Basic Structures of Matter – Supergravitation Unified Theory (BSM-SG) based on an alternative concept of the physical vacuum

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- The classical electrodynamics developed by James Clerk Maxwell is based on the assumption of existence of material Ether. His original equations are in quaternions.
- The only objection of Einstein against the material Ether in “Sidelights of Relativity” (1922) is that the physicists failed to provide a working model
- Methodological errors in Michelson-Morley experiment. Modern laboratory Ether-drift experiments detect the velocity and direction of our motion through absolute space – a strong evidence against the concept of expanding Universe

Framework of the Basic Structures of Matter – Supergravitation Unified Theory (BSM-SG):

- **Empty Euclidean space** without any physical properties and constraints

- **Two superdense fundamental particles** (FPs) (radius ratio 2/3) possessing elasticity and different time constants, which mean value is associated with Planck's time 5.39 x 10^{-44} (s)

- **A fundamental law of supergravitation (SG):** the interaction forces between the indestructible FPs in empty space are inverse proportional to the cube of the distance

$$F_{SG} = G_o \frac{m_{01} m_{02}}{r^3}$$

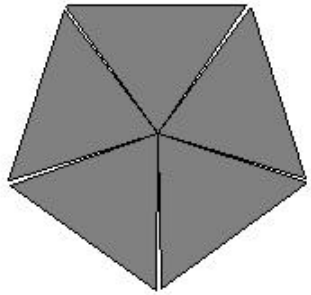
where: G_0 – SG constant, m_{01}, m_{02} – SG masses, r - distance

• Energy is indispensable feature of FPs and their formations

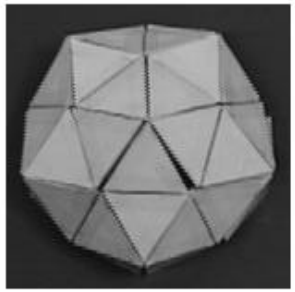
- The superdense FPs are able to carry **large vibrational energy**, while having a **low intrinsic inertia** in a pure empty space (due to the extremely small time constant)
- FPs can congregate in 3D structural formations possessing **common vibrational modes** and forming hierarchical **levels of matter organization**
- **Vibrational energy of structural formations and SG law**: The 3D structural formation may absorb a finite vibrational energy, so it exhibits an energy well with a saturation limit. The interaction SG energy between structures try to fill the energy well. SG forces between formations from the same and different FPs are different. In the second case, the common energy well is different and SG forces may change the sign (a feature of SG constant G_0)

Formations of FPs at the lowest level of matter organization taking place in a hidden phase of galactic evolution

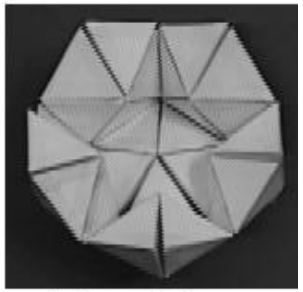
Primary Tetrahedron (TH)



Quasi Pentagon (QP)



external view



internal view

Quasi Ball (QB)

1 QB = 12 QP = 60 TH

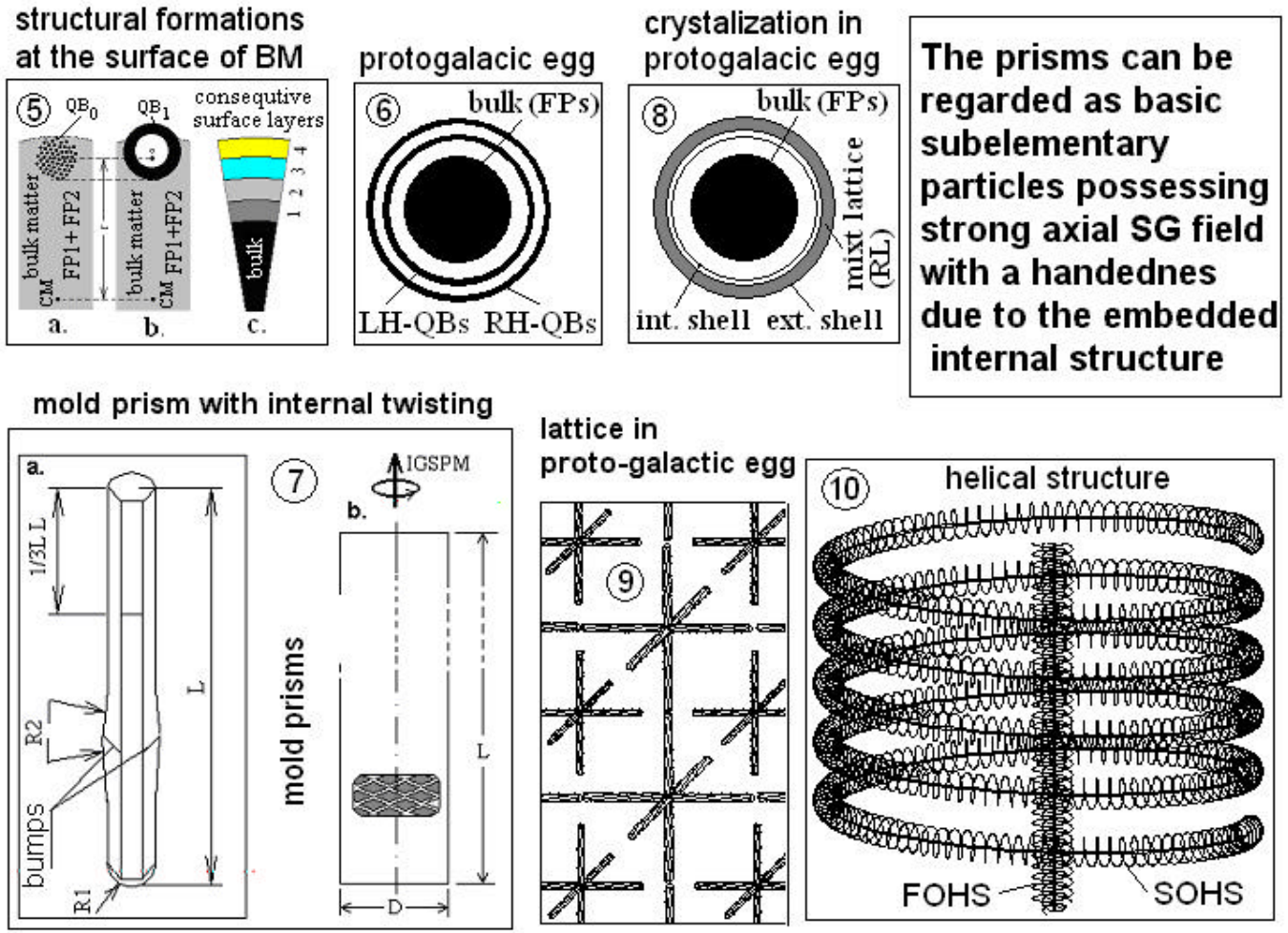
The angular gaps in the QP combine into one gap of 7.355^0. Then QB can be left or right-hand twisted

- the lowest level

2 bits memory carrying the chirality.

Structural formations at low level of matter organization take place in an unique crystallization process preceding the birth of the individual galaxy (scenario presented in Chapter 12 of BSM-SG).

Final products: protons, neutrons, electrons (made of helical structures HS), fragments of HSs and free prisms.



•Explosion of the protogalactic egg - birth of a new galaxy. The free prisms form a Cosmic Lattice (CL), while the stable particles firstly form the simple atoms, such as hydrogen, deuterium, tritium, helium.

• The CL space is formed of alternatively arranged CL nodes made of 4 prisms of the same type.

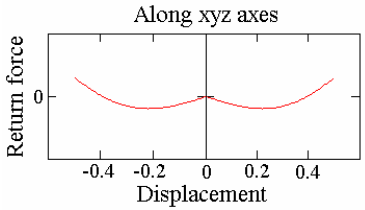
• The distance between the CL nodes is kept by the SG forces the sign and strength of which depend on distance due to the different time constants of the two FPs .

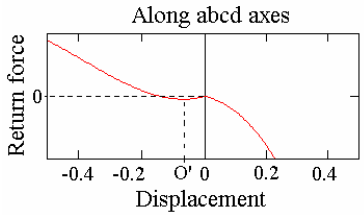
• CL space possesses quantum and space-time properties and Zero Point Energy, which includes two components: a Static (strong one) and a Dynamic (weak one)

• The SG field between the elementary particles in CL space is propagated by the ***abcd*** set of axes of the CL nodes and appears as Newtonian gravitation

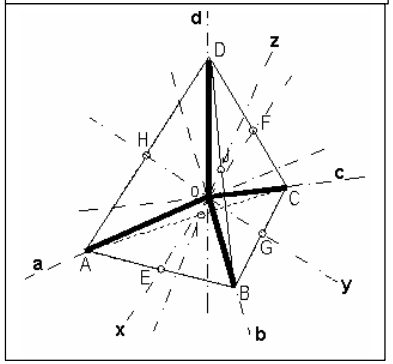
• The Electrical and Magnetic fields are specific type of CL space modulation, based on dynamical properties of the CL nodes involving momentums along the ***xyz*** set of axes.

CL NODE DYNAMICS





Flexible CL node

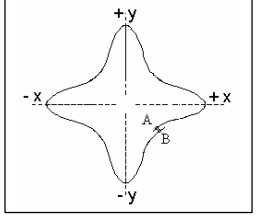


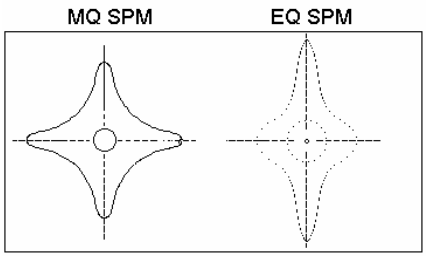
Oscillations described by vectors: NRM (Node Resonance Momentum) **SPM (**Spatial Presession momentum)**.**

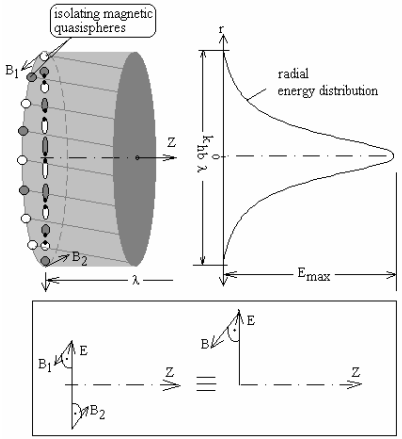
NRM trace – almost flat but not closed curve

The tip of SPM vector circumscribes 2 types of closed surfaces called: Magnetic Quasisphere (MQ) Electric Quasisphere (EQ)

NRM trace

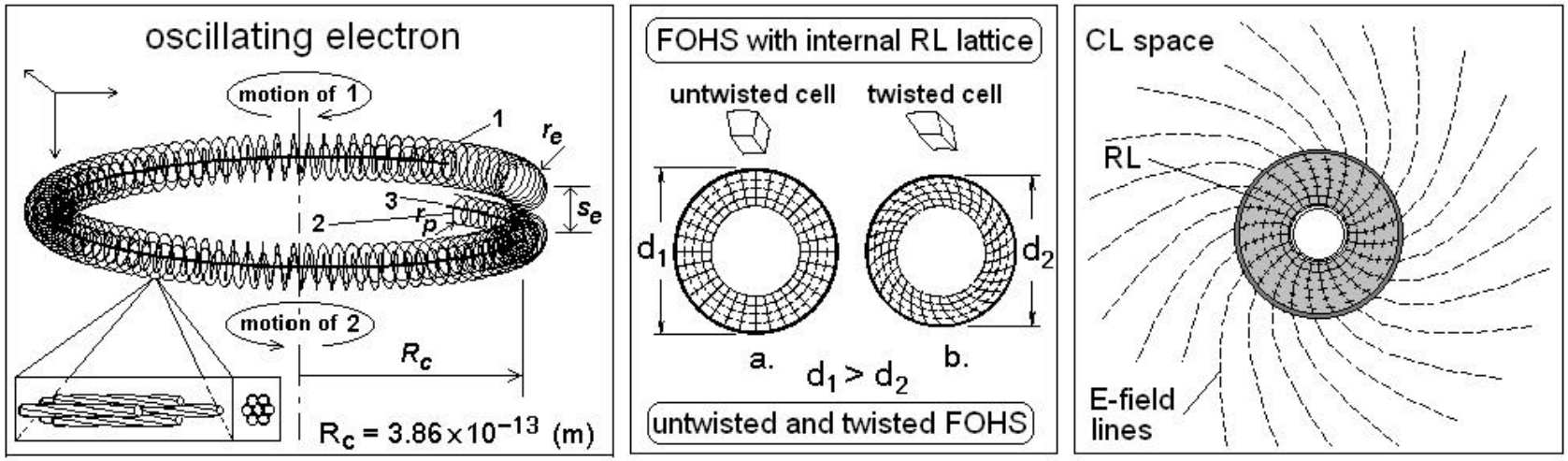






Segment of the wavetrain structure of the photon, showing the arrangement of the running EQs and MQs of both types.
EQs carry the energy momentum.
MQs assure the boundary conditions.
EQs define the E-field vector
MQs define the H-field vector

- **Elementary particles -** built of prisms arranged in **helical structures** as a result of unique crystallization process preceding the birth of the galaxy
- **Electron** – one coil of First Order Helical Structure (FOHS) **-** an oscillating 3-body system with two proper frequencies. The first one is the Compton frequency equal to the SPM frequency of the CL node.



- The **denser internal lattice of FOHS** modulates the external CL space, creating aligned EQ SPM – **electrical field lines.** When moving and rota-ting it creates closed loops of phase synchronized MQs – **magnetic lines**.
- **Confined motion:** The screw-like motion of the rotating and oscillating electron and its interaction with the CL space SPM frequency result in a confined motion with preferred velocities, corresponding to (13.6/n) eV, where ***n*** matches the principal quantum number of the Bohr atomic model. In a closed loop motion, this number defines the length of the quantum orbit.

Derived CL space parameters by using the features of the electron model

Static CL pressure, P_S: defines the Newtonian mass of elementary particle as a pressure exercised on its denser internal lattice

$$P_S = \frac{m_e}{V_e}c^2 = \frac{g_e h\nu_c^{\,4}(1-\alpha^2)}{\pi\alpha^2 c^3} = 1.3735\times10^{26} \quad (\mathrm{N/m^2}) \qquad (4)$$

$$m = (P_S/c^2)V_H \quad (\mathrm{kg}) \text{ - } \textbf{Newtonian mass equation of elementary particle} \quad (5)$$

- **Partial CL pressure, P_P**: related to the inertial properties of the elementary particles in CL space at their confined motion

  $P_P = P_S\alpha\upsilon / c$ $(\mathrm{N/m^2})$ where: υ - is velocity (6)

- **Dynamical CL pressure, P_D**: - exercised on atoms and molecules by ZPE waves responsible for equalization the CL space background energy.

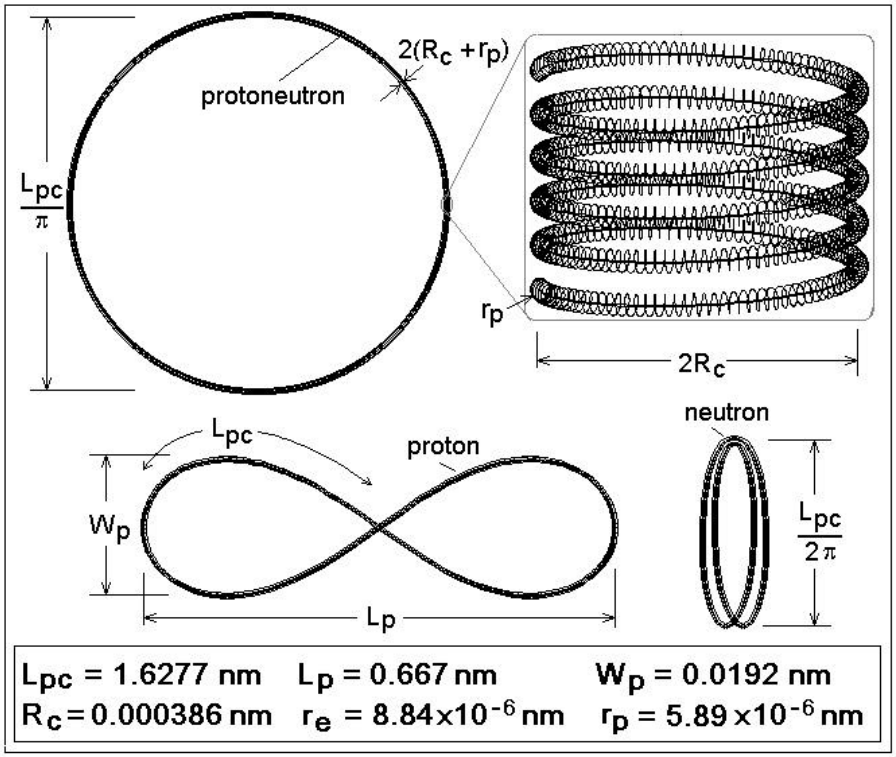
$$P_D = \frac{h\nu_c}{cS_e} = \frac{g_e h\nu_c^{\,3}(1-\alpha^2)}{\pi\alpha c^3} = 2.0258\times10^3 \quad (\frac{N}{m^2 Hz}) \qquad (7)$$

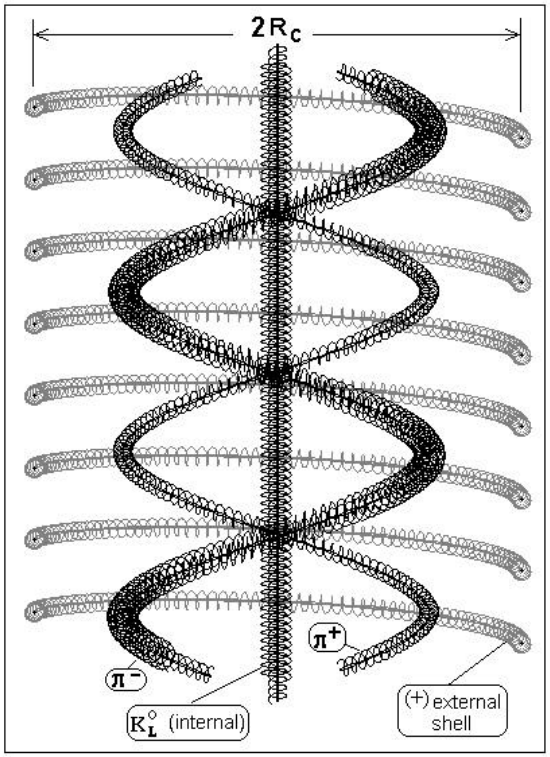
The signature of P_D is the observed Cosmic Microwave Background (CMB). Therefore, **the estimated temperature of 2.72K** (by fitting of CMB to a blackbody curve) **in fact is a CL space background parameter.** The derived theoretical expression is:

$$T = \frac{N_A^{\,2}}{S_W}\frac{h\nu_c(R_C + r_p)^3 L_{PC}^{\,2}}{2cR_C r_e R_{ig}}\frac{\mu_e}{\mu_n} = 2.6758K \qquad (8)$$

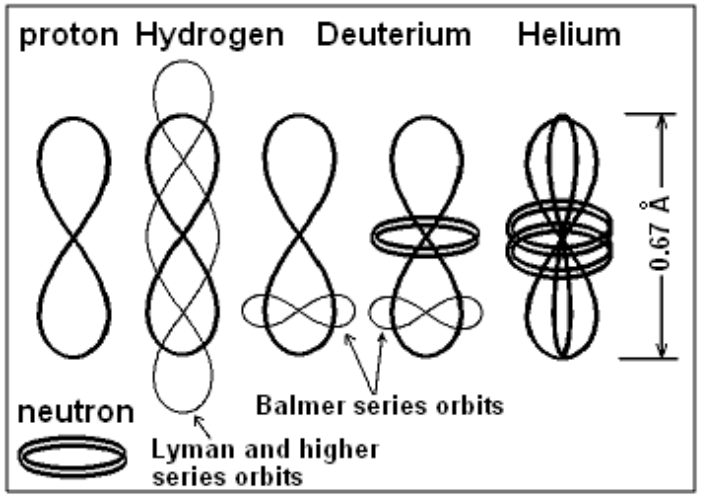
- **Other estimated CL space parameters**
  CL node distance (at xyz axes) ~ $1.0975\text{x}10^{-20}$ (m),
  NRM (resonance) frequency: $1.0926\text{x}10^{29}$ (Hz)
  SPM frequency = Compton's frequency (known): $1.2356\text{x}10^{20}$ (Hz)

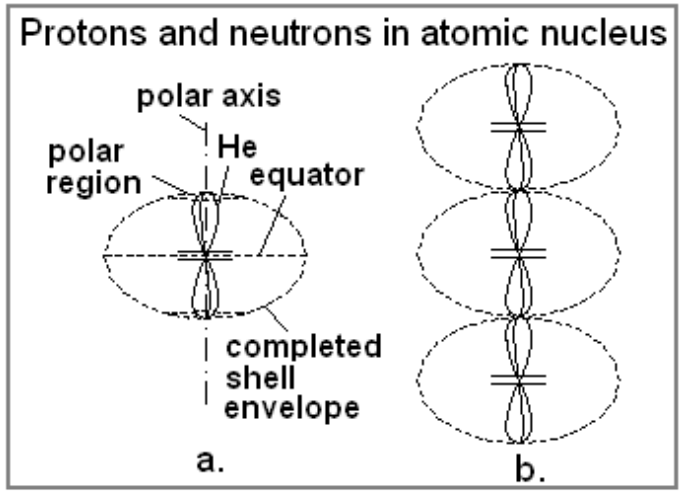
Proton and neutron and their internal structure (all elementary particles are built of helical structures)

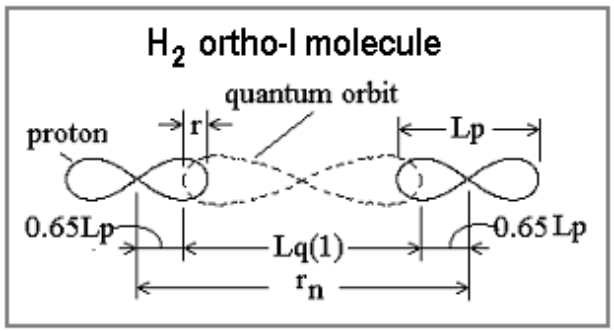


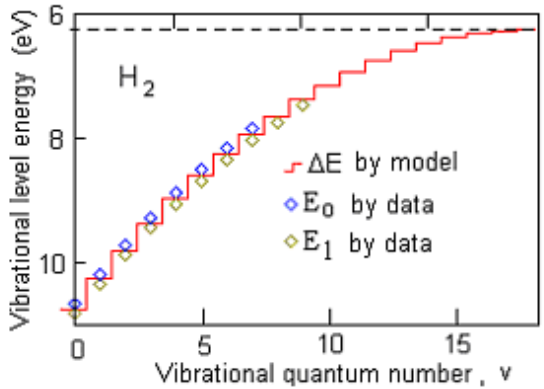


Using the particle data and the derived mass equation, the internal structure of the proton and neutron is identified. The calculated dimensions are verified by analysis of atoms connected in molecules and experimentally obtained bond lengths.







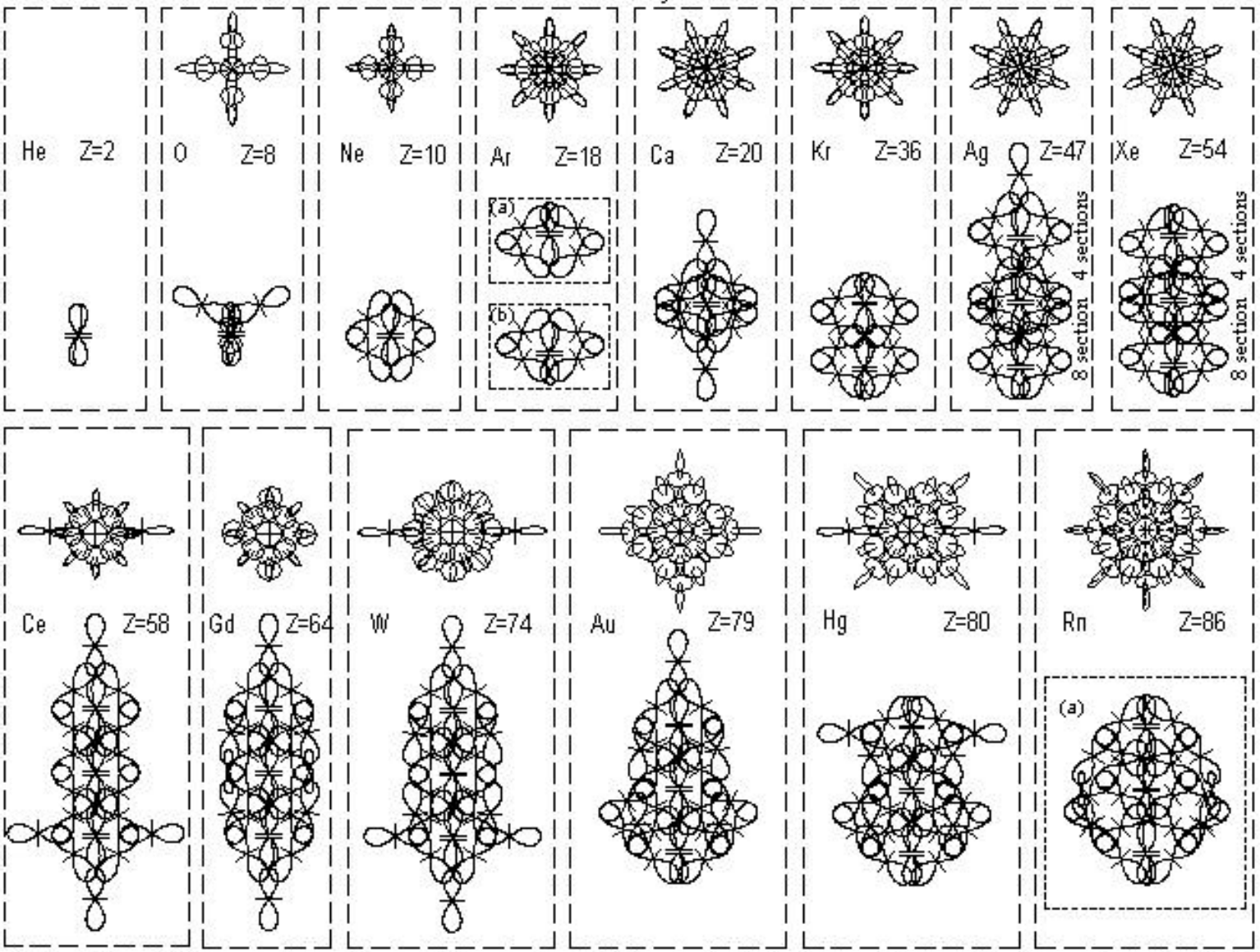


$$E_V = \frac{C_{SG}}{q[[[L_q(1)(1-\alpha^4\pi\Delta^2)]+0.6455L_p]^2} - \frac{2E_q}{q} - \frac{2E_k}{q}$$ - Vibrational energy levels

$$C_{SG} = G_0 m_0^{\,2} = (2h\nu_c + h\nu_c\alpha^2)(L_q(1)+06455L_p + 5.2651\times10^{-33}$$

$$C_{SG}/Gm_p^{\,2} = 2.82\times10^{31}$$ - Density ratio between SG and atomic matter

BSM Atlas of atomic nuclear structures Projection views of selected elements



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

Inertia beyond Newton's first and second laws (BSM-SG, Chapter 10)

Multiplying Eq. (6) by the electron's structure volume one obtains

$\vec{E}_{IFM} = P_P V_e = h\nu_c \alpha \vec{\upsilon} / c$ [J] – for a moving electron (13)

The vector E_{IFM}, called an Inertial Force Moment, allows to estimate the deviation energy of the folded CL nodes, displaced from their normal positions at velocity υ . It can be scaled for moving proton (neutron) using the volume ratio between FOHSs of electron and proton (equal to their mass ratio).

$\vec{E}_{IFM} = (m_p c\alpha)\vec{\upsilon}$ - for a moving proton; $\vec{E}_{IFM} = (m_n c\alpha)\vec{\upsilon}$ - for a neutron (14)

$\vec{E}_{IFM} = (c\alpha Au)\vec{\upsilon}$ - for an atom with an atomic mass A, u – atomic mass unit (15)

The vector E_{IFM} permits to transfer the concept of folded node energy to a solid object. The analysis of the force moment of a real body with a mass m in a free fall motion under acceleration g leads to the expression: $\Delta E_{IFM} = \alpha cmg$ The gravitational potential in the initial moment is: $U_G = GMm/R$. Dividing ΔE_{IFM} on U_G we get

$U_G / \Delta E_{IFM} = R/(\alpha c)$ [s] (16)

For a time interval equal to the Compton time Eq. (16) gives a value $R = \alpha c / \nu_c = 1.7706 \times 10^{-14} (m)$, which is twice the smaller radius of the electron.

Conclusion: The **CL nodes folds and deviate** around the small electron radius - an indication of its **inertial interaction** in CL space. The result is transferable to any elementary particle by referring its mass to the mass of the electron.

Fig. 21 shows a plot of Eq. (16) for solar planets and moons. All points lie on a predicted theoretical line, however, Mercury (number 15) appears in a reversed order.

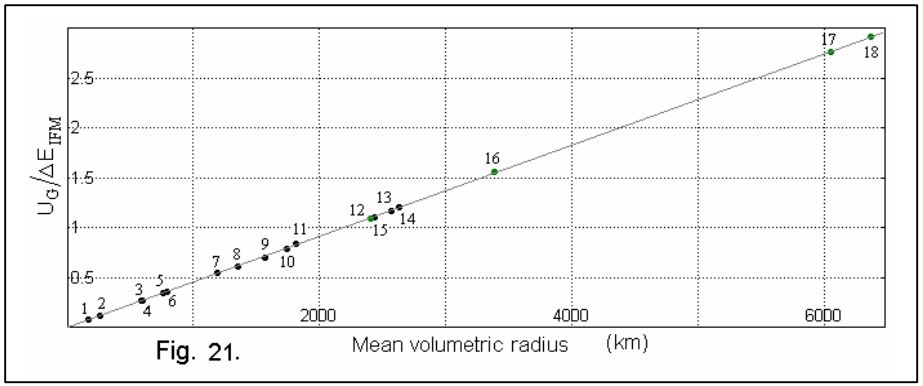


Fig. 21.

1 – Nereid, 2 – Vesta, 3, Umbriel, 4 – Charon, 5 – Oberon, 6 – Titania, 7 – Pluto, 8 – Triton, 9 – Europa, 10 – Moon, 11 – Io, 12 – Calisto, 13 – Titan, 14 – Ganymede, **15 – Mercury**, 16 – Mars, 17 – Venus, 18 – Earth. Mercury (number 15)

Fig. 22 shows a plot of the planetary and moon masses versus their volume.

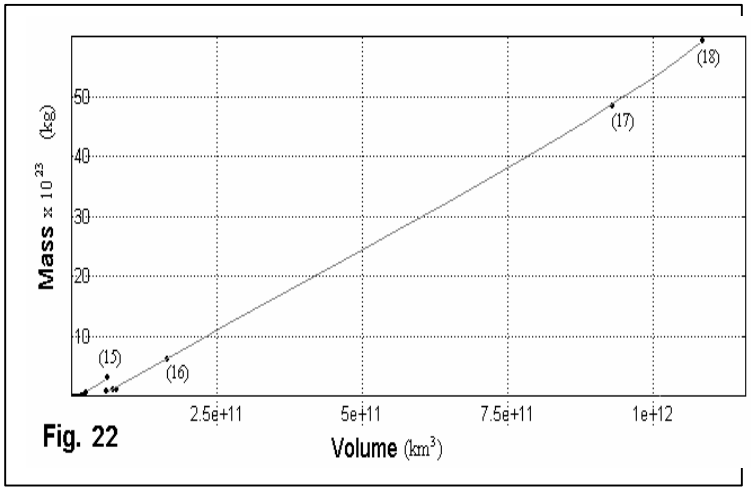
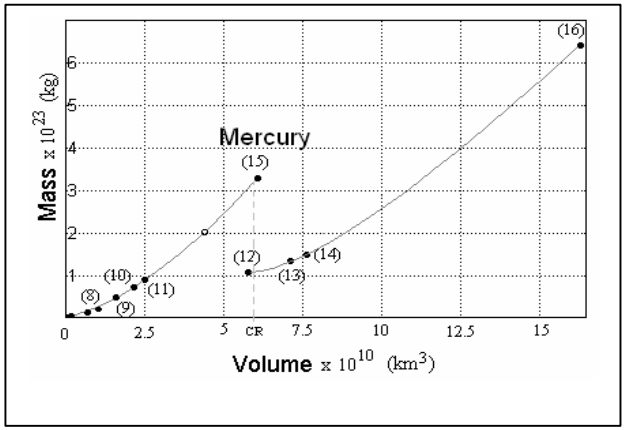


Fig. 22



Expanded view of the broken trend

Hypothesis: Protons and neutrons in the central region may crush forming a denser bunch of straight FOHSs. Such formation may cause a strong magnetic field. This is in agreement with the formations of pulsars from collapsing stars (Chapters 10&12).

The square of the ratio between the E_{IFM} and the kinetic energy of the planet is

$$\left[\frac{E_{IFM}}{E_K}\right]^2 = \frac{4\alpha^2 c^2}{GM_S} r = C_E r \qquad (18)$$

Using the solar mass $M_S = 1.9891 \times 10^{30} (kg)$, one obtains $C_E = 1.44238 \times 10^{-7}$.

Fig. 23 shows a plot of $[E_{IFM}/E_K]^2$ versus the mean orbital radius r for the solar planets. The slop of the fitted line gives a data value of C_E, which differs from the theoretical one only by 0.06%.

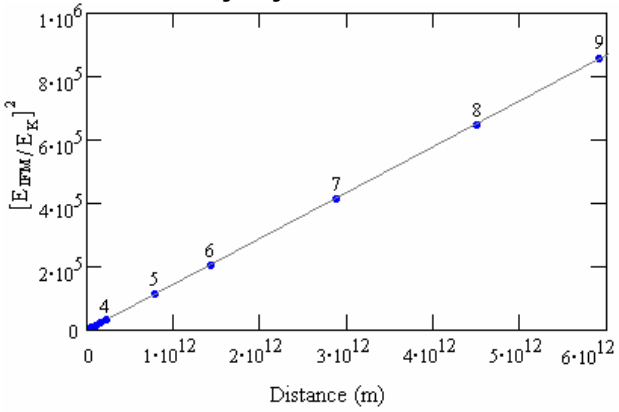


Table 2. Solar system planets.

1.Mercury	**6. Saturn**
2.Venus	**7. Uranus**
3.Earth	**8. Neptune**
4.Mars	**9. Pluto**
5.Jupiter	

Conclusions:

The expressions from (11) to (16) and corresponding plots indicate that the **fine structure constant (α) plays a role in the inertial interactions**. Indeed, dividing Eq.(6) on Eq. (4) one obtains an expression dependent only on **(α)**

$$P_P / P_S = \alpha^2 / \sqrt{1-\alpha^2} \quad \text{(for optimal electron velocity (13.6 eV)} \qquad (19)$$

(For suboptimal velocities of 3.41 eV and 1.51 eV the ratio (19) is divided on 2 and 4).

$\boldsymbol{P_S}$ is related to the mass and $\boldsymbol{P_P}$ to the dynamics (for particle, atom, molecule and solid object). Eq. (19) indicates that the CL space defines a preferable ratio between the mass of an object (or system) and its kinetic energy. This ratio might have a signature in the galactic rotational curve and the evolution of the galaxies from S0 to SB or Sc branch. This conclusion comes from the BSM-SG analysis of the galactic rotational curves for different types of galaxies provided by Rubin et al. [26] and other papers.

Indication of our motion through a CL space of Milky Way: the preferable orientation of the polar axes of the solar planets in respect to our galactic rotation

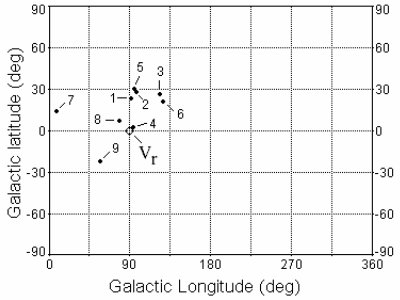


Fig. 24. Solar system vector V (estimated by extragalactic sources and North pole axes of the solar system planets in galactic coordinates.

1. Mercury
2. Venus
3. Earth
4. Mars
5. Jupiter
6. Saturn
7. Uranus
8. Neptune
9. Pluto

According to BSM-SG (Chapter 12), **the individual galactic CL space serves as an absolute space, while the galactic matter may wobble**, so the solar system velocity estimated by extragalactic sources may not coincide with the direction of our absolute motion. Now modern laboratory Ether-drift experiments detect the velocity vector of our motion through the absolute space [4,5,6,7,11].

Galactic (cosmological) redshift: - not a Doppler type, but a result of energy losses caused by multiple wavetrain refurbishing of the photon when crossing the boundaries between the galactic CL spaces. **One signature of this phenomenon is the Lyman Alpha Forest.** The Universe is stationary. The corrected distance for a redshift of **z** is

$$r = \frac{c^2 \ln(\tilde{n})}{\tilde{L} H_0} \int_0^z \frac{x}{\ln(1+x)} dx \qquad (20)$$

where: $\tilde{n}$ - an average quasirefractive index obtained from the mean number density of the Lyman alpha forest lines in a signal from a distant quasar [27], $\tilde{L}$ - an average distance between the neighboring galaxies, H_0 – Hubble constant, c – velocity of light

Figure 25 shows a Hubble plot from experimental data for z up to 1.75 [28], while Fig. 26 shows the theoretical plot of Eq. 20, normalized to the constant $(c^2 \ln(\tilde{n})/\tilde{L}_0 H_0)$.

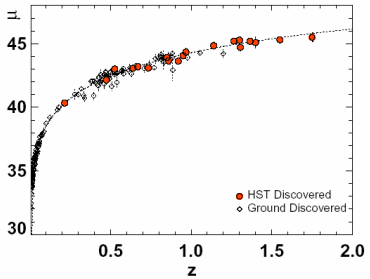


Fig. 26

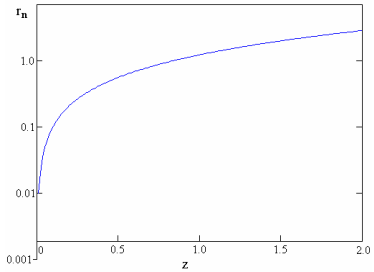


Fig. 27

A new interpretation of the Einstein's equation $E = mc^2$

Annihilation or creation of matter is impossible, mass is not equivalent to matter.

$mc^2 \rightarrow E$ - valid for the of Newtonian mass disintegration (in particle collision experiments) or hiding of the positron's mass inside of the electron structure

$E \rightarrow mc^2$ - valid for creation of a virtual particle (not possessing matter)

$E \Leftrightarrow mc^2$ - valid for the binding energy in atomic nuclei, as a result of small change of the CL space node distance in presence of matter.

Conclusions: A new vision about space, Universe and Micro-Cosmos

- **The galactic redshift is not of Doppler type. The Universe is stationary.**
- **Every galaxy has its own cycle comprised of a visible active life and a hidden phase of matter recycling. The Gamma Ray Bursts (GRB) are detectable signatures of a birth or collaps of a galaxy. The Globular Clusters and some irregular galaxies (like Sagitarius) are remnants from the previous galactic life, which have escaped the collapse.**
- **The physical vacuum contains underlying superfine material structure**. It defines space-time, Quantum Mechanical and Relativistic properties of the space and is responsible for propagation of the Gravitational, Electrical and Magnetic fields.
- **The Supergravitational law is the most fundamental law in Nature.**
- **The fundamental laws of Physics are embedded in the superfine material structures of the physical vacuum and the elementary particles.**
- **The fine structure constant is embedded in the basic level of matter organization, while its signature is propagated in the upper levels.**
- **The space contains hidden energy, which is not of EM type.**
- **Gravitation and inertia are not intrinsic features. They could be manageable by proper modulation of the parameters of the physical vacuum.**

BSM-SG publications

- First publication in: **www.helical-structures.org** (regularly updated web)
- First and second electronic editions archived in National Library of Canada, (2002 and 2005)
- Article about the electron in **Physics Essays** (2003) and other articles in the on-line **Journal of Theoretics**.
- A poster report in Physics of the IIIrd Millennium Conference, 3-5 Apr 2005, Huntsville, AL, USA
- Book ***Beyond the Visible Universe***, 2005 (popular presentation)
- Book ***Basic Structures of Matter–Supergravitation Unified Theory***, 2006 Trafford Publishing, Canada – full theory (paper back & electronic book)

- Book review in **Physics in Canada**, issued by the Canadian Association of Physicists
- Presentations in other conferences and seminars