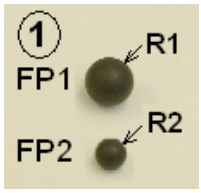
Basic Structures of Matter – Supergravitation (SG) Unified Theory

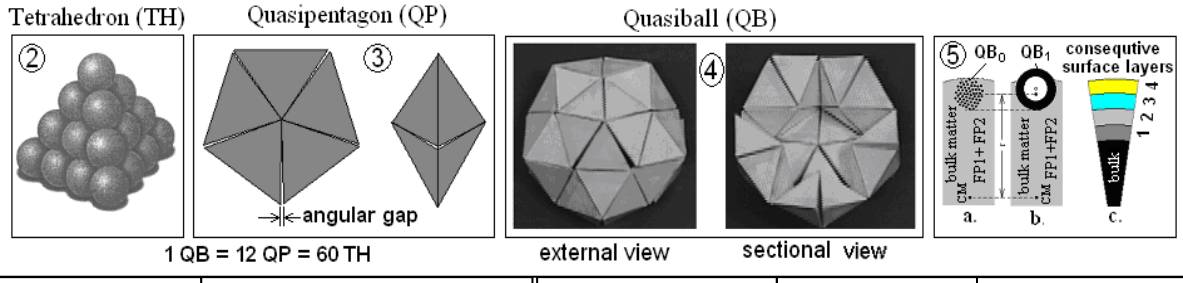
Elementary particles crystallization in a hidden galactic phase under SG law in empty space

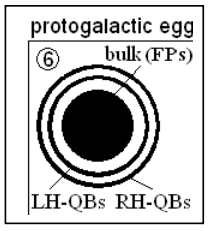


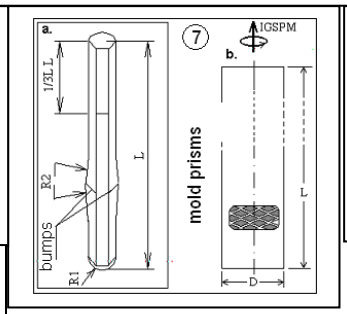
FP1 and FP2 are indestructible fundamental superdense particles of proto-matter with size ratio $R_1/R_2 = 3/2$ and time constants associated with the Planck's scale. Under universal SG law the they can congregate into stable geometrical structures in a hidden galaxy phase.

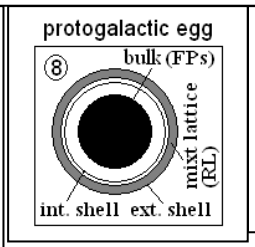
$$(t_1 + t_2)/2 = T_{PL} = \sqrt{\frac{Gh}{2\pi c^5}} = 5.39\times10^{-44}\,(s) \quad (R_1 + R_2)/2 = L_{PL} = \sqrt{\frac{Gh}{2\pi c^3}} = 1.616\times10^{-35}\,(m)$$

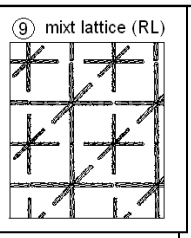
SG law: $F_{SG} = G_0 m_{01} m_{02} / r^3$, where: G_0- SG constant, m_0 – SG masses, r - distance

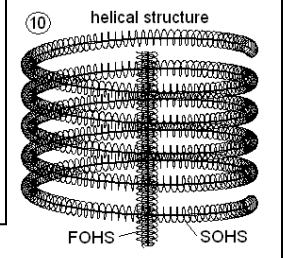






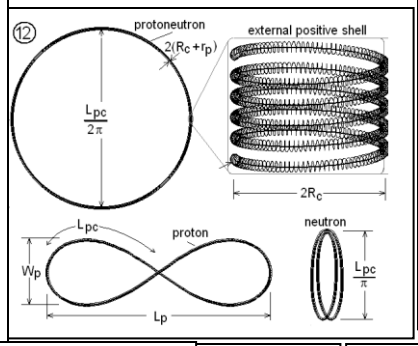


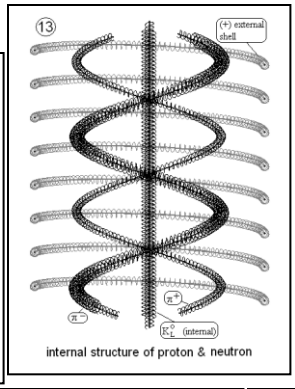


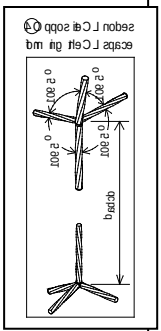


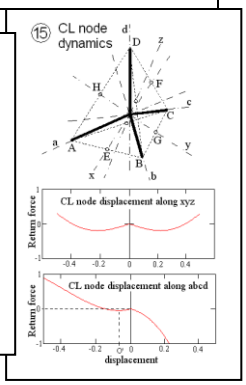
11. **Crystallization** of FOHS & SOHS in clusters; cluster refurbishing; Final products: electrons + protoneutrons.

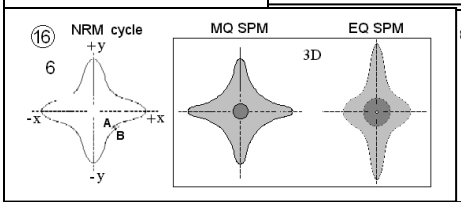
The appearance of internal CL space leads to break of the external egg shell; birth of a new galaxy: a new CL space + elementary particles

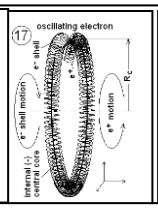


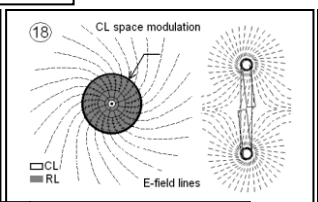


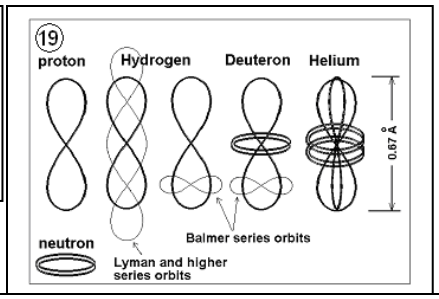


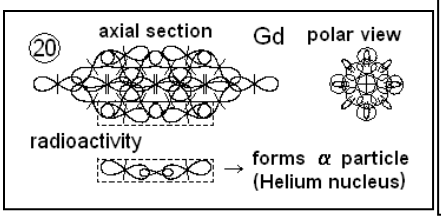


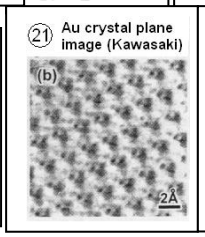


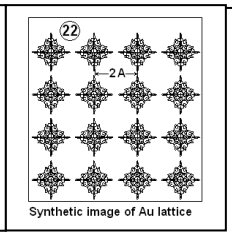


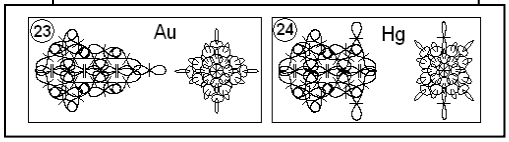






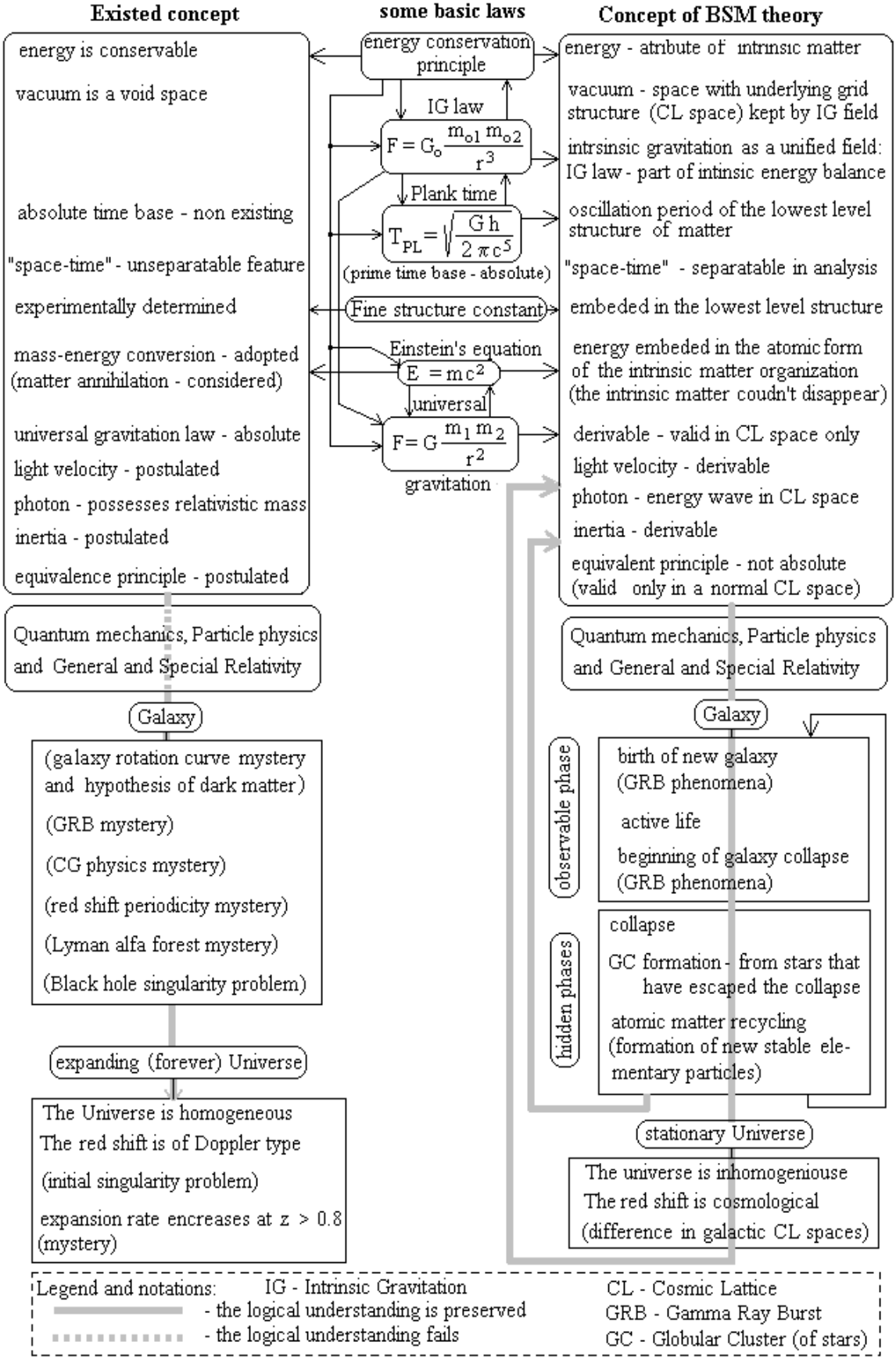






1. Fundamental particles FP1 and FP2 and with parameters associated to the Planck's scale
2. Tetrahedron (TH) – the most compact formation of spherical particles of one and the same type.
3. Quasipentagon (QP) – the most compact formation of THs. It can possess a right or left-hand twisting due to angular 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 a higher-order number
6. Protogalactic egg formed by consecutive eruptions of layers 4 and 3 and compressed to shells by the SG forces.
7. Prisms mold by SG forces due to the 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 right and left-hand twisted prisms allowing crystallization of helical structures.
10. First Order Helical Structure (FOHS) and Second Order Helical Structure (SOHS).
11. Major phases before the formation of a new galaxy with CL space and elementary particles from the same prisms. The newborn CL space interconnects with the CL space of other galaxies. The identified detectable signature is a Gamma Ray Burst.
12. Shape of a protoneutron and its conversion to a proton or a neutron (a single neutron is unstable in CL space.
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 form the CL space. The gaps between the alternative types of CL nodes are supported by the specific feature of SG law based on oscillating modes (Chapter 12 of BSM-SG).
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 Compton's time. MQ SPM (Magnetic Quasisphere) is the shape of SPM vector hodograph in the absence of an 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 ε_0 and μ_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 closed loop quantum orbit lifetime.
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 the result of the 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 α decay. The positions of the protons in the nucleus before the formation of the α 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-SG
23. Sectional and polar views of Au nucleus, from the Atlas of Atomic Nuclear Structure (derived in BSM-SG).
24. Sectional and polar views of Hg nucleus, from the Atlas of Atomic Nuclear Structures.

Matter-energy balance at the different levels of matter organization



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