# APPENDIX:

# ATLAS OF ATOMIC NUCLEAR STRUCTURES

1. S. Sarg © 2001, "Atlas of Atomic Nuclear Structures", monograph

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2. S. Sarg, "Atlas of Atomic Nuclear Structures According to the Basic Structures of Matter Theory, Journal of Theoretics, Extensive papers, 2003.
http: www.journaloftheoretics.com

# Atlas of Atomic Nuclear Structures

**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 nano-technology and the biomolecules.

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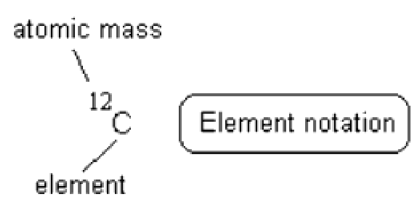
Notes: The symbols used for notation of the protons and neutrons and their connections in the atomic nucleus are given in Page II-).

Notations:

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

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S. Sarg, New approach for building of unified theory about the Universe and some results, http://lanl.arxiv.org/abs/physics/0205052 (2002)

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

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# 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 Applications of this book.

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 characterized 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. The growing limit for stable high Z-number elements is apparent from the shelf completion limitation 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.

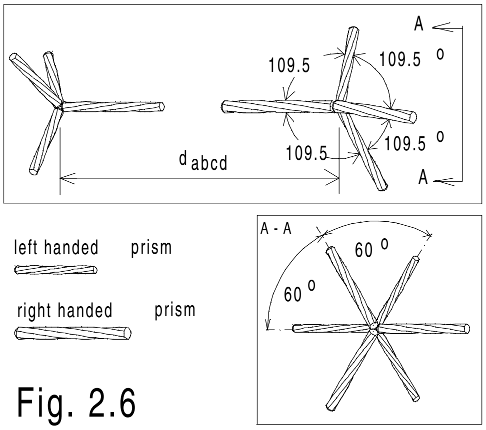
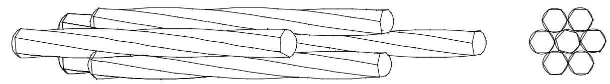
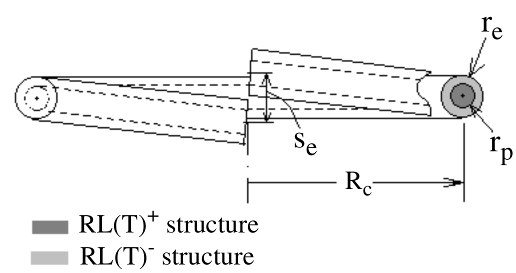



Fig. 2.6



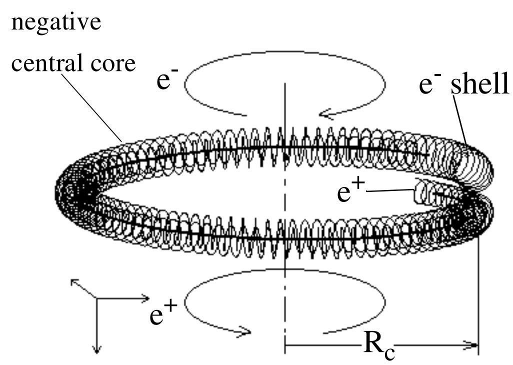
Core node from prisms of same type
(building element of the helical structure)
Note: The twisted prisms model is used

Fig. 2.8.B

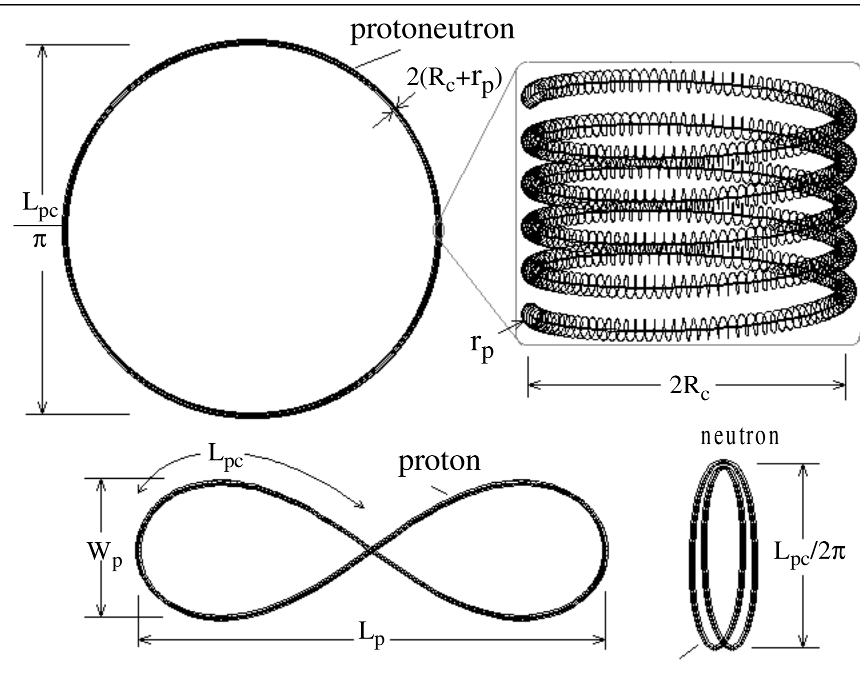



Electron structure geometrical parameters

$e^+$




Oscillating electron




Shape and envelope structure of proton and neutron

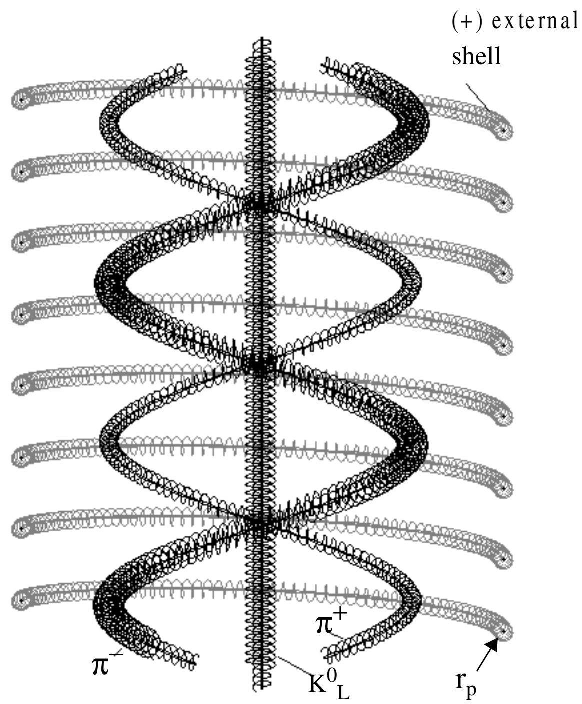



Fig. 2.15.B. Axial sectional view of proton (neutron) showing the external positive shell (envelope) and the internal elementary particles - pions and kaon. All of them are formed by helical structures possessing internal RL structures (not shown).

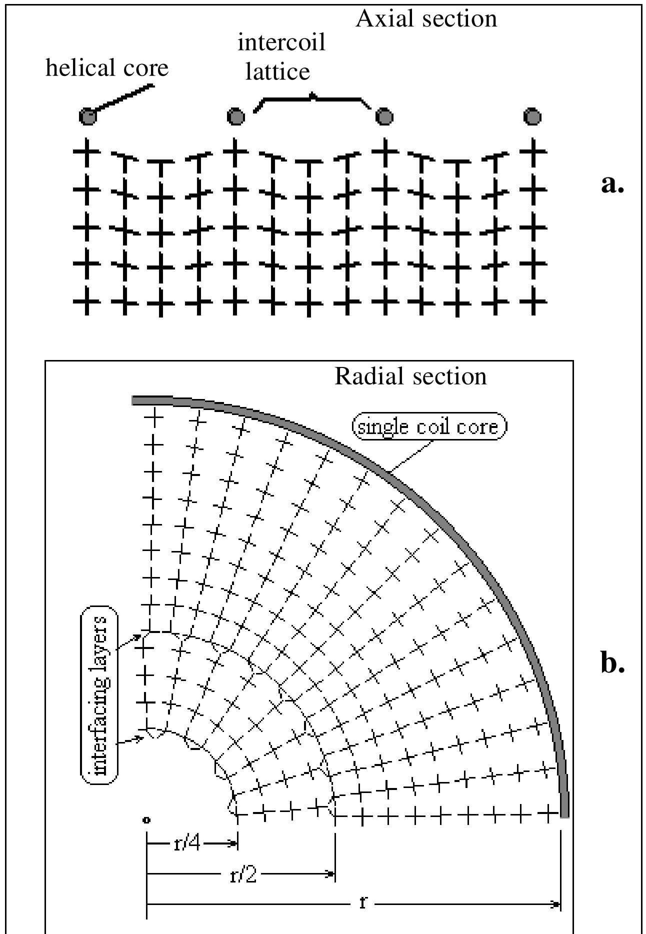



Fig. 2.16 Axial and radial section geometry of 2 layers of internal RL structure of SOHS (not twisted). The actual number of layers in the radial section is much larger.

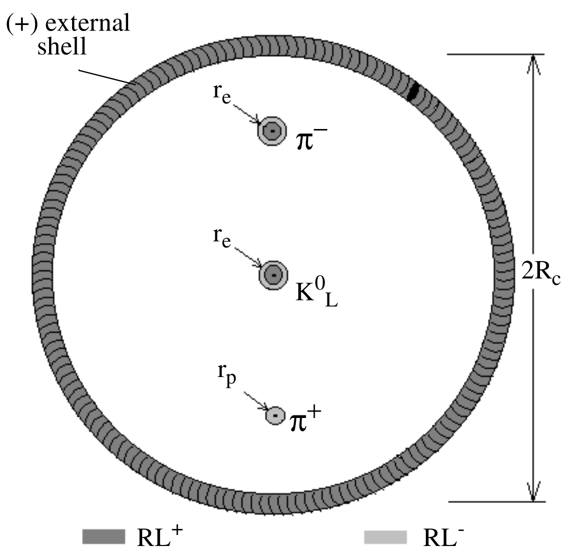



Fig. 2.15.A. Radial sectional view of a proton (neutron) core with internal elementary particles and their internal RL structures. The RL structures are not twisted for the kaon, partly twisted for the pions and fully twisted for the external shell.

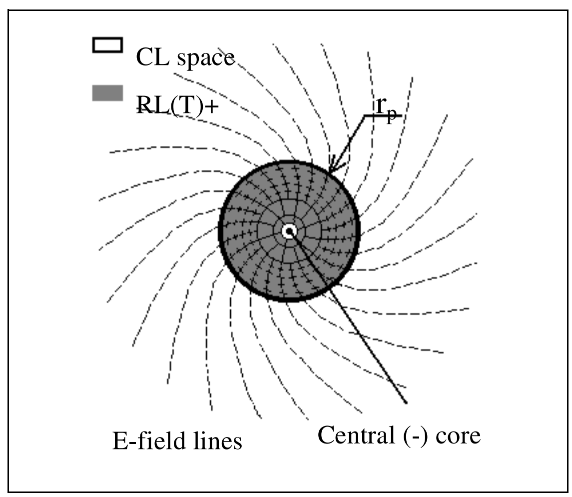
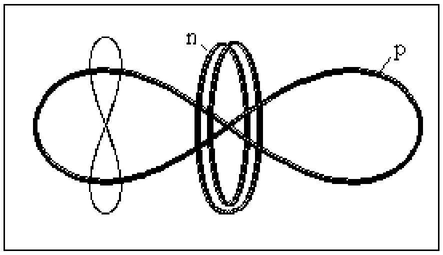
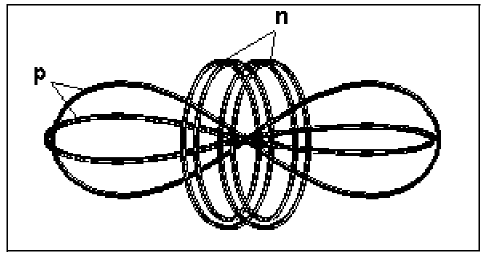


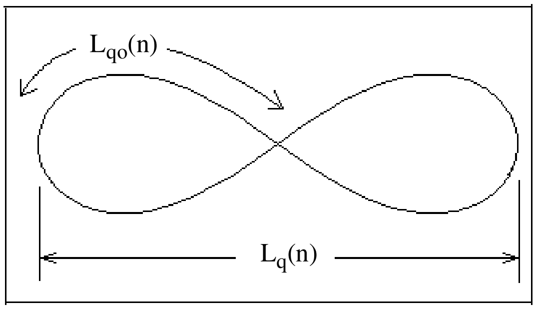

Fig. 2.29.E. Radial section of positive FOHS with twisted internal $RL(T)^+$ structure generating E-field in CL space. The radial section of the FOHS envelope core and the central core is formed of 7 prisms. $r_p$ - is a radius of the FOHS envelope.



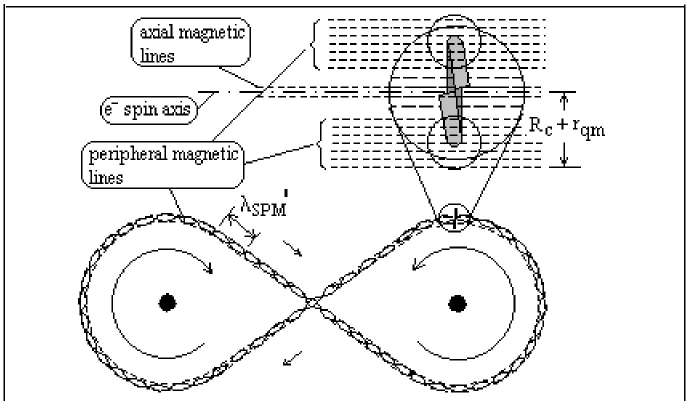

Deuteron with Balmer series orbital




He nucleus




Simple quantum orbit (n - is the subharmonic number)




Electron orbit in Balmer series

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

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

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

where: $n$ is the subharmonic number of the quantum orbit; $\lambda_c$ - is the Compton wavelength; $\alpha$ - 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 of BSM).

**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, related to the calculations and cross validations of these parameters.

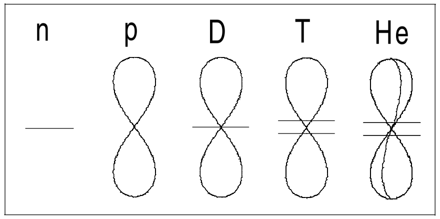
**Table 2:**

| 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 |

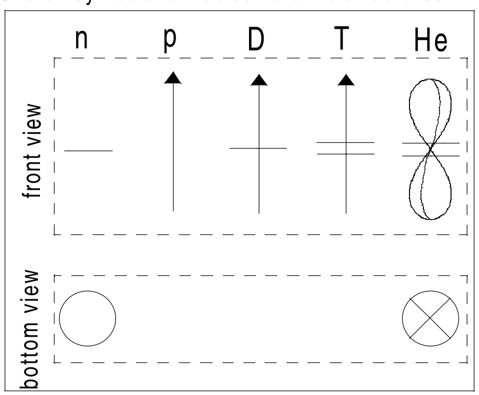
Notes:
(1) $R_c = 3.86159 \times 10^{-13}$ (m) - is the Compton radius of the electron.
(2) $1A = 10 \times 10^{-10}$ (m) - is the Amstrong unit for length

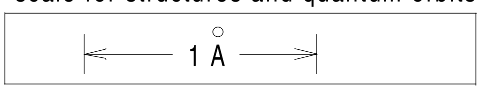
Shape symbols of nuclear atomic structures



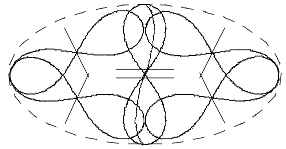

Sketch symbols of nuclear atomic structures



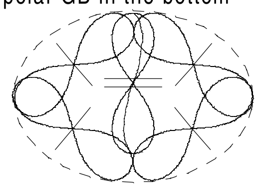

scale for structures and quantum orbits



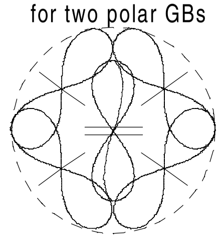

Polar section of Ar



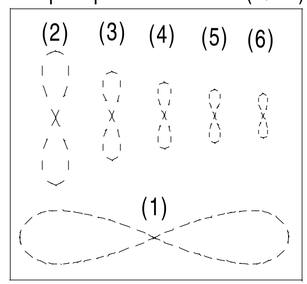
Polar section of Ar for a polar GB in the bottom



Polar section of Ar for two polar GBs

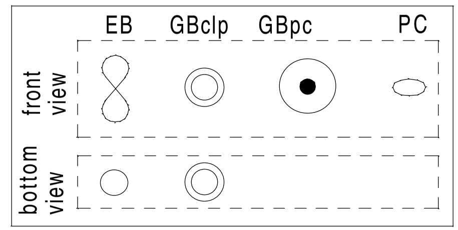


Simple quantum orbits (QOs)

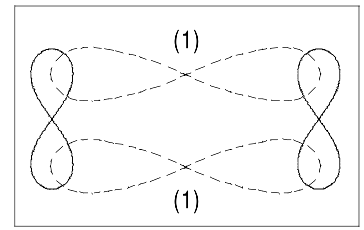



(1) first harmonic QO (13.6 eV)
(2) second subharmonic QO (3.4 eV)
(3) third subharmonic QO (1.51 eV)
(4) fourth subharmonic QO (0.85 eV)
(5) fifth subharmonic QO (0.544 eV)
(6) sixth subharmonic QO (0.377 eV)

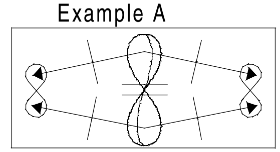
Connection symbols



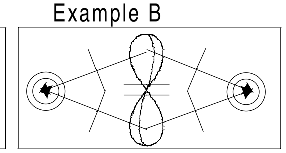

H2 - para state




Example A

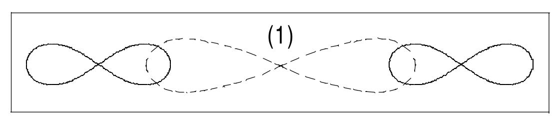


Example B



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

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

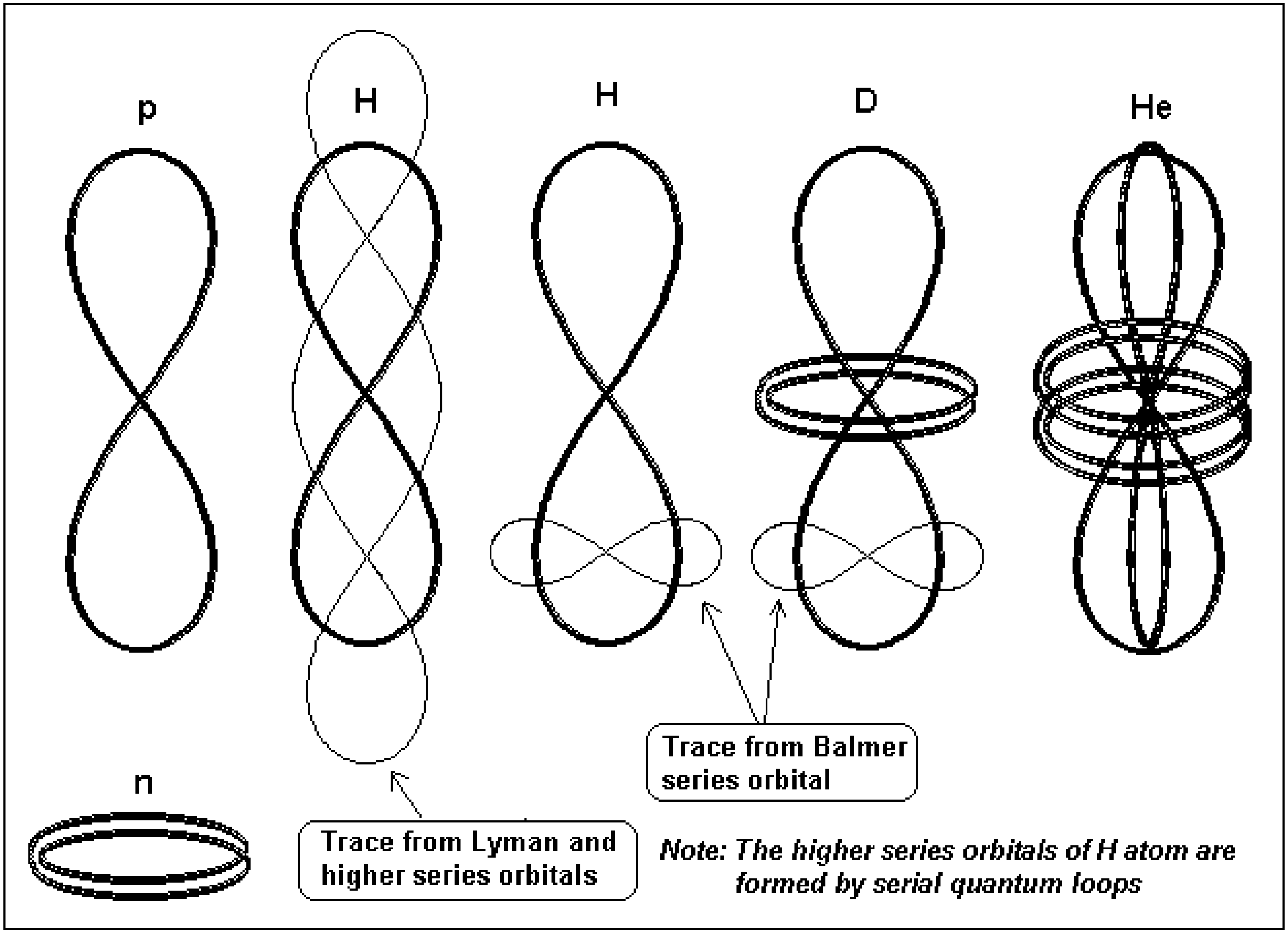


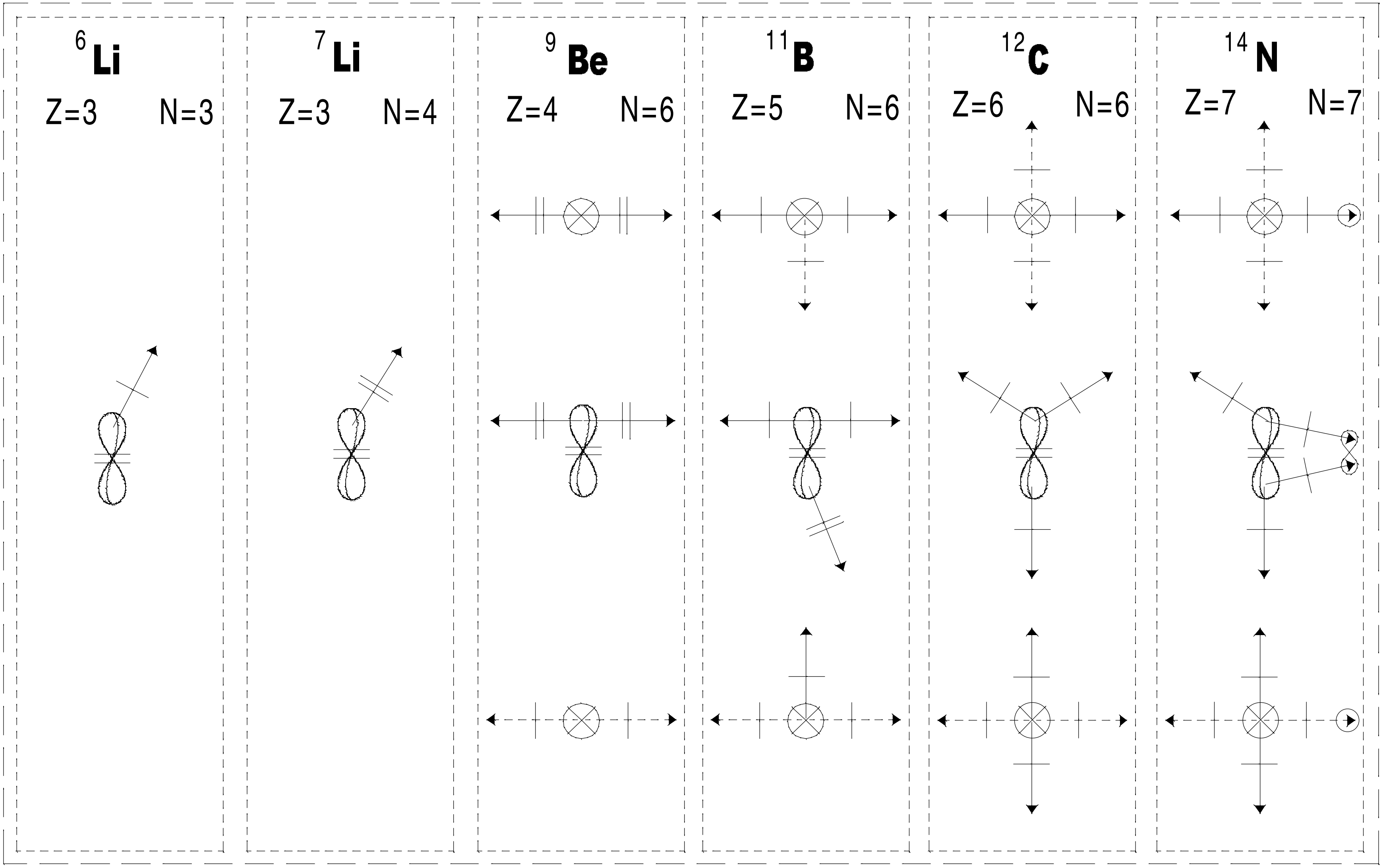

Notations:

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

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


p
H
H
D
He
n
Trace from Lyman and higher series orbitals
Trace from Balmer series orbital
Note: The higher series orbitals of H atom are formed by serial quantum loops



$^{6}Li$
Z=3 N=3
$^{7}Li$
Z=3 N=4
$^{9}Be$
Z=4 N=6
$^{11}B$
Z=5 N=6
$^{12}C$
Z=6 N=6
$^{14}N$
Z=7 N=7