

## Space-time origin according to the Basic Structures of Matter – Supergravitation Unified Theory

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The treatise Basic Structures of Matter (BSM) is based on an original idea about physical vacuum, which has never been investigated before. It follows the recommendation of James Clerk Maxwell expressed in his “*A Treatise on Electricity and Magnetism*” vol. II, section “A medium necessary”:

*...In fact, whenever energy is transmitted from one body to another in time, there must be a medium or substance in which the energy exist after it leaves one body and before it reaches the other, ... Hence, all these theories lead to the conception of a medium in which the propagation takes place...*

Similar statements and recommendations for search of the basic physical model of this medium Maxwell provides also in his “*Dynamical Theory of the Electromagnetic Field*”.

The Basic Structures of Matter (BSM), a Super Gravitation Unified Theory, unveils the relation between the forces in Nature by adopting the following framework:

- Empty Euclidian space without any physical properties and restrictions
- Two super dens fundamental particles (see panel 1) able to vibrate and congregate
- A Fundamental law of Super Gravitation (SG) – an inverse cubic law valid in pure empty space.

An enormous abundance of these two particles, with energy beyond some critical level, are able to congregate into self-organised hierarchical levels of geometrical formations, based on the fundamental SG law. This leads deterministically to creation of space with quantum properties (known as physical vacuum) and a galaxy as observable matter. All known laws of Physics are embedded in the underlying structure of the physical vacuum and the structure of the elementary particles. The fundamental SG law is behind the gravitational, electric and magnetic fields and governs all kinds of interactions between the elementary particles in the space of physical vacuum.

The structure of the physical vacuum, called a Cosmic Lattice (CL) distinguishes from the old ether-like concept by number of features, such as: a high stiffness and pressure, quantum mechanical and space-time features and folding properties. As a result, its complex but well-defined behaviour permits explanation of the enigmatic phenomena in Particle Physics, Quantum mechanics, Relativity and Cosmology. The space and time properties of the fundamental particles and their formations in the structural level below the CL structure are absolute. The space-time relativistic features of the physical vacuum are result of modulation effects caused by the immersed material objects (GR effects) and by their motion (SR effects). These features become apparent when analyzing the behavior of the single elements of the CL space – the CL node (panel 14) and the motional behavior of an elementary particle, for example the electron. Such analysis leads to definition of the basic physical parameters of the CL space: a Static CL pressure, a Dynamic CL pressure and a Partial CL pressure. The first one defines the Newtonian mass of the elementary particle (a mass equation is derived in BSM). The second one defines the Zero Point Energy (ZPE) related to the Electrical and Magnetic fields. The third one is related to the inertial properties of the elementary particles. The unveiled features allow making analysis beyond the Newton’s laws about gravity and inertia and beyond the theory of Special and General Relativity. Additionally, the existence of two types of Zero Point Energy (ZPE) is revealed: a static one (ZPE-S) and a dynamic one (ZPE-D). The first one is related to the Newtonian mass and the effects of GR, while the second one – to the Electrical and Magnetic fields. One important feature of the CL nodes is their ability of self-synchronization with identified experimental signature – the Compton wavelength. This phenomenon is involved in the definition of the permeability and permittivity of the physical vacuum and it is responsible for the constancy of the velocity of light. Three important predictions follow from the BSM theory: (1) The ZPE-S is the primary source of the nuclear energy; (2) The physical vacuum is able to propagate longitudinal (scalar) wave component; (3) The gravitational and the inertial mass of a body could be manipulated by proper modulation of the parameters of the physical vacuum.

The Russian academician G. V. Nikolaev arrived to similar conclusions about the physical vacuum, while offering “Non-contradictable electrodynamics”, published in number of books (in Russian).

Keywords: Basic Structures of Matter, Supergravitation unified theory, helical structures, Cosmic Lattice space, Atlas of ANS

## Appendix: Selected graphics material from BSM treatise (the graphics panel No is encircled in the upper left corner)

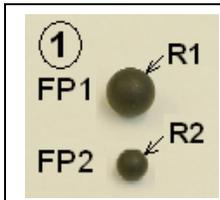
1. Fundamental particles FP1 and FP2 and the relation of their intrinsic time constants and dimensions to the Planck's scale
2. Tetrahedron (TH) – the most compact formation of spherical particles of one and a same type.
3. Quasipentagon (QP) – the most compact formation of THs. It can possess a right or left-hand twisting due to angular gaps of the embedded QPs – a lower memory of the chirality.
4. Quasiball – the most compact formation of QPs. The upper order TH is formed by QBs of lower order
5. Self-formation of alternative layers of upper order QBs, formed respectively by FP1 and FP2. The excess vibrational energy is transferred to the alternative layers with higher order number
6. Protogalactic egg formed by the consecutive eruptions of layers 4 and 3 and compressed to shells by SG forces.
7. Prisms mold by SG forces due to destruction of the upper level QBs, while the destruction of lower level QBs makes them smoother. a. – shape of mold prism, b. – internal arrangement of QPs providing an axial SG anisotropy. Prisms from FP1 and FP2 preserve the size ratio 3:2, while inheriting the right and left-hand axial SG fields from the embedded lower level QBs.
8. Protogalactic Egg after the formation and release of the prisms, which forms a mixed lattice in the internal space of the egg.
9. Mixed lattice from the right and left-hand twisted prisms providing conditions for crystallization of helical structures.
10. First Order Helical Structure (FOHS) and Second Order Helical Structure (SOHS).
11. Major phases before formation of a new galaxy with CL space and elementary particles from the same prisms. The new-born CL space interconnects to the CL space of other galaxies. The identified detectable signature is a Gamma Ray Burst.
12. Shape of a proton-neutron and its conversion to a proton or a neutron (the latter is unstable in CL space, when it is alone)
13. Internal structure of the proton and neutron, showing the identified structure of the pions and kaon.
14. The flexible elementary CL nodes from right and left-handed prisms forming the CL space. The gaps between the alternative types of CL nodes is supported by the specific feature of SG law based on oscillating modes (Chapter 12 of BSM).
15. CL node dynamics. The two diagrams show the SG return forces for deviations along the two sets of axes of symmetry: xyz and abcd. The oscillation properties are described by the vectors NRM and SPM.
16. NRM (Node Resonance Momentum) trace. SPM (Spatial Precession Momentum) – contains a large number of open loop NRM cycles. NRM cycle together with the CL node distance defines the velocity of light, while the SPM vector is responsible for its constancy. The SPM period is equal to the Compton's time. MQ SPM (Magnetic Quasisphere) is the shape of SPM vector hodograph in the absence of electrical field, while EQ SPM (Electrical Quasisphere) is its shape when such field is present. The parameters of NRM and SPM vectors define in the  $\epsilon_0$  and  $\mu_0$  of the physical vacuum.
17. Electron - an oscillating system of 3 structures: external (-) shell, internal positron and a (-) central core. The first proper frequency of the system = SPM frequency = Compton's frequency. Its motion in CL space exhibits QM features: preferable QM velocities (13.6 eV, 3.41 eV, 1.51 eV ...related to the magnetic radius); QM spin; anomalous magnetic moment. Derived parameters: a relativistic gamma factor, a physical meaning of Planck's constant and a lifetime of a closed loop quantum orbit.
18. Every FOHS contains a denser internal quasi-rectangular lattice (RL) and twisted structure of prisms, which modulates the SPM vector of the proximity CL space, providing aligned EQ SPM CL nodes forming the spatial lines of the electrical charge.
19. Overall shape of proton, neutron, hydrogen, deuteron and helium with some quantum orbits. Protons and neutrons are held in the nucleus by the balance between attractive SG forces and repulsive electrical ones. The energy of the electrical charge is supplied by the SG energy contained in the ZPE of the CL node. The attractive forces between the protons are result of synchronization of SG modes in their prisms with a frequency higher than the NRM frequency of the CL node.
20. Axial section and polar view of Gd nucleus with some insight about the radioactive  $\alpha$  decay. The positions of the protons in the nucleus before the formation of the  $\alpha$  particle (He nucleus) is shown by dashed lines.
21. Au crystal plane image by a tunneling microscope (Courtesy of Kawasaki et. Appl. Phys. Lett., **76**, 1342-1344, (2000)).
22. Synthetic image of Au crystal plane obtained by using the atomic nucleus of Au derived in BSM.
23. Sectional and polar views of the Au nucleus, from the Atlas of Atomic Nuclear Structure (Atlas of ANS, by S. Sarg)
24. Sectional and polar views of Hg nucleus, from the Atlas of Atomic Nuclear Structures.

### Related publications:

1. S. Sarg, *Basic Structures of Matter*, first electronically archived edition ISBN 0973051507, (2002), second electronically archived edition, ISBN 0973051558 (2005)
2. S. Sarg, *Atlas of Atomic Nuclear Structures*, ISBN 0973051515, (2002)
3. S. Sarg, New approach for building of unified theory, <http://lanl.arxiv.org/abs/physics/0205052> (May 2002)
4. S. Sarg, New vision about controllable fusion reaction D+D->He with efficiency energy yield ISBN 0973051523 (2002)
5. S. Sarg, Theoretical analysis of biomolecules using BSM models, ISBN 097305154X (2002)
6. S. Sarg, A Physical Model of the Electron according to the Basic Structures of Matter Hypothesis, *Physics Essays*, **16**, No 2, 180-195, (2003)
7. S. Sarg, Brief introduction to BSM theory and derived atomic models, *Journal of Theoretics* (extensive papers) 2003
8. S. Sarg, *Beyond the Visible Universe*, ISBN 0973051531, (2004)
9. S. Sarg, *Basic Structures of Matter – Supergravitation Unified Theory*, (completed and corrected version, in print 2006)
10. S. Sarg, additional material in [www.helical-structures.org](http://www.helical-structures.org)

# Basic Structures of Matter – Supergravitation (SG) Unified Theory

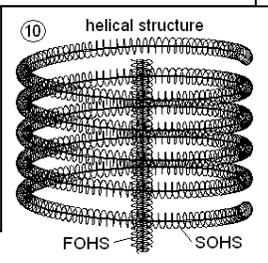
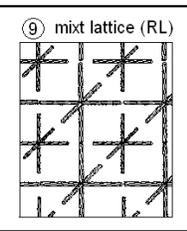
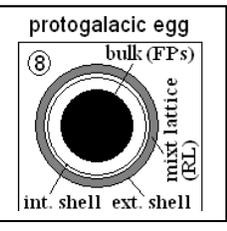
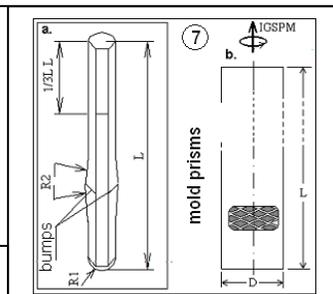
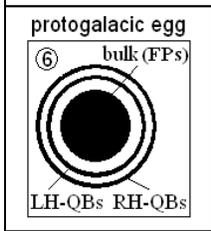
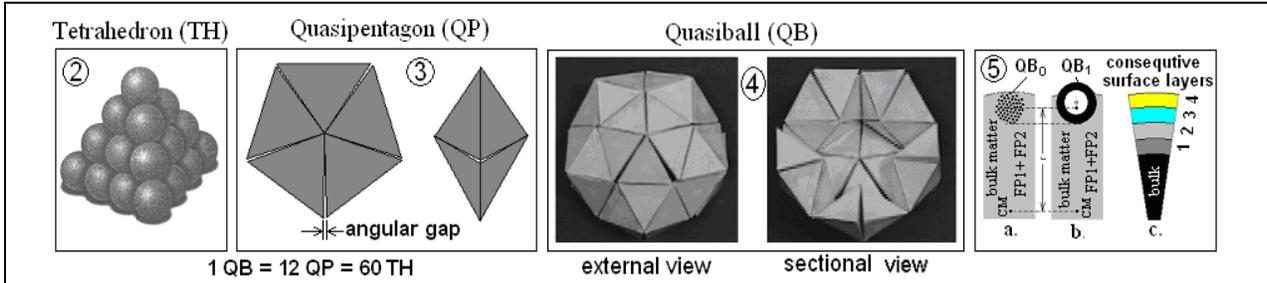
Framework: a classical pure empty space, two fundamental particles FP1, FP2 and SG law



FP1 and FP2 with a radius ratio of  $R_1/R_2=3/2$  are superdens but elastic with time constants and sizes associated with the Planck's scale. They vibrate and congregate based on the SG law.

$$(t_1 + t_2)/2 \sim T_{PL} = \sqrt{\frac{Gh}{2\pi c^5}} = 5.39 \times 10^{-44} (s) \quad (R_1 + R_2) \sim L_{PL} = \sqrt{\frac{Gh}{2\pi c^3}} = 1.616 \times 10^{-35} (m)$$

SG law:  $F_{SG} = G_0 m_{01} m_{02} / r^3$ , where:  $G_0$ - SG constant,  $m_0$  - SG masses,  $r$  - distance



11. Crystallization of FOHS & SOHS in clusters; cluster refurbishing; Final products: electrons + protonneutrons  
 Internal CL space appearance; break of external egg shell; birth of a new galaxy: a new CL space + el. particles

