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BSM-SG Unified Theory Beyond Quantum Mechanical Formalism. Atlas of Atomic Nuclear Structures

Dr. Stoyan Sarg Sargoytchev

Abstract: The Basic Structures of Matter - Supergravitation Unified Theory (BSM-SG) was developed from a critical reassessment of modern theoretical physics, motivated by the absence of physically intuitive models for quantum and relativistic phenomena. The theory rejects the notion that such phenomena are fundamentally beyond logical explanation. The starting point is the assumption that physical space possesses intrinsic structure. The invariance of the speed of light across all scales implies the existence of a medium whose properties define electromagnetic propagation. One of the major derivatives of the BSM-SG theory is the Atlas of Atomic Nuclear Structures that provides a foundation for high-resolution computational modeling, advanced materials design, and unified physical interpretation beyond conventional quantum formalisms.

Keywords: space-time, physical vacuum, supergravity, Coulomb field distribution, beyond quantum mechanical formalism

1. Space-time medium (Chapter 2 of BSM-SG).

Logic predicts that there should be some superfine structure in space that defines its quantum mechanical properties. Until the beginning of the 20th century, the existence of such a substance, called the Aether, was assumed, but no working classically justified model was found. Logically, such a substance could not be a fluid, but rather a super-fine structure in which everything is immersed. The elements of this structure could be maintained by a more fundamental law than gravity: for example, the forces at microscopic distances, instead of being inversely proportional to the square of the distance, would be inversely proportional to the cube of the distance. This law in the BSM-SG theory [1,5] is called supergravity (SG).

In BSM-SG the physical medium is a discrete super-fine 3D lattice composed of left- and right-handed geometric elements. These elements are made of super-dens material denoted as SG matter. Their positions are stabilized by a short-range interaction termed Supergravitation (SG), characterized by an inverse-cube distance dependence. Groups of four elements (write-hand twisted) form tetrahedral nodes, and alternating nodes of four elements (left-hand twisted) assemble into a three-dimensional Cosmic Lattice (CL) kept by the specific SG forces. The neighbouring CL nodes are interconnected along the abcd axes. The small gaps between the nodes kept by the specific SG law permit spatial node oscillations. The internode distance is in the order of 10^{-10} (m), which is a billion times smaller than the dimension of the elementary particles (estimated in BSM-SG). [1,5, Chapter 2].

The elements of the CL node are held by the SG forces, so the angles between the abcd axes are not fixed. For static geometric position, the angles between abcd axes is 109.4 degrees and between xyz axes – 90 degrees. Due to the asymmetry between abcd and xyz axes the central position is not stable, so the CL node makes complex spatial oscillations. They are described by the vector Node Resonance Momentum, NRM, and Spatial Precession

momentum, SPM. The NRM transfers the photon wave at one internode distance (about $1x10^{-10}$ (m)), while the SPM vector synchronizes the phase at a distance of the known Compton wavelength ($2.43x10^{-12}$ (m)). This provides extreme accuracy of the speed of light from the nanoscale to the galactic scale.

The geometry of the CL nodes with their two sets of axes of symmetry, abcd and xyz and vectors describing their dynamics are shown in Figure 1. Electric charge (+ or -) is interpreted as a static modulation of the lattice geometry (of left-handed and right-handed nodes) by the elementary particles. The modulation is caused by the helical structure of the elementary particle, which is made by the same twisted geometrical elements that build the Cosmic Lattice. Due to a complex symmetry between abcd and xyz axes, the dynamic central position of oscillating CL node does not coincide with the geometrical one. This implies exitance of a zero-point energy which has a finite value above the zero kelvin degree temperature (Chapters 4&5 of BSM-SG).

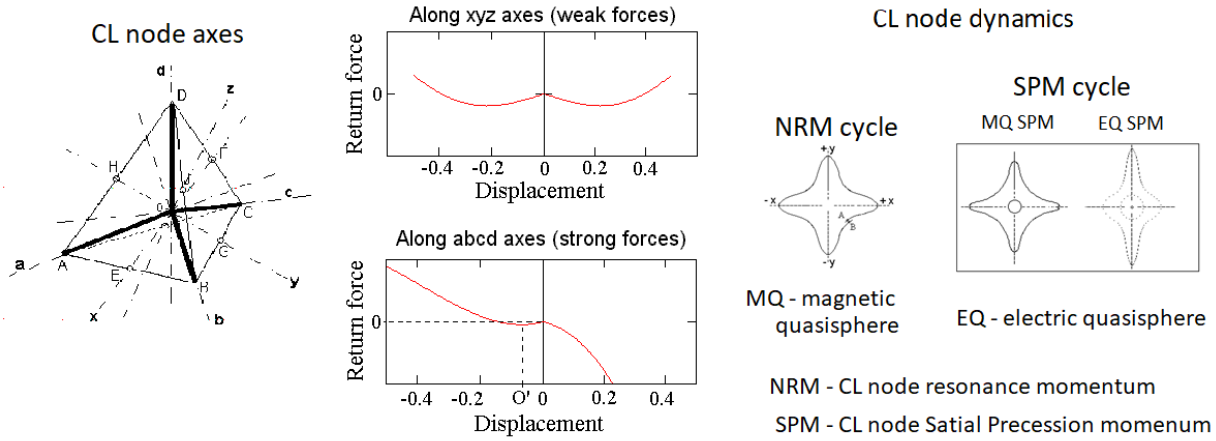

Fig. 1. CL node geometry and restoration (return forces) along the abcd and xyz axes. Vectors NRM and SPM in magnetic and magnetic fields. (BSM-SG, Chapter 2 and Appendix C).

2. Gravitational mass and matter (Chapter 2 and 3 of BSM-SG)

Gravitation and inertia arise from pressure exerted by the lattice on the internal substructure of elementary particles. The stable elementary particles are formed of the same SG matter, but they are not spherical (described later). When SG matter from protons and neutrons accumulates in atomic nuclei, the distance between the nodes of the KR changes slightly and the microcurvature of the Cosmic Lattice space is created. In the far field, the total mass of atomic nuclei from a certain number of protons and neutrons appears less than the sum of their individual masses. This is evident for the masses of atomic nuclei when the number of protons and neutrons in them increases. This phenomenon is known as mass deficiency, expressed by Einstein's formula

$E = mc^2$, where m is mass. Therefore, mass is not equivalent to matter itself but a measurable manifestation of Cosmic Lattice deformation. In this process, the SG matter is not changed. Since the gravitational and inertial masses are equal, according to Newton's laws, one may assume that the CL deformation could change the inertial mass as well. This framework naturally explains nuclear mass defects without invoking matter–energy annihilation. The mass equation is derived in section 3.13, Chapter 3 of BSM-SG. It is defined as a static CL pressure on the impenetrable SG volume of the elementary particles.

The gravity defined by Newton is propagated in CL space by the axes abcd. In this physical environment the SG field is propagated in a far field as gravity forces are inverse square dependent on distance. The xyz axes are orthogonal, providing propagation of light

(Electromagnetic field). **Therefore, the CL node configuration provides the direct connection between the gravity and the Electromagnetic field.**

In a space far away from a massive body, the MQ SPM and EQ SPM, shown in Figure 1, are fully symmetrical with respect to the central point O. In a space of the gravitational field of a massive body, the central point is displaced. This provides a spatial curvature, which is in agreement of Einstein's claim that the gravity is a result of a spatial curvature. BSM-SG additionally reveals that space micro-curvature exists also around the superdense atomic nuclei, which is also important for definition of the finite lifetime of the excited states of the electron.

Additionally, when an elementary particle is moving in CL space, the flexible CL node oblates its denser internal structure while the partly folded CL nodes preserve the motion momentum. This is in full compliance with Newton's law.

3. Elementary particles (Chapters 6 and 12 of BSM-SG)

The concept of the elementary particle crystallization is described in Chapter 12 of BSM-SG. A short summary is given in [6].

3.1 Proton and neutron

When protons and neutrons were smashed in the first colliders (1947), it was noticed that the first sub-particles, mesons (later called pions and kaons), always had a very precise, well-defined mass. Later, it was strongly confirmed (see Table 1). This would not have been possible if protons and neutrons were spherical. The pions and kaons have very short life and decay into muons with altered masses. The logic suggests that their structure is helical that initially collapses as a result of a change of the helical pitch, and after a short time they are destroyed because they are not stable. The exception is the left-over electron or positron, which have a single turn helical shapes.

Table 1

Elementary particle	Mass [MeV/c^2]	Mass Accuracy %	Lifetime [s]
proton	938,272		stable
neutron	939,565		Stable in nuclei
pion$^{+/-}$	139.57	0.0000129	2.6033x10^{-8}
kaon$^{+/-}$	497,614	0.00324	1.2379x10^{-8}
muon	105,658	0.0005x10-8	2.1968x10^{-8}
electron	0.511		stable

Logical considerations: Protons and neutrons have the shape of a toroid with an outer shell of a certain thickness, and inside there are other toroids, for example, one along the central curve and two others twisted around it. The central one is a kaon, and the two with left and right twists are a positive and negative pion, respectively. They all have a closed helical structure of the same prisms as in a cosmic lattice, and SG forces keep them stable. When the outer shell is broken, (just like a helical structure of twisted prisms), they decay quickly, a phenomenon known as a lifetime. Protons and neutrons are stable due to their closed shape of helical structures held by SG forces. Open shapes of pions, and kaons outside of proton and neutron are unstable and decay.

Another question follows: Why do protons and neutrons have masses that differ only by 0.14%. In addition, a free proton is stable, and a free neutron (usually in motion) decays into a proton. In addition, a neutron, although it is considered neutral, creates a magnetic field when moving.
Logical answer: Under the action of SG forces, the shape of the proton is not circular but becomes a twisted toroid with a projection resembling a figure eight, but rather a 3D Hippoped curve. Its electric (Coulomb) field (positive) is not point-like but is distributed around its geometric shape. The toroidal structure can also takes the form of a double-folded toroid, and this is the neutron. However, this happens in the strong SG field of atomic nuclei. At such shape the strong SG field localizes its electric field, (also positive) in the nearby volumetric region around its structure. However, this allows it to be kept in the saddle of the proton field, while at the same time having the freedom to rotate and create its own magnetic field. The latter interacts with the magnetic fields of the electrons whose orbits follow the distributed electric field of the protons. This creates conditions for the known nuclear spins for which there is no classical explanation in the known quantum mechanical models.

3.2. Electron (Chapter 3 of BSM-SG)

The electron has a mass 1836 times smaller than that of the proton and neutron but has a magnetic moment 630 times larger than that of the proton. The external shape of the electron, illustrated in Fig. 2, is like a truncated small toroid with a helical pitch which is the cause of its anomalous magnetic moment. It is an oscillating system of three helical structures, one inside the other, with its own frequency identified as the well-known Compton frequency. At the same time, the nodes of the cosmic lattice have the same frequency. Thus, at speeds a $c\alpha$, $c\alpha/2$, $c\alpha/3$ corresponding to energies: 13.6 eV, 3.4 eV, 1.51 eV ..., where c – is speed of light, α - is the fine structure constant. the phase oscillations of the electron coincide with the phase moments of the propagating light vector. These are the preferred quantum speeds of the electron at the Bohr atom. At these speeds, the electron "screws" into the Cosmic Lattice with smaller resistance. However, it creates much stronger turbulence in CL space than the proton, which manifests itself as a magnetic field.

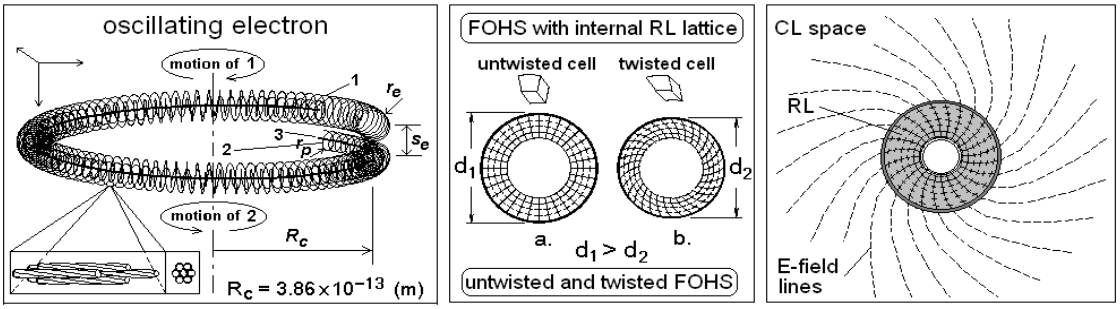

Fig. 2 The electron as a 3-body oscillation system of helical structures (BSM-SG, Chapter 3), [5].

4. Atlas of Atomic Nuclear Structures (ANS) (Chapter 7 and 8 of BSM-SG)

Based on derived models, stable atomic nuclei are systematically arranged into an Atlas of Atomic Nuclear Structures. The most important conditions for nuclei to be stable are the following:
(a) The compact form of stable atomic nuclei is a result of spatial symmetry and balance between supergravity forces and the electric fields of protons and neutrons. Magnetic fields from electrons in localized electron orbits interact with the magnetic fields of rotating neutrons. Disturbance from an external EM field causes temporal switching of nuclear spin, which is behind the observable Nuclear Magnetic Resonance (in MHz and GHz spectral range).
(b) Validation of the obtained atomic structures in the BSM-SG theory by using the following known properties.
Validation employs data from:

- Particle data experiments
- X-ray properties of the elements in a solid state.
- Laue back-reflection patterns
- Relation between the nuclear binding energy and X-ray spectra of elements
- Principal and secondary oxidation numbers (valences) of elements.
- Ionization potential dependence of Z number
- Orbital interactions and pairing between the electrons from different orbitals
- Radioactive decay of unstable isotopes
- Optical atomic spectra
- Photoelectron spectra of molecules
- Nuclear magnetic resonance of the elements
- Nuclear configuration and VSEPR model for chemical compounds
- Vibrational properties of the atoms in the molecules in a gas phase.

Figure 3 illustrates the protons and neutrons in the atomic nuclei of the first light elements. Their positions are defined by the SG and Coulomb forces distributed around the SG material structure.

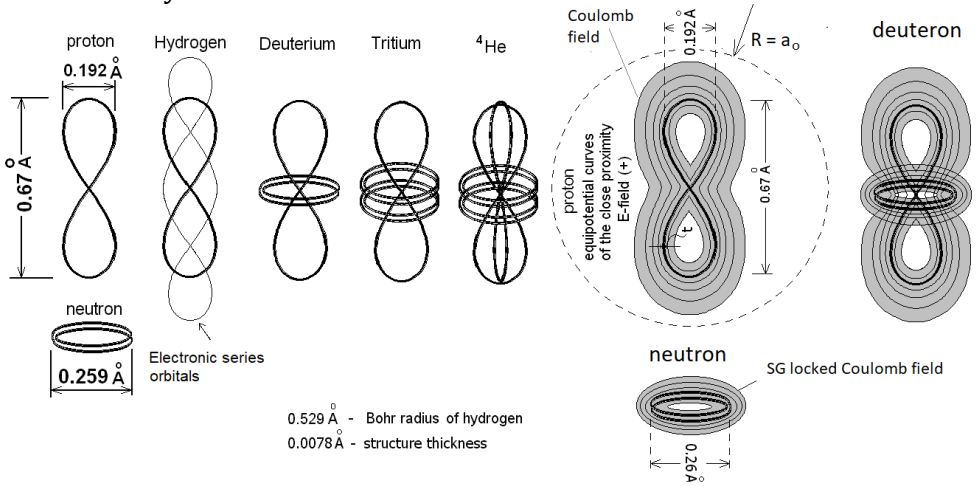

Fig. 3. Proton and neutron and their nuclear arrangement in light elements. The Coulomb fields are shown by a gray scale. At a distance, only the proton's field is detected like a point charge.

Figure 4 illustrates the derived rules for heavier elements. Protons and neutrons are shown by symbols (proton as fig 8 and a neutron as a short line).

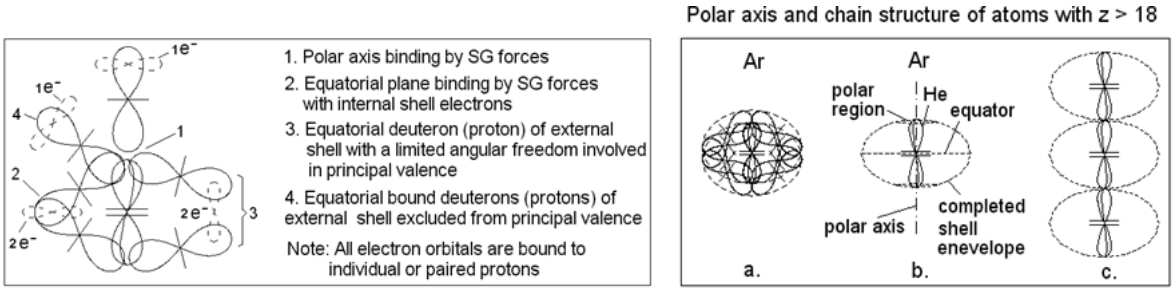

Fig. 4. Derived rules for the spatial positions of protons and neutrons in heavier elements

Figure 5 illustrates two rows of the Periodic Table according to Atlas ANS, and selected atomic nuclei. The free ends of the protons correspond to the external electron layer. It is evident how

the primary valences initially increase from 1 to 4 and then decrease to 0 at the noble gases because they are excluded by electronic bonds (electronic orbits between two protons).

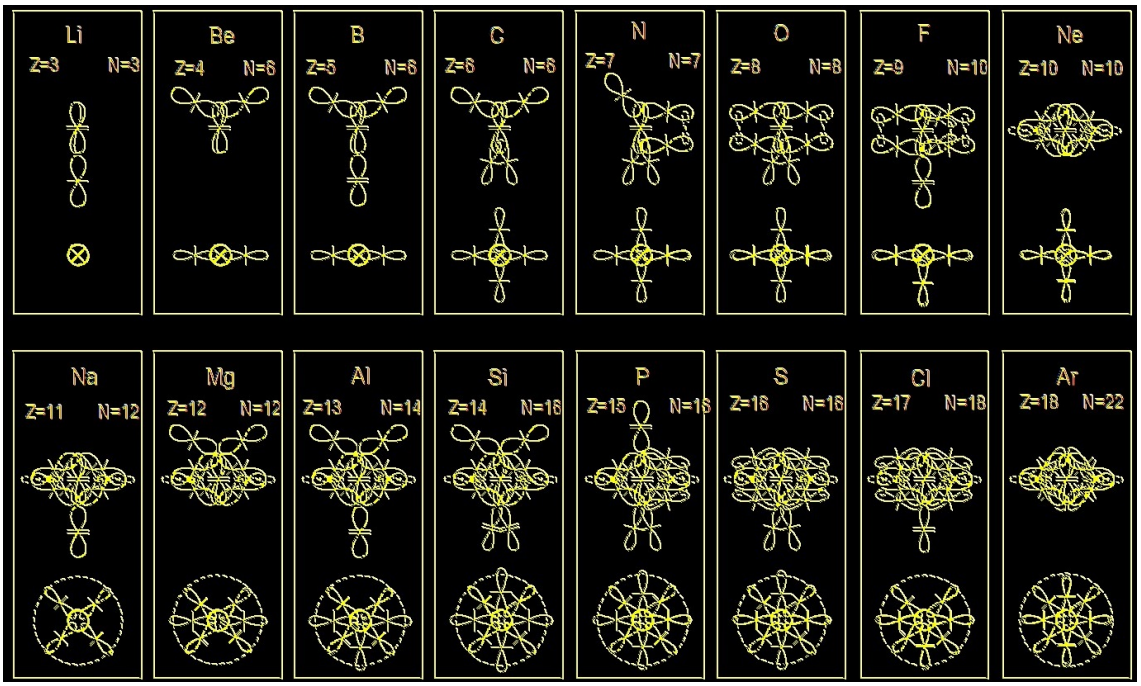

Fig. 5. Two rows of the Periodic Table by Atlas ANS.

Figure 6 illustrates projection views of selected atomic nuclei according to the BSM-SG

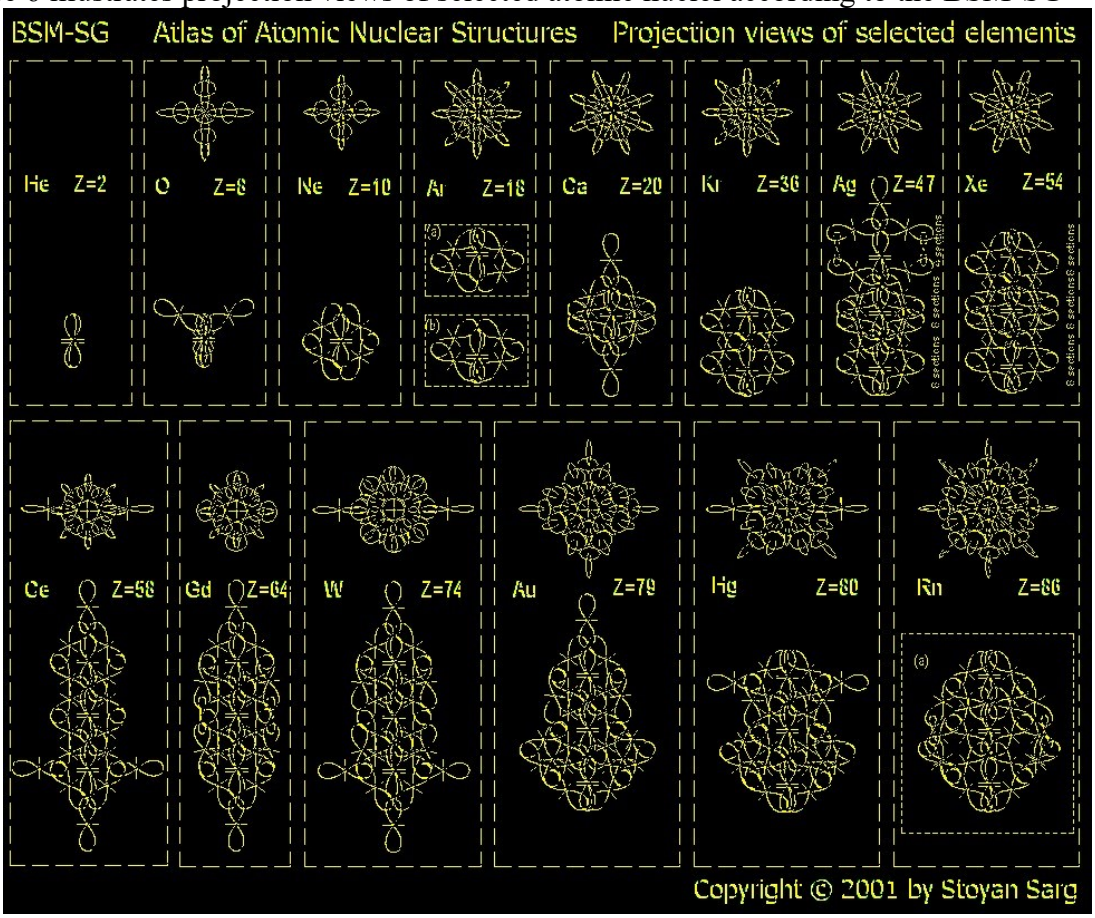

Fig. 6 Selected atomic nuclei according to the Atlas ANS derived in BSM-SG theory. For better visualization, protons and neutrons are shown by symbols

Figure 7 illustrates the Periodic Table up to Z-number 103, according to the BSM-SG theory. It is part of the Atlas of Atomic Nuclear Structures, according to BSM-SG theory.

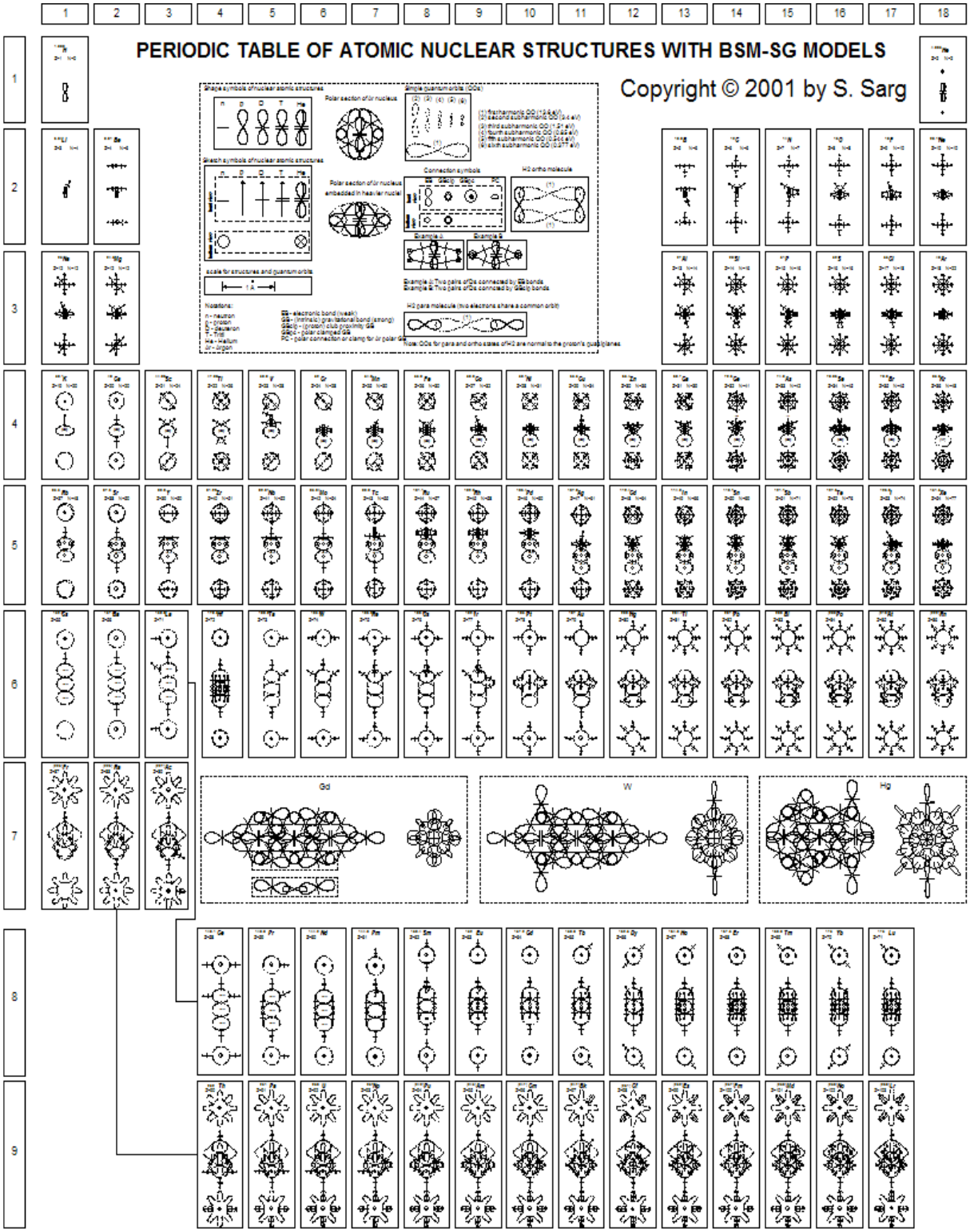

Fig. 6 Periodic Table of the elements according to the Atlas ANS derived in BSM-SG theory. The nuclei exhibit well defined polar axes of symmetry.

One example of obvious conclusions from the ANS is why the rare earth elements of Lanthanides are suitable for strong magnets. The reason is the alignment of a large number of neutrons and electronic orbitals in their nuclei. Another example is the suitability for qubit quantum states [9].

4. Conclusions

The **BSM-SG unified theory** introduces a physically defined medium underlying the space–time description of the physical vacuum, enabling a logically consistent interpretation of physical phenomena beyond conventional quantum-mechanical formalism and establishing links between quantum mechanics, classical mechanics, and relativity. A major derivative of the theory is the **Atlas of Atomic Nuclear Structures (ANS)**, which provides a framework for high-resolution computational modeling and advanced materials design. The Atlas ANS reproduces the established Periodic Table while introducing explicit nuclear geometries and internal field distributions. Electronic orbital positions are determined by the distributed Coulomb forces of the nucleons and are physically identifiable. The explicit treatment of physical dimensions and fields, including **Supergravity**, offers clear advantages for computer modeling, interpretation of electron-microscope images, molecular modeling, and simulations of new materials with predefined physical and chemical properties

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Short biography of the author

Dr. Stoyan Sarg Sargoytchev (b. 1945) holds an engineering diploma and a PhD in Physics, with extensive experience in international space research. He has dual citizenship Bulgarian and Canadian. He has contributed to projects with Intercosmos organization and ESA collaboration, Bulgaria-India collaboration, NSF at Cornell University USA, and the Canadian Space Agency. Alongside his research career, he developed the BSM-Supergravitation Unified Theory, an alternative framework challenging quantum mechanical formalism and mainstream cosmology. He has been a plenary and a keynote speaker in two dozen international conferences. After retiring from York University, Canada, in 2012, he became a Distinguished scientific adviser at the World Institute for Scientific Exploration, USA. In 2024, he founded the Society of Earth Civilization and Universe.