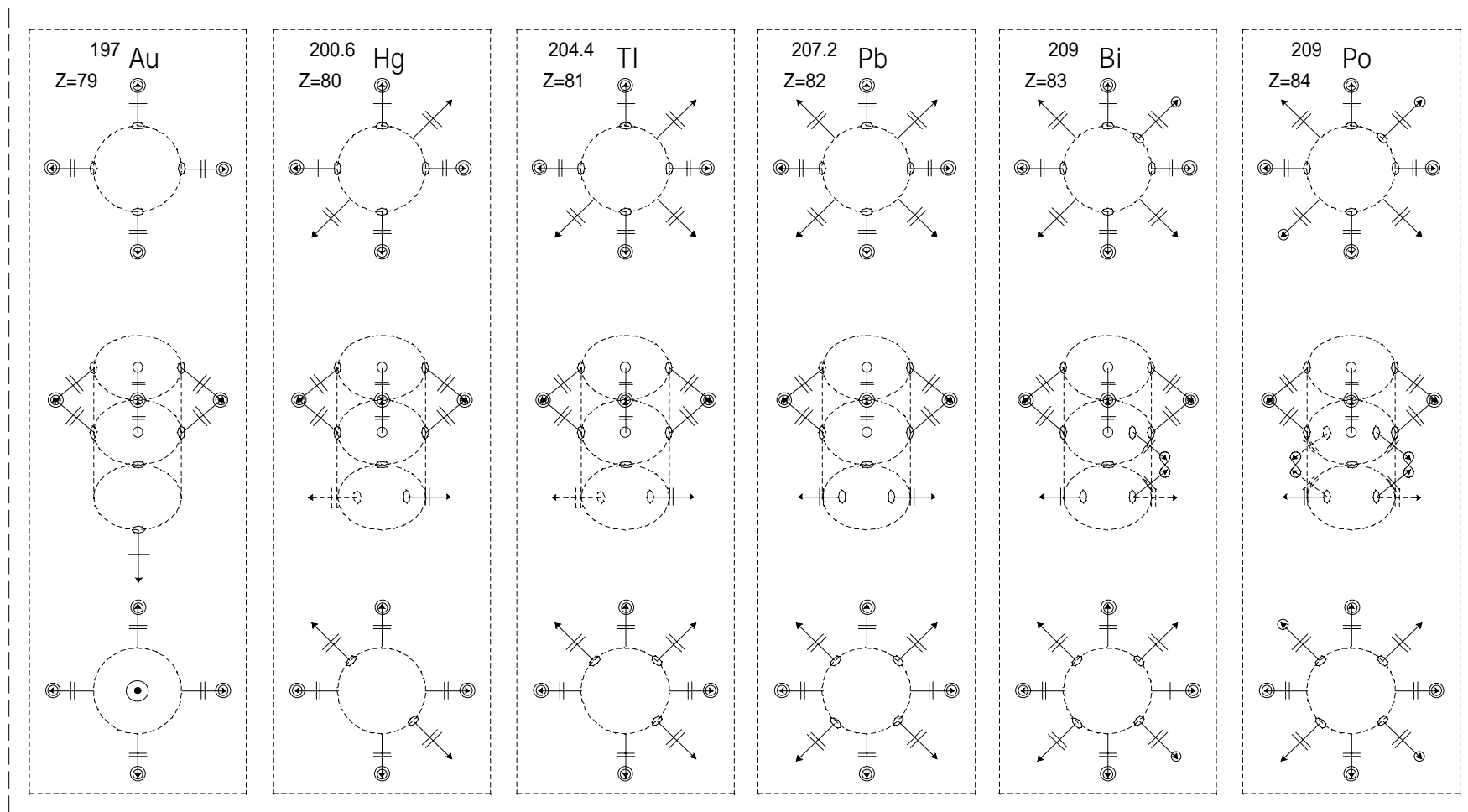


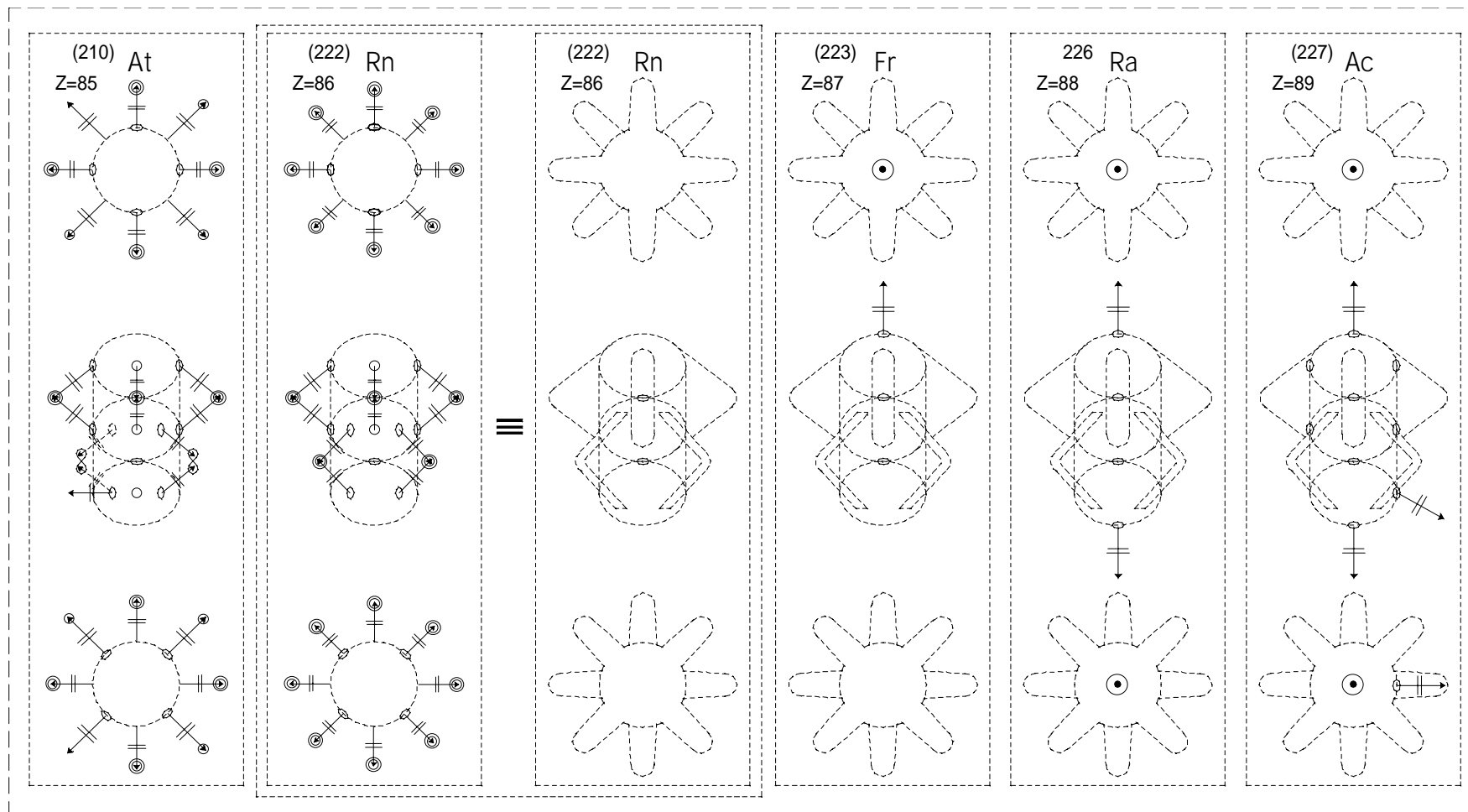


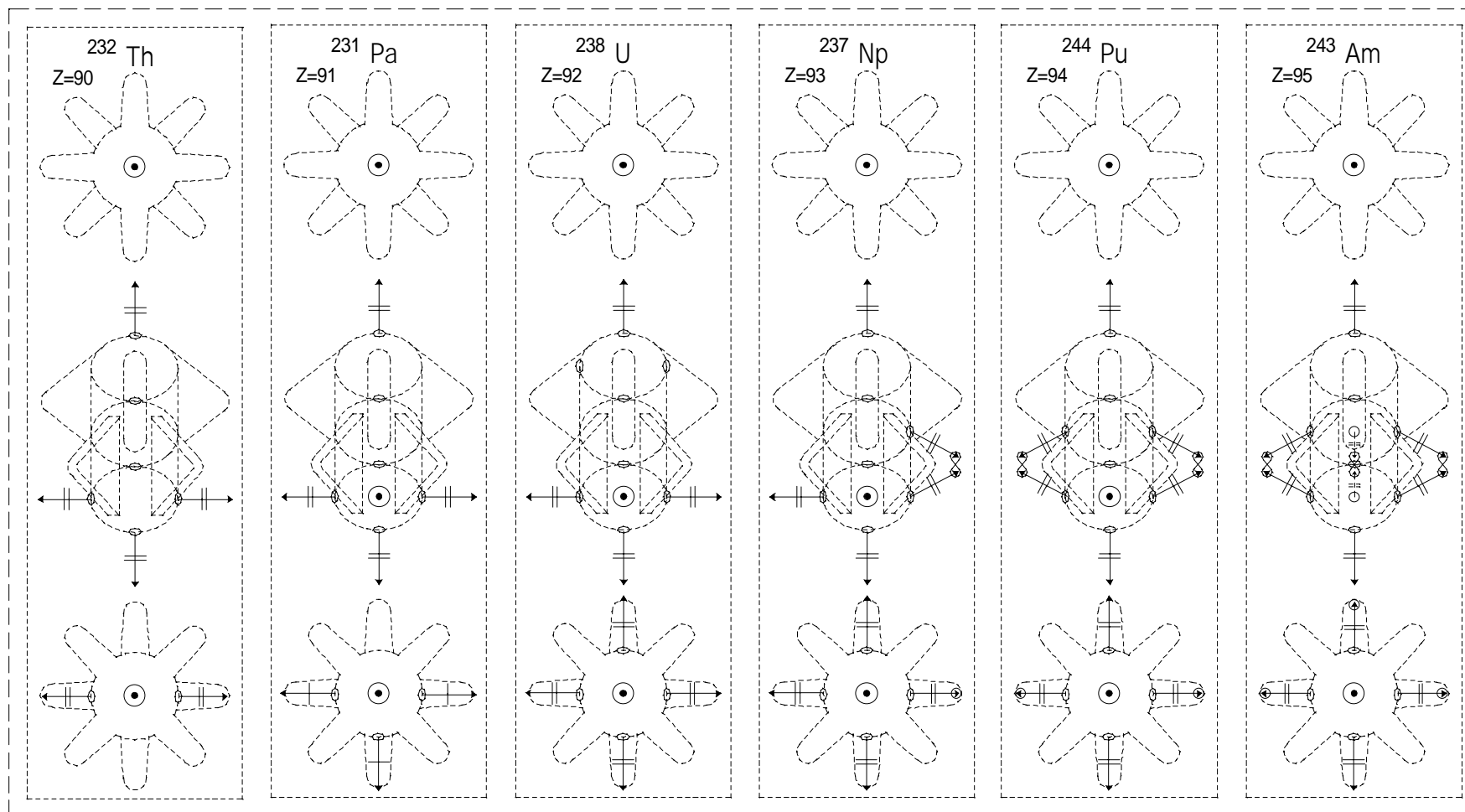


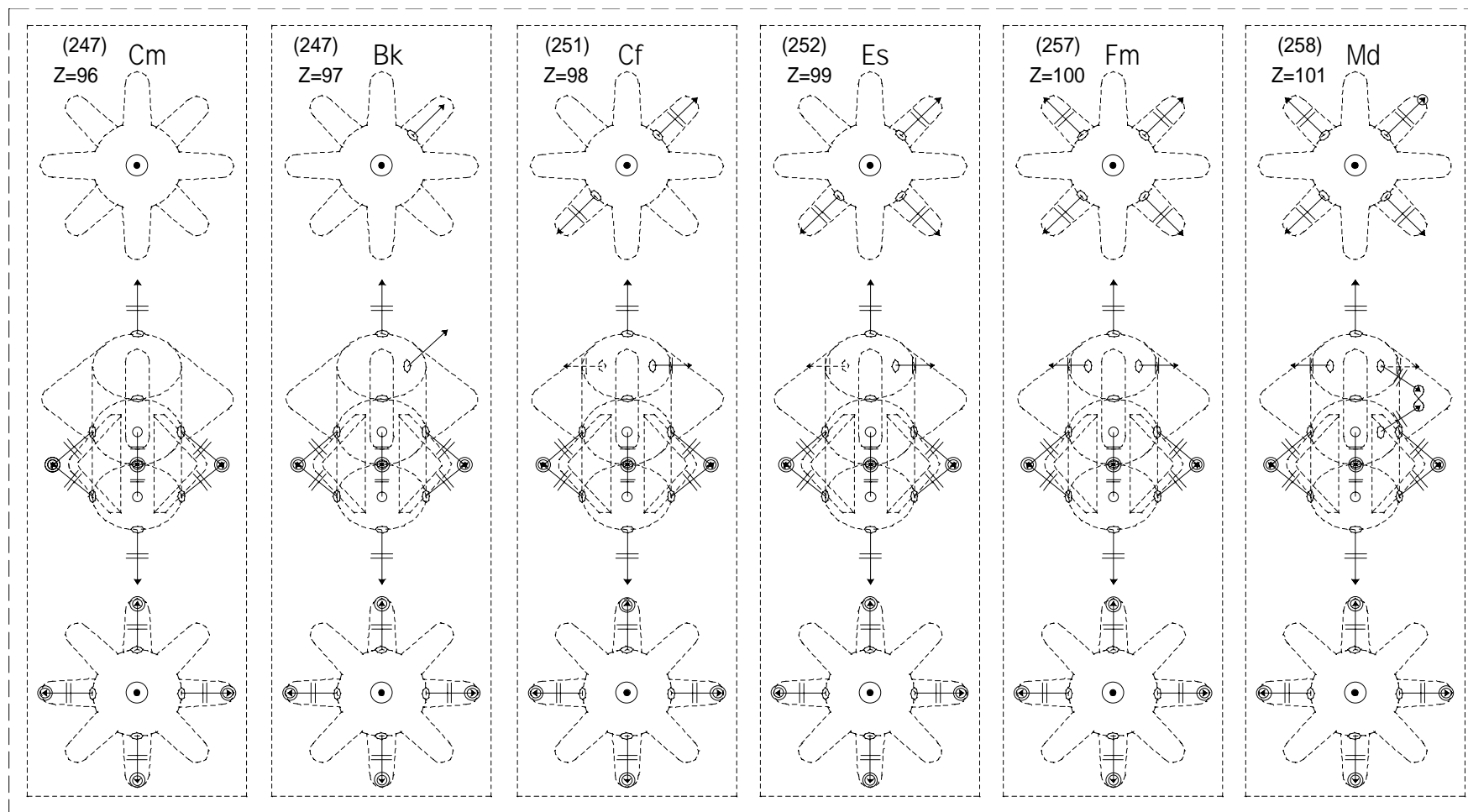


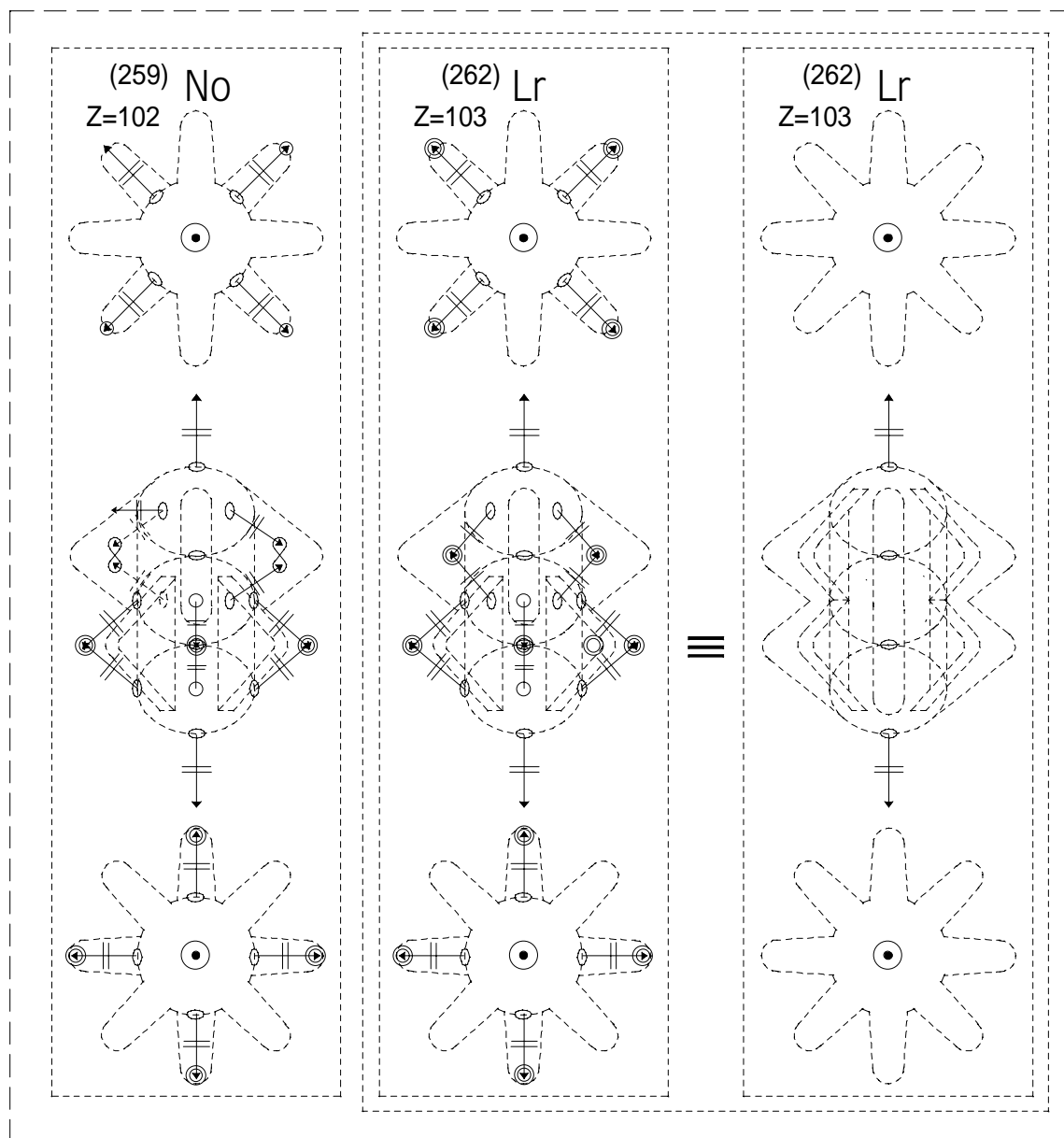












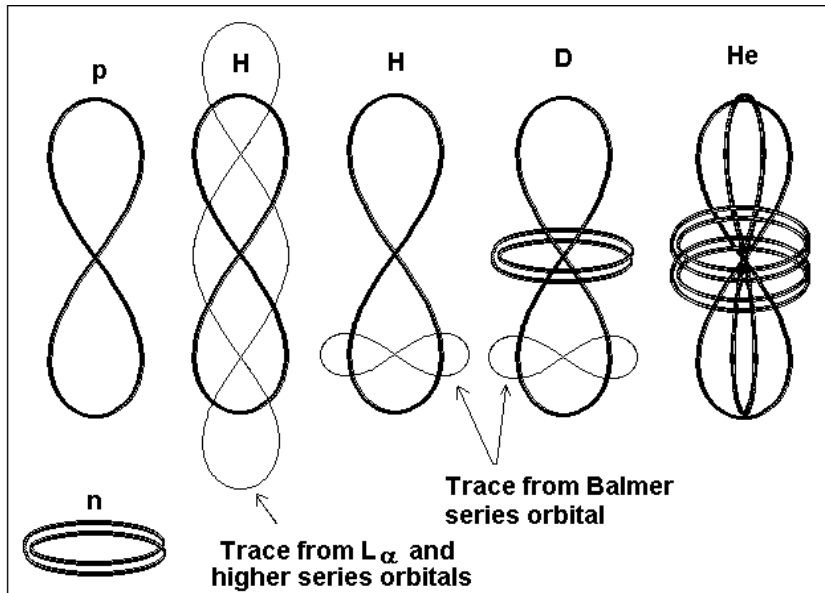
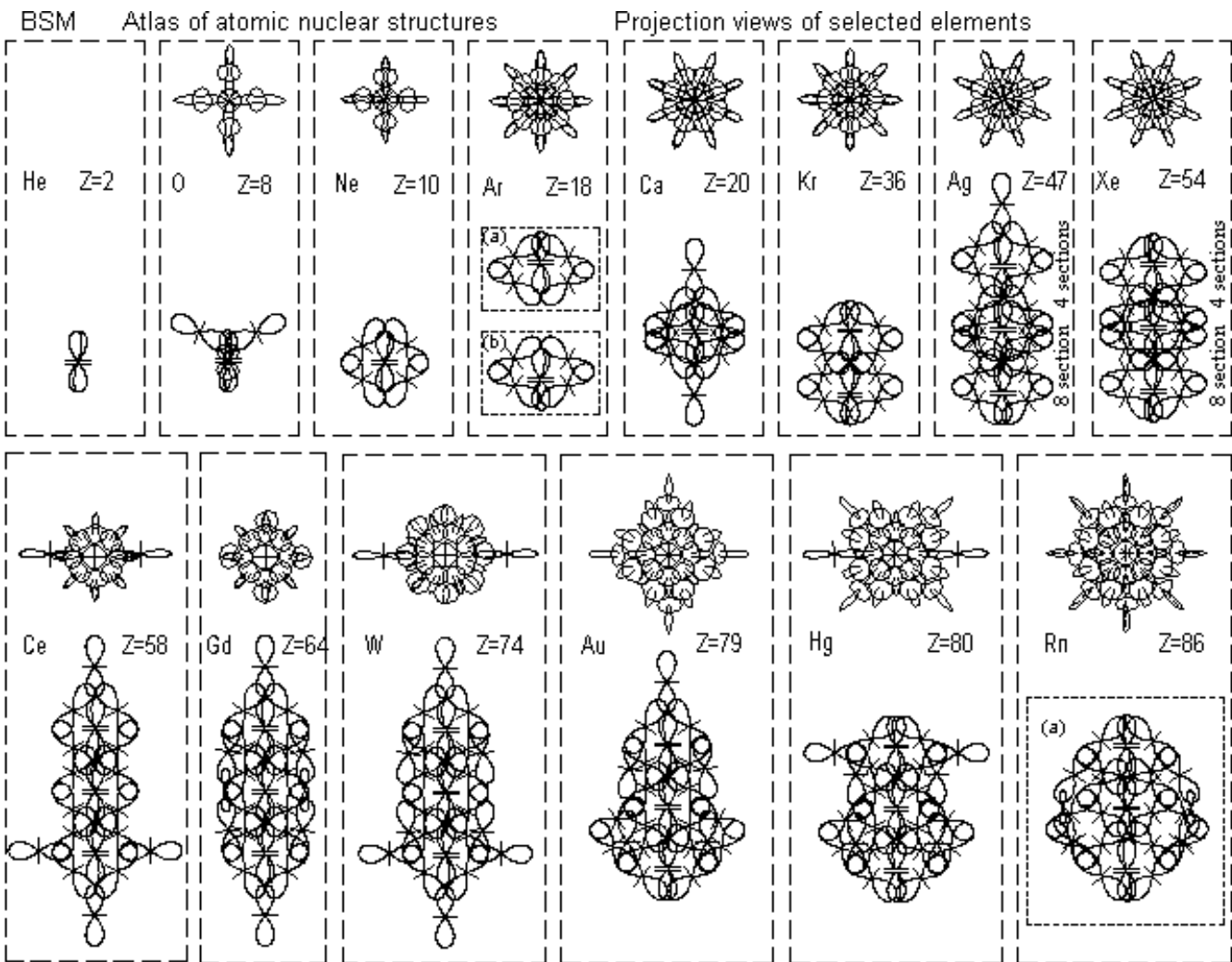


Fig. 4



Note: (a) and (b) are polar sections of the nucleus with two selected planes. The angle between them is 22.5°

(In the polar axis sections only hadrons closed to the section plane are shown)