Chapter 2. Matter, space and fields

2.1. Alternative concept about the physical vacuum and material structure of the sub-elementary particles.

The main objective of the BSM thesis is a building of a functional base for Unified theory operating in a real three-dimensional space and unidirectional time. In such aspect the BSM thesis adopts approach in which the principles of real objectivity, causality and validity of the human logic are strongly observed. Consequently, the BSM approach differs from the approach adopted by the Modern physics, where some of the above principles could be violated.

One of the main difference from the existing so far theories, however, is the concept about the space in which we live and observe, known as a physical vacuum. BSM thesis is based on an original alternative vacuum concept that has not been explored so far. Such concept requires reformulation of some of the adopted by the Modern physics postulates and laws, however, it leads to analytical methods in which the guiding role of the logical understanding is extremely powerful. The benefit is that tough physical phenomena from different fields can be analysed with unbelievable success.

The alternative vacuum concept admits that the space is not void but containing underlying structure of distributed hidden matter of some more primary form than the known elementary particles. These structure is quite distinctive from the concept of ideal gas or the Ether models, which dominated before the 20th century.

The new approach puts the matter existence as a primary fundamental concept, while the energy is always its attribute. The matter may exist in hierarchical levels of formation and it is quite reasonable to admit that some lower levels in a microscale range is beyond the present technological limit of detection. Then some destruction of structural formations to a level below the detection limit may seam for us as a matter annihilation.

The above considerations requires broader formulations of some fundamental concepts about matter, space and energy, in accordance of the adopted principles of real objectivity, causality and understanding:

- definition of absolute space in a classical way, free of relativistic considerations
- definition of structured space as a three dimensional grid, whose properties are defined by the spatial order and properties of some basic sub-elementary particles.
- a logically expecting option that the elementary particles also possess a structure in which the same sub-elementary particles are including as building blocs

The introduced definitions must provide a bases for the following:

- an understandable logical explanation of the Quantum Mechanics, the relativistic phenomena and the space-time features of the space and matter as interactions between the atomic substructures and the structured space
- an understandable logical explanation of the basic physical parameters as mass, inertia, and field properties as interactions between a structured space and the elementary particles possessing an underlying structure.

In some level of matter organization lying in the hierarchy below the known stable elementary particles (proton, neutron, electron, positron) we may expect a common sub-elementary particles that could be building blocks for both - the structured space and the elementary particles. In search for such particles it is a reasonable to expect that they should posses features for explanation of the field property of the matter and the quantum features of the space. Extensive analysis of phenomena from different fields of physics allowed to formulate the search criteria for the possible physical model of this structure. Its properties must explain the basic physical effects in the complex relation "matter - energy - space - time - gravitation - fields". The search for the correct model took also into account number of recently published theoretical articles about the vacuum properties. They are related with some features, such as the Zero Point Energy, the quantum fluctuations and the polarizability of the vacuum. Number of theoretical works in this field are provided by T. H. Boyer, H. E. Puthoff, A. Rueda, M. Ibison, B. Haisch and others.

The defined criteria allowed to narrow the range of search, so one of the most promising model is suggested. According to this model, **the vacu-**

um space possesses a underlying grid structure of sub-elementary particles arranged in nodes.

The most promising candidates for such sub-elementary particles appeared to be a **pair of profiled rods with shape close to hexagonal prism, made respectively by two different substances of intrinsic matter, possessing gravitational anisotropy and embedded helicity in their lower level structure.** The possible lower level structure of the suggested profiled rods and how they are formed is discussed in Chapter 12. **For simplicity of the visualization and analysis, the suggested profiled rods are replaced by three-dimensional models of right handed and left handed hexagonal twisted prisms.** These models are convenient for visual presentation of the unveiled structure of the vacuum space and the elementary particles. For this reason we will use the concept of the twisted prisms during the course of BSM theory. The chosen model of twisted prism is suitable for understanding the very basic matter properties in a structured space without an initial knowledge of underlying structure of the basic particles. However we need to know some of the basic properties of these particles in order to understand the physical processes of their interactions. So we will define a priory some of their properties with the presumption that they will be confirmed later in the course of the theory.

The shape of the twisted prisms are shown in Fig. 2-1.

Some of their basic properties are the following:

- **The model of the basic particles in the observable Universe are left handed and right handed twisted prisms, made of two substances of intrinsic matter.**
- **The left handed prism has a scaled mirror image similarity with the right handed one. The dimensional scale factor between the left and right-handed prisms is 3/2.**
- **The attraction forces in empty space between two prisms of same handedness (a same intrinsic matter substance), is not the same as between two prisms of different handedness (different intrinsic matter matter substances)**
- **The length to diameter ratio of both prisms has a minimum acceptable value dependable of twisting angle.**
- **The two ends of the prisms are rounded**
- **There are bumps on any surface of the hexagonal rods (prisms) as shown in the Fig. 2.1, obtained during the phase of their formation.**

Fig. 2.1.a. shows sketches of left and right handed twisted prisms, that are accepted models of the real prisms. Fig. 2.1.b. shows the external shape of the real prisms with

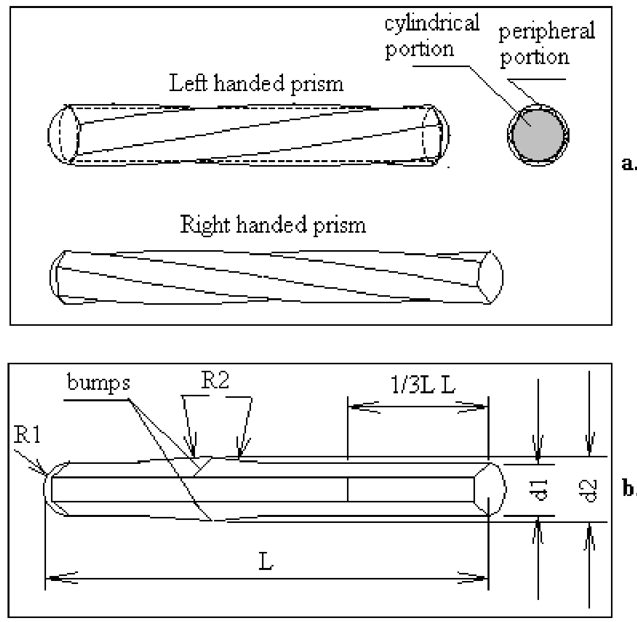


Fig. 2.1

a. Model of twisted prisms (with external twisted shape)

b. Real shape of the real prism (with internal twisting)

The approximate length of the longer prism (estimated in the following later analysis) is in a range $(1 \sim 10) \times E^{-21}$ (m)

2.2 Basic definitions and physical laws.

2.2.1. Adopted terms and definitions

Using the suggested model of twisted prisms it is possible to present models of major formations: the structured space and the stable elementary particles from which the atomic matter is built.

BSM relies strongly on the principles of real objectivity and causality. This leads to the following considerations: **All physical processes are**

in three dimensional space and the time is unidirectional. This allows using a classical physical approach in the analysis of any kind of physical phenomenon. For this reason two types of spaces are defined:

- **Empty space** (or not structured space) - the space properties are not influenced by the matter
- **Lattice space (**structured space**)** - the space properties are influenced by the matter

The lattice space contains gravitational lattice structure. The space properties are defined by the parameters of this structure.

The lattice space and the atomic matter (whose lower level is the level of the elementary particles) are both built by the basic particles - the prisms.

The adopted above definition of two type of spaces provides a possibility to study the properties of the structured space (the vacuum), and the elementary particles. For this purpose two types of 3-dimensional frames are used:

- **Lattice frame**
- **Absolute frame**

The lattice frame corresponds to the space known in our world with its quantum properties and relativistic features.

The absolute frame is introduced for convenience. For this frame the classical definitions of space and time are valid. Physically it is a classical 3D empty space but usually it is filled with a Lattice - the unique vacuum structure. Theoretically we may investigate the phenomena of the structured space if having two absolute etalons: for length and for time. Let initially define the following etalons for length and time:

- **absolute length unit -** the stable length of one of the prisms

- **absolute time base** - a mode frequency of the intrinsic gravitation of the prism.

The meaning of the absolute time base that is an attribute of the Intrinsic Matter (discussed later) could be understood in the final chapter, as it is difficult to be explained here. During the analysis in this and following chapters, however, we will find many signatures of secondary time bases**.** One such useful **secondary time base is the Compton frequency that appears to be a signature of both: a specific oscillation property of the space lattice structure and the oscillation property of the electron.** The electron structure is unveiled and discussed in Chapter 3, where it is shown that it is a 3 body structure with two proper frequency. The first proper frequency, namely, is the well known Compton frequency.

According to a BSM approach the structure of the vacuum and the matter are always regarded as placed in an absolute frame. The definition of lattice frame and absolute frame provides the opportunity to separate the time-space parameters in the analysis. This is impossible if the vacuum structure is unknown as in the present state of Modern physics. Once this structure and its properties are unveiled, the quantum mechanical and relativistic phenomena could be analysed and physically understood.

2.2.1.A Level of matter organization

It will become apparent in the following chapters that the intrinsic matter possesses a broad range of organizational complexity in which hierarchical level could be clearly distinguished. In such space it is useful to introduce a term **level of matter organization**. The suggested model of twisted prisms does not belong to the lowest level of matter organization, although, it is convenient for analysis the structure of the space and the elementary particles using the present knowledge about their properties. The possible lower level structure of the prisms is discussed in Chapter 12., after some important features in the upper level structures become apparent from the analysis in the previous chapters. It is useful at this stage to list some features about the matter organization in different levels, while they will become apparent in a later analysis.

- The formations belonging to any lower level of matter organization are implemented in the upper higher level with their restricted freedom of vibrational modes and energy exchange.
- Any lower level formation possesses higher frequency vibrational modes in respect to the upper one.

 (corrected December 2003)

2.2.2 Adopted postulates and basic physical laws

One of the main goals of BSM theory is to reduce the number of postulates to a minimum. From the other hand, the structural pyramid of matter organization is so big that it is not convenient to refer always the complex processes to the vary basic postulates. One good feature of the BSM approach is that many postulates accepted by the contemporary physics (for example the constant light velocity) appear derivable. In order to simplify the analysis while keeping a close link to the present knowledge, in the same time, **two type of postulates are adopted in BSM: basic and derivable.**

The validity of the adopted basic postulates comes partly from the accumulated scientific knowledge and partly by the following later BSM analysis.

The derivable postulates, rules and laws are result of the adopted basic postulates. They are not so apparent in the beginning but are derivable from the analysis.

2.2.2.1 Basic postulates and parameters

A. The energy conservation principle

B. The energy could not be separated from the matter

C. The gravitation is a form of energy exchange between intrinsic matter objects involved in the total energy balance of the system.

D. Basic physical parameter: The fine structure constant α

2.2.2.2 Derivable postulates, rules and laws

A. Valid for the both types of space (later defined as an empty and lattice space)

- **The most efficient and fast energy exchange between the separate systems is by multiple oscillations in a frequency range closer to the system resonance frequencies**
- **The oscillation frequency of the energy exchange is quite distinctive for the different level of matter organization. Lower level formations exchange energy at higher frequencies**

B. Valid in lattice space only

- **The lattice space contains distributed matter connected by a static and kinetic energy (two types of the Zero Point Energy)**
- **The validity of number of postulates adopted by the contemporary physics is preserved (a constant light velocity, the equivalence principle, the relativistic phenomena)**
- **The validity of the basic laws adopted by the contemporary physics is preserved: Newton's gravitational law, the laws of inertia, the rules in Quantum mechanics and so on.**
- **The validity of the basic physical constants is preserved, for instance:** μ_0, ε_0, h, q, λ_c, G, m_e, m_p
- **The difference between the parameters of both type of intrinsic matter substances leads to a complex energy exchange between the formations in higher level of matter organization**

C. Laws, valid in empty space only

Some of the physical laws in empty space are different from the laws in the lattice space.

- **The law of intrinsic gravitation is a modified version of the law of universal gravitation.**
- **The inertial interactions between matter objects in empty space are different than in the lattice space.**

The gravitation between intrinsic matter will be called an **intrinsic gravitation (IG) and the corresponding forces of attraction, respectively, intrinsic gravitational (IG) forces.**

The main difference between the Newton's law of gravitation and IG law is in the inverse power degree of the distance. The attraction forces according to the Newton's gravitational law (known as universal) are inverse proportional to the square of the distance. The attraction Intrinsic Gravitational forces in an empty space (classically pure void) are inverse proportional to the cube of the distance, according to Eqs. (2.1)

$$F_{ig} = G_o \frac{m_{o1} m_{o2}}{r^3} \tag{2.1}$$

where: m_o is the intrinsic gravitational mass of the particle made of intrinsic matter; F_{ig} - is intrinsic gravitational force in empty space; G_o is the intrinsic gravitational constant in empty space;

r - is the distance in an absolute frame

It is assumed that the IG force is related to the theoretically known physical parameter called Planck's frequency, ω_{PL}

$$\omega_{PL} = \sqrt{\frac{2\pi c^5}{hG}} \qquad (2.0)$$

In the article "Gravity as a zero-point fluctuation force", H. E. Puthoff (1989) begins from the equation of the Planck's frequency and using one hypothesis of Sakharov successfully derives the Newton's law of gravitation. This result is used as a valuable initial point in BSM concept. Relying on the Planck's frequency as a real physical parameter is a step in a right direction in the process of building the BSM concept. The confidence about this is increased by the results obtained latter from the analysis of the derived models and their consistency with known physical parameters and experimental results.

The intrinsic gravitational constant G_o could be different from the known gravitational constant G. The latter is measured and valid for a lattice space.

The intrinsic gravitational constant may also have two different values for the objects of the two substances of the matter:

G_{os} - for IG force between objects made of same intrinsic matter substance

G_{od} - for IG force between objects made of different intrinsic matter substances

The following relation between the two gravitational constants is accepted initially, but its validity becomes apparent later.

$$G_{os} > G_{od} \qquad (2.1.a)$$

The relation (2.1.a) becomes apparent in the analysis of some properties of the two types of prisms in Chapter 6 and the lower level structures involved in the prisms in Chapter 12.

The application of the law of inertia for the objects made of intrinsic matter like prisms is different from the objects in the macroworld. The objects in the macroworld are complex formation of prisms, that could be referred as ordered structures. The ordered structures operate in a lattice space, where the gravitational lattice is responsible for the inertia and for which the Newton's first law is valid. However, single prisms and simple formations of prisms put in empty space, interact differently.

The gravitational and inertial properties of material objects are different for:

- formations of different level of matter organizations

- formation of same level of matter organization but put in different space environments: (a pure empty space or a lattice space).

In order to distinguish the above mentioned differences, the following terminology is introduced:

- **intrinsic gravitational mass** - according to the law of the intrinsic gravitation given by eqs. (2-1)
- **apparent gravitational mass (or Newtonian mass)** - the mass of ordered structures in a lattice space (the mass we are familiar with)
- **intrinsic inertial mass** - defines the inertial property of the intrinsic matter in empty space
- **apparent inertial mass (or inertial mass we are familiar with)** - for the ordered structures in lattice space

In order to give some preliminary vision for the mentioned differences, Fig. 2.2 illustrates two objects of same level of matter organization but in two cases: in a pure empty space and in a lattice space.

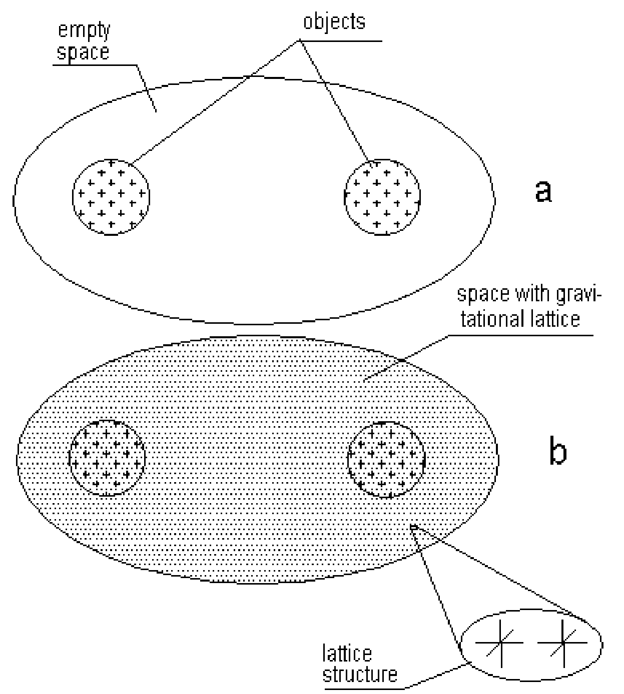


Fig. 2.2
Objects of rarefied matter in empty space (case a) and immersed in a lattice space (case b)

In case **a.** two objects of rarefied matter are placed in empty space. In case b. the same objects are placed in a lattice space (immersed in a gravitational lattice). In the first case we have intrinsic gravitational interaction between two intrinsic masses. In the second case the gravitational lattice will change significantly the gravitational attraction between the immersed two objects. In the same time the inertia will be also affected. The inertia in case **b.** will be much larger, than in case **a.** due to the increased interaction between the rarefied system from one side and the lattice from the other. The two objects may have own lattice configurations. So they may be regarded as body systems with own properties. The two body systems may affect the surrounding lattice, forming a local lattice space. In such case, the interaction between the body system with its local field and the global system **may involve folding and unfolding of the lattice nodes** (these unique features of the lattice node will be discussed later). The folded lattice nodes are able to pass through the normal lattice space, so their interactions with the rarefied objects may define the inertial properties of that object in a lattice space. The inertial properties of the particles and macrobodies in lattice space are theoretically analysed in Chapter 10.

2.3 Guessed property of the intrinsic matter

The guessed property of the two substances of the intrinsic matter are envisioned by analysis of selected geometrical structures in a lattice space leading to logical explanation of fundamental physical processes. The criterion for validation of the apriory accepted properties is the agreement between the theoretically derived results and the corresponding results from observations and experiments. This has been an iterative process until the correct model and properties are unveiled. The correctness of the presented here features as “apriory properties” will become apparent during the course of BSM presentation.

Apriory accepted properties of the intrinsic matter:

- **Two substances of intrinsic matter exist. Their lower level structures are not mixable due to their different parameters, such as specific intrinsic density, different intrinsic time constant and as a result - different IG constants**
- **The IG attraction law for object of intrinsic matter in empty space is inverse proportional to the cube of distance between them. The IG constant for object of same substance is one and a same, but for objects of different substances is different and could even reverse the sign of the IG forces**
- **The shape of the basic particles is obtained under enormous pressure during a phase of formation (a hidden phase of a galaxy existence, discussed in Chapter 12). Their low level structure could not be changed even in the high temperature processes in the stars.**

The assumption for different specific IG of both substances comes from number of considerations that will be mentioned in the course of BSM presentation. The mentioned above possibility for inverting the IG forces are discussed in Chapter 12.

During the course of the BSM theory, an evidence will be provided, that the length ratio, between the two prisms is 2/3. This is the ratio between the left and right handed prisms (if the assignment of the handedness is correct).

$$L_R/L_L = 3/2 \tag{2.2}$$

The same ratio between their circumscribed radii is accepted. The analysis of the atomic particles shows that the physical dimensions of one of the prisms have to be larger than the other. The same consideration is necessary for the existence of the gravitational lattice structures and the explanation of the crystallization process of the subatomic particles. While accepting a dimensional similarity between the both type of prisms, their volume ratio is not a same as their length ratio.

$$V_R/V_L = 27/8 \tag{2.2.a}$$

From these considerations, an initial guess for the specific weight ratio of the two substances could be obtained.

The intrinsic forces between a pair of left handed and pair of right handed prisms in empty space are given respectively by Eqs. (2.3) and (2.4).

$$F_L = G_{os}\frac{{m_L}^2}{r^3} = G_{os}\frac{V_L^2\rho_L^2}{r^3} \tag{2.3}$$

$$F_R = G_{os}\frac{{m_R}^2}{r^3} = G_{os}\frac{V_R^2\rho_R^2}{r^3} \tag{2.4}$$

where: m_L and m_R are the IG masses of the left and right handed prisms;

V_L and V_R are their volumes, ρ_1 and ρ_2 are the specific IG weights of the two intrinsic substances.

Making a ratio between both forces and having in mind Eq. (2.2) and dimensional ratio $R_L/R_R = h_L/h_R$, we arrive to the expression for the ratio between their intrinsic matter densities.

$$\frac{\rho_L}{\rho_R} \geq \frac{8}{27}\,; \qquad \frac{\rho_L}{\rho_R} \neq \frac{8}{27} \tag{2.5}$$

where: R_L and R_R are the equivalent radiuses of the two prisms, regarded as cylinders, ρ_L and ρ_L are their intrinsic matter densities

The IG force between two prisms of different matter substances is:

$$F_{R\_L} = G_{od}\frac{V_R\rho_R(V_L\rho_L)}{r^3} \tag{2.5.a}$$

$$F_L/F_R = 1/4\,. \tag{2.5.b}$$

This difference allows selectiveness in the attractions between prisms. **Prisms of same substance (and handedness) are attracted stronger.** This feature is very important factor in two important cases: the self creation of the lattice space from free prisms and in the phase of particle crystallization. (Additional possible differences based on IG interactions between the two intrinsic matter substances become apparent in the hypothesis of the mechanism behind the IG interaction, discussed in Chapter 12).

In Eq. (2.5.b) the distance parameter r is eliminated. But in the further analysis we will need this parameter. We must keep in mind also that the two type of prisms have a length ratio of 2:3. According to the definition of **absolute frame** in §2.2.1 we need a reference length, so we must selected one of the prism as an absolute etalon length.

In §2.6 the underlying structure of the vacuum is presented. We live and observe phenomena only in a lattice space and we operate with a length unit. According to the Modern physics, the length unit is related to the light velocity. From a point of view of BSM it is not a primary but a secondary etalon for length, however, it is involved in all our physical measurements. So we must use a common etalon for length in order to analyse and determine the vacuum structure parameters. The common length reference in a prism's level is discussed in Chapter 6. It gives a bridge to the length unit we use in the Modern physics today. Following the adopted concept that the same intrinsic matter substances are attracted much stronger means that for a common unit length the following relation is valid:

$$G_{os} > G_{od} \tag{2.6}$$

The above relation may obtain a logical sense if accepting that IG force between two objects of intrinsic matter are related with some **super high intrinsic frequencies** of the low level structures contained in the prisms. These frequencies could come from some intrinsic features of the two intrinsic matter substances related also to their specific intrinsic density. The both substances should have different intrinsic frequencies. In this case the IG attraction between same substances could be regarded as interaction based on a same intrinsic frequency. In the case of different substances the IG interactions are characterised with different intrinsic frequencies. In Chapter 12 some insight about the possible explanation of IG forces is discussed. A model of IG interaction is presented (related with a resonance type of energy interactions at superhigh intrinsic frequency).

The assumption of super high intrinsic frequency automatically leads to existence of **intrinsic time constant**. This constant is intrinsically small as we will find in Chapter 12, but it is a necessary factor for explanation of the inertial interaction processes between objects of intrinsic matter in empty space.

The existence of super high intrinsic frequency and intrinsic time constant of the intrinsic matter will become more apparent through the course of the BSM.

The provided below results of calculations show how the mentioned above conditions are satisfied for a proper relation between the IG constants. The calculations are made for diameter to prisms peripheral length ratio 1/6, and for IG constant relation $G_{od} = (2/3)G_{os}$ The rounded ends of the prisms are also included as hemispheres. If assuming a ratio of $\rho_R/\rho_L = 1/3$, and keeping the prism dimensions unchanged, we get the following force ratio for the three combinations of prism pairs.

$F_{(\text{right pairs})}/F_{(\text{left pairs})} = 1.265$
$F_{(\text{right-left pair})}/F_{(\text{right pairs})} = 0.5927$

$F_{(\text{right-left pair})}/F_{(\text{left pairs})} = 0.7493$

One useful parameter is the IG mass ratio between the both type of prisms:

$m_R/m_L = 1.125$

where: m_R and m_L are respectively the IG masses of the right and left handed prism

The IG (intrinsic gravitational) masses obtain mathematical meaning according to IG law in empty space in a similar way as the masses in the Newton's gravitational low (valid only for a structured space). They could be considered as attribute of IG matter. The possible internal structure of the prisms is discussed in Chapter 12.

One important parameter of the externally twisted prisms (as a model) is the ratio between the volumes of the twisted peripheral part and the inscribed internal cylindrical core. For prisms with above mentioned length to diameter ratio, this parameter is 0.09239. This ratio appears close to some intrinsic ratio of the real prisms (discussed in Chapter 12).

The application of the twisted prism as a model simplifies of the real prisms provides a possibility to denote one parameter based on a simple geometrical feature, which is common for both type of prisms parameter of the both twisted prisms by a **pure geometrical relation.** This is the ratio between the volumes of the twisted peripheral part and the internal cylindrical part of the hexagonal prism. For this purpose the following abbreviations are introduced.

CP - the **central part** of the prism: the cylindrical part inscribed inside of the hexagonal section of the prism plus two semispherical ends

TP - the peripheral **twisted part** of the prism

2.4 Inertia of objects made of intrinsic matter in empty space.

Our every day perceptions does not give us enough indications that we may live in a world of structured space. We accept the inertia as a something natural in the nature. We never ask ourselves why the heavier objects need more energy for acceleration.

Let consider a simple example of pair flywheels possessing same external dimensions, but the first one is a solid body, while the second one is hollow. The solid one exhibits a larger inertia. When calculating the moment of inertia of a flywheel we reference velocity of the every mass point of the wheel to a fixed not rotational frame. Despite the fact that only the points lying on the surface are in touch with the external rest space, all the mass points in the solid flywheel contribute to the moment of inertia. Logically thinking it seams that these mass points move through some media.

According to BSM concept, we are immersed in fine structured space with a node distance much smaller than the physical dimensions of the elementary particles. Our experimental environments could never provide conditions for empty space. Therefore, our natural perceptions are based on the observations provided only in this environment and the derived laws are valid also for a structured space environment. Consequently, they can not be automatically transferred for an empty space conditions. For this reason we must define a more general criterion for inertia to be valid for low level structures in empty space. Later these criteria will be apply for the elements from which the structured space is built. The inertial criterion in empty space could be defined by introduction of a new term called **inertial factor.**

The inertial factor between simple objects of intrinsic matter, involved in repeatable motion, is equal to the ratio between their interaction energies and the mean gravitational energy averaged per one cycle.

$$I_F = \frac{E_I}{E_g} \qquad (2.6.a)$$

where:

I_F - is **the inertial factor**, and E_I is the interaction energy normalized to one cycle of repeatable motion.

$E_g = F_{ig}/d$ is the average IG energy (or potential), calculated for the distance d between their centres of repeatable motion and normalized also per one cycle.

The interaction energy can be expressed as a work. The gravitational energy also could be expressed as a work for moving of one particle from its position, corresponding to a distance d, to infinity.

The inertial factor in empty space does not appear so simple as the inertia of a Newton's mass in structured space. Firstly it could not be defined for a single object. Secondly, even for simple objects the inertial factor depend of the shape of the objects, their mutual space positions, the type of motion and the relative velocity between them.

The analysis of possible simple cases of interacting intrinsic matter objects in empty space provides the following results for the inertial factor:

(a) one object with any shape: the inertial factor could not be defined. There is not intrinsic interaction.

(b) two spheres: When rotating around their centres or around a common center, but keeping a constant distance between them, their inertial factor is zero. If the distance between them changes, the inertial factor obtains some finite value.

(c) two cylinders at fixed distances. 1) If they perform an own axial rotation about a common axis, their inertial factor is zero. 2) If they perform rotation or motion in result of which the common geometrical position changes, their inertial factor will have some finite value.

(d) two axially aligned twisted prisms, with fixed axial distance but with oscillating motion along their axes: The internal part of the prisms, regarded as inscribed cylinder (CP), will exhibit zero inertial factor for a case of rotation but some finite inertial factor for a case of axial vibration. The peripheral twisted part (TP) will exhibit non zero inertial factors for both : a rotational motion and an axial motion. The total inertial factor I_F could be expressed as a sum of two factors, one for the axial vibrations E_{vib} and a second one for the rotational motion E_{rot}.

$$I_F = \frac{E_{vib}}{E_g} + \frac{E_{rot}}{E_g} \tag{2.7}$$

(e) a set of left and right handed twisted prisms arranged alternatively, but with a constrain that the distance between the centers of vibration of the same type of prisms is kept constant.

The prisms will exhibit axial and rotational (spin) interactions. The axial interaction is contributed mainly by the inscribed cylindrical part (CP). For case **e.** the following conclusion can be made:

Conclusion 2.4.1: The momentum interaction from axial vibrations, contributed by inscribed cylindrical part (CP), has one and a same sign for the right and left handed prisms. The net algebraic sum of interaction energy for axial vibrations for a volume containing a large number of ordered prism pairs could become equal to zero.

The momentum interaction from the axial and rotational motion, due to the twisted peripheral part (TP) of the prisms has different sign for the right and left handed prisms. The net algebraic sum from the (TP) interactions will have a finite value different than zero.

The energy conservation principle requires the motion invoked by intrinsic interactions to be performed for a finite time. This is valid also for two intrinsic matter bodies left under IG forces. Evidently some intrinsic parameter of the intrinsic matter should be defined. We can call it an **intrinsic time constant**. It will determine how fast the interactions between simple shape objects of intrinsic matter in empty space will be performed if they are suddenly left in a condition of free motion due to the IG between them. This parameter could not be zero, because in such case the interacting objects will get infinite velocity that leads to violation of the energy conservation principle. The intrinsic time constant is related to the intrinsic super high frequency of the intrinsic matter, discussed in the previous paragraph. In the course of BSM it will be shown that the structured space also possesses a characteristic time constant, but the intrinsic time constant of the intrinsic matter is much smaller.

Finally we may define some of the basic properties of the accepted basic particle and their representative model: the twisted prisms.

- **Any prism looks one and a same, when viewing from both ends, although, the both type of prisms are always distinguishable by the direction of their twisting.**
- **When turning around axis perpendicular to their cylindrical axis, the prisms obtain the same spatial position for rotational after a rotational angle of 180 deg. Then mathematically the spatial orientation of the prisms could be described as opposite but not vanishing vectors, possessing a common origin point.**
- **The IG field of the twisted prisms is anisotropic and characterized by a vector possessing two components: axial and rotational**

Some of the last feature signatures will become more apparent during the later analysis and especially in the analysis of the lowest level structures in Chapter 12.

2.5 Dynamical interactions between spatially ordered prisms

Let analyse some simple interactions between aligned prisms in empty space. In Fig. 2.3.a the left and right prisms are aligned in their common cylindrical axis. If the prisms L1 and L3 rotate synchronously with variable speed, the middle prism L2 will tend to rotate with the same speed and direction, without getting any translational moment. From the other hand, the prisms R1 and R2 will get a translational moment due to the peripheral IG interaction, caused by the different helicity (handedness). The distances d will be not affected, but the distance x will be affected by the peripheral IG interactions. We can call this type of interaction an **axial interaction**. The interaction effect is the same if the prisms L1 and L3 are fixed and R1, R2 are free to rotate and translate.

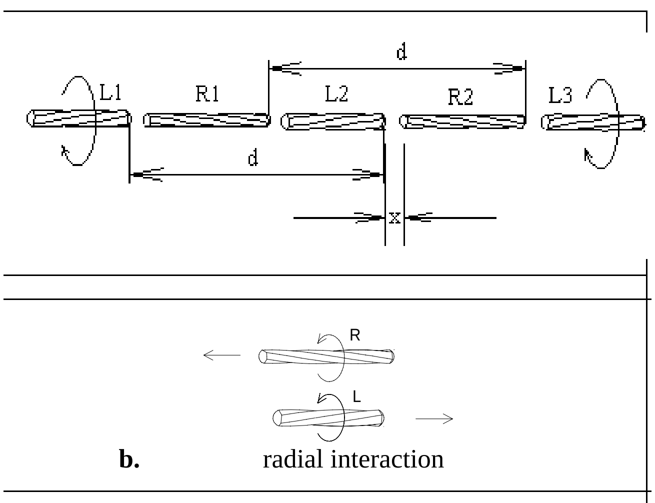


Fig. 2.3
Interaction between spatially ordered prisms in a classical void space

In Fig. 2.3.b. a pair of right and left handed prisms are parallel each other. If both prisms get angular momentums in a same direction, the interaction will cause momentums with axial components in opposite direction, so they will tend to separate. If the angular momentums are in opposite direction, they will tend to stay together. If instead of right and left handed, we have pair prisms of same handedness, the interaction will keep them together. We will call this type of interaction a **radial interaction.**

We could refer to the both effects of interaction, simply as, a **pair prism interaction.**

From the analysis of the dynamics of interactions it becomes evident that a group of moving and spinning prisms will have enhanced common inertial properties. This will lead to some preferable spatial distribution for the prisms of such group. For example: a single left handed prisms in a bundle of right handed prisms will get relative momentum with direction in order to escape the bundle. In the same time, the spinning prisms with a same handedness, in a bundle, will exhibit common inertial interactions that will keep them together.

We can summarize the following basic inertial properties of a group of spatially ordered prisms.

- **Group of spatially separated prisms of same handedeness with common axial alignment, moving and rotated in a same direction, will have common interactions tending to equalize their velocities. The intrinsic inertia of such bundle is larger than the product of inertial interaction between pair prisms multiplied by the number of pairs in the bundle.**
- **An uniform spatial lattice structure formed of prisms will have a constant inertial factor. (this conclusion is provided in §2.6.2)**

2.6. Gravitational lattices in empty space.

2.6.1. Types and general properties of the gravitational lattices

The gravitational lattice is an ordered 3 dimensional spatial structure, composed of prisms, held only by intrinsic gravitational forces. Ignoring firstly the boundary conditions, the basic requirements to the lattice is to be a stable. This means that the return forces acting on a unit cell should be conservative. In other words a displaced single node should have a tendency for returning to the range of stable positions. Some types of lattices are stable if proper boundary conditions exist.

Let consider the following three types of gravitational lattices whose existence exist in empty space could be possible: a **mono rectangular**

lattice (RL), a **mixed rectangular lattice** and a **cosmic lattice (CL)**. Anyone of these structures contains a unit cell that we may call a **lattice node**. It is formed of exactly defined number of prisms of same type hold together only by the IG forces. The inverse cubic law (about distance) dependence of the of these forces becomes apparent from the following later analysis.

Rectangular lattice composed of same type nodes is illustrated in Fig. 2.4. It could be referenced also as a monorectangular lattice.

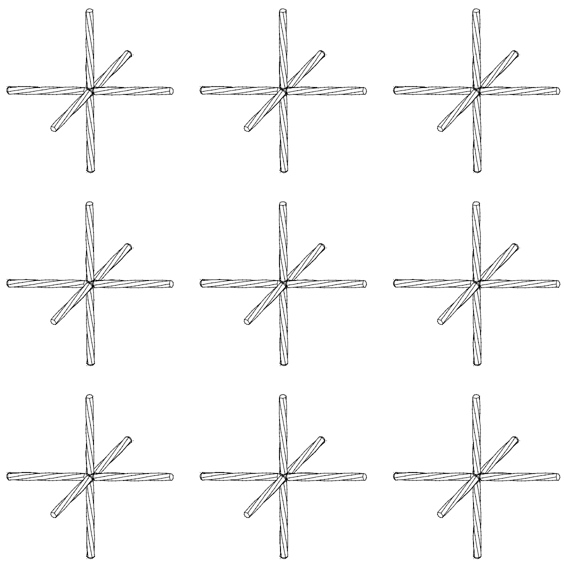


Fig. 2.4
Mono rectangular lattice
(only one layer is shown)

The mono rectangular lattice is dependable of the boundary conditions. They may cause a deviation of the lattice cell from a cubic shape. The mono rectangular lattice is able to exist inside of long cylindrical space. In such case the unit cells of the rectangular lattice can get a shape closer to trapezoid or twisted trapezoid. Despite of this, we may still refer all type of such modification to a rectangular lattice (RL). The distortion of RL could be considered as an additional feature.

In the mixed rectangular lattice, the nodes formed of the shorter prisms are in the center of the rectangular cell, formed by the nodes of longer prisms. This type of lattice also requires boundary conditions. Fig. 2.5 shows configuration layer of mixed rectangular lattice. The both type of nodes does not lie in one plane.

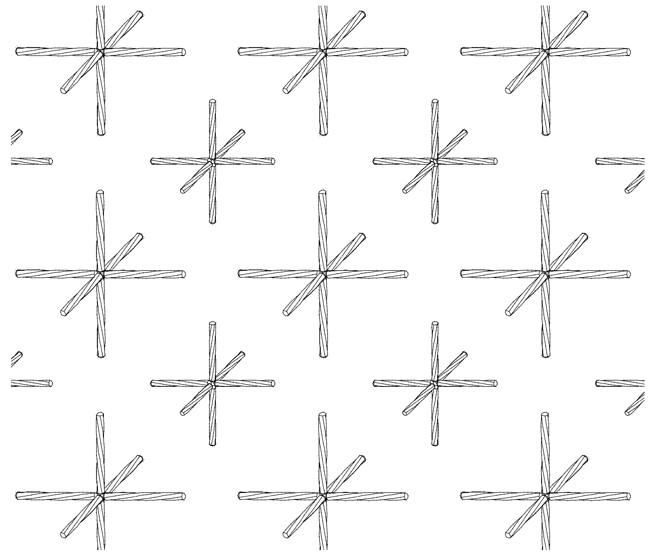


Fig. 2.5
Mixed rectangular lattice
(both type of layers are in different planes)

One specific feature of the rectangular lattices is that the gaps between neighbouring prisms may become zero. In case of mono RL in cylindrical space (with cylindrical boundary conditions) this option is possible only for the prisms with a radial alignment, but not for tangentially aligned prisms. In case of mixed RL in spherical space (with spherical boundary conditions) the gaps between the longer size prisms are almost zero, while the gaps between the smaller size prisms are not. Consequently, the smaller size prisms have much larger freedom in this case

The least dense lattice is the **Cosmic Lattice (CL).** It has arrangement similar to the crystal structure of the diamond, but with alternatively arranged right and left handed nodes. Each node is formed of 4 prisms of same type held by IG forces. The CL structure is more difficult to be drawn, than the rectangular one. For this reason only the common positions of two neighbouring nodes are shown in Fig. 2.6.

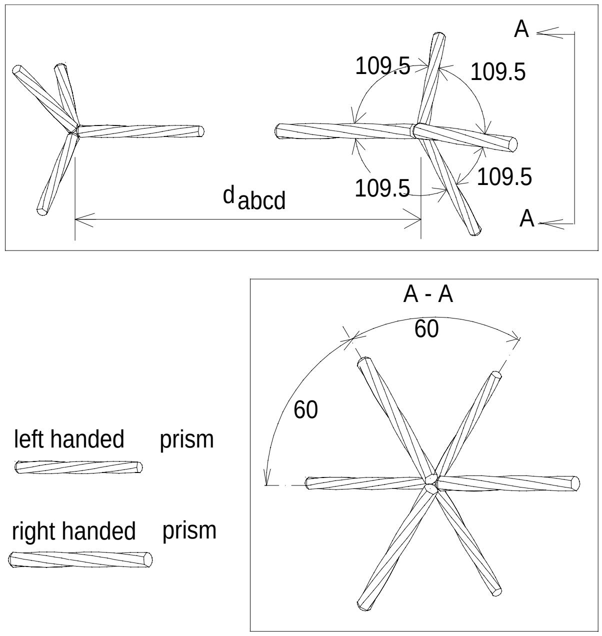


Fig. 2.6
Common position of pair nodes of CL structure

A two dimensional sketch of thin lattice layer of CL structure is given in Fig. 2.7, where the right and left handed nodes are shown as black and white rectangles.

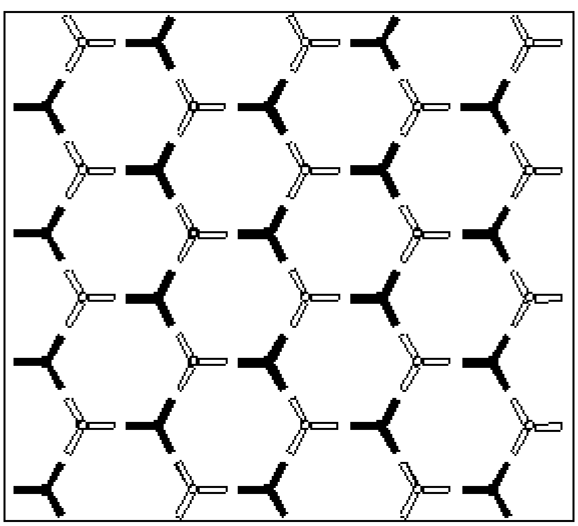


Fig. 2.7
Plane projection of Cosmic lattice layer

The drawing shown in Fig. 2.7 is a projection of one layer of the cosmic lattice. The hextograms in this drawing in fact are projection of quasi hextogram formations of the lattice that do not lie in one plane. So the white and black nodes shown in the figure lie on different tilted planes in respect to the drawing sheet. In such case the apex angles are projected as 120 deg angles, while in the real lattice they corresponds to angles of 109.5 deg (This angle is valid only if not considering vibrational motion of the flexible CL nodes).

One very important feature of the CL type of lattice is the finite gap between the prisms of the neighbouring nodes, as shown in Fig. 2.6. While this feature is initially accepted and used in all BSM analysis its explanation is provided in the last chapter 12, where a possible explanation of IG forces is provided.

The **Cosmic Lattice** can be formed around object, containing large matter quantity. It may exist without external boundary conditions and at very low temperature. Its own stiffness has a finite value that is related to a DC type spatially distributed zero point energy. The cosmic lattice is spread throughout the visible Universe and penetrates even inside of the atomic particles, such as the proton and the neutron. Put in a volume of empty space the cosmic lattice provides a structured space referred as a **CL space**.

The existence of mono rectangular lattices requires external boundary conditions. Such type of lattice exists inside the structures of the electron, positron and some subatomic particles, as pions and kaons.

Criterion for stability of the gravitational lattices

The gravitational lattice is not a momentary formation but a stable one. Based on the discussed so far conditions for stability, a **stability rule** can be formulated for the presented three type of gravitational lattices.

- **The return forces for any axis passing through the neighbouring node prisms should be conservative.**

The stable existence of the gravitational lattice and especially the CL type requires additional self repairing mechanism from disturbances caused by some external conditions. For CL type of lattice the self repairing mechanism could be of same origin as the lattice creation mechanism. So it could be the following:

Due to the difference of IG constants of the two substances, the different volumes of both type of prisms, and the IG anisotropy (including twisting) the prisms of same type are selectively attracted. This leads to formation of two type of nodes: right handed and left handed. The cosmic lattice (CL) nodes are formed of four prisms, whose axes in geometrical equilibrium position are at 109.5 deg, each other. The rectangular lattice nodes are formed of six prisms, whose axes in geometrical equilibrium position are at 90 deg each other (not considering a possible distortion from the boundary conditions). After first parent domain of the lattice is formed, the additional growing is facilitated by the spatially ordered IG forces, the IG anisotropy and their dynamical interaction.

The empty space provide conditions for formation of CL type lattice only. The two rectangular lattice require different environment condition, that will be discussed later (such conditions exists only in the hidden phases of particle crystallization).

Summary **about the general features** of the gravitational lattices:

1) The cosmic lattice contains nodes of four prisms

2) The both types of rectangular lattices contain nodes of 6 prisms

3) Every CL node of right handed prisms have symmetrical neighbouring CL nodes of left handed prisms and vs versa.

4) The prisms of any one of the CL node possesses a freedom for their orientation to the neighbouring nodes but they are always attached to their own nodes.

5) The CL node formation and lattice building is a self sustaining process, govern by the IG energy balance between the two type of intrinsic matter from which the prisms and CL nodes are built.

6) The IG interactions between the prisms are characterised with axial gravitational anisotropy and handedness. When using the twisted prism model, the first feature is associated with the inscribed cylindrical core, while the second one - with the twisted peripheral part. The Intrinsic Gravitation is undetectable in CL space, but it is behind the Newtonian gravitation that may exists only in CL space between ordered structures composed of prisms.

7) The IG forces may leak through CL space in two cases: (a) close atoms or molecules (some of the Wan der Walls forces); (b) highly polished solid objects in a close proximity (Casimir forces)

8) The rectangular gravitational lattices have much larger stiffness than the cosmic lattice.

9) The interconnection between the CL and the RL formations is very weak.

10) In CL space the motion of left (or right) handed prism from one CL node of the lattice invokes an opposite motion of right (or left) handed prism of neighbouring CL node due to the twisted attribute (handedness) of their IG fields.

11) The lattice nodes could oscillate around their central points, but the prism axes of the neighbouring nodes are always aligned due to the IG forces. This alignments are accurately kept even during the node resonance oscillation, due to the intrinsically small time constants of the intrinsic matter substances.

12) The kinetic energy distributed between the oscillating nodes of CL structure provides the AC type Zero Point Energy (ZPE) of the vacuum.

13) The two basic types of gravitational lattices (CL and RL) have different oscillation properties, stiffness and resistence to destruction.

14) A Massive object, containing a large quantity of prisms, causes geometrical deformation of the surrounding CL space, known as a space curvature. In this aspect every massive object is surrounded of modulated CL space. The gravitational field is propagated by the cylindrical part of the twisted prisms (used as model) from which the CL nodes are formed. In ensemble of few massive bodies, every one has its own local gravitational field and locally modulated CL space.

15) The atomic matter (the matter we know) is built of elementary particles (arranged in atoms) containing fine structure which contains RL type of lattice. Assuming a constant motion in the galactic CL space the fine struc-

ture of RL type is obstacle for the CL lattice, so the CL nodes are separated, partially folded, d deviated and then returned and reconnected to the CL space. This processes is behind the inertia of the atomic matter, whose inertial factor is much larger than the inertial factor of the prisms interactions.

16) The mass density in any macro object is not uniform. It is distributed in more or less dens zones which modulate differently the CL space in which they are immersed.

17) Dense formations (structures) of prisms of same handedness placed in CL space affects the both types of CL space nodes in a different way. The non symmetrical behaviour in this type of interaction leads to appearance of field effect. (The electric and magnetic field are discussed later in this chapter.)

18) A CL disturbance caused by the motion of dense formations of highly ordered structures built of prisms of same type appears as an energy flow, exhibiting a complex spatial and time variable pattern (the magnetic energy is discussed later in this chapter).

19) The CL space allows propagation of diversity of waves: zero point (or order) waves, EM waves, virtual particle waves, shock type of waves.

20) The Cosmic Lattice exhibits two types of energy wells related to a Zero Point Energy of the vacuum - a DC type (like direct current) and AC type. Presently only the AC type of ZPE is recognized in Modern physics, due to the adopted concept of the physical vacuum. The DC type of ZPE, envisioned by BSM, is the energy holding the integrity of the CL space. Some of its major physical parameters (derived in this chapter) are the Static and Dynamic Lattice Pressures. The Static pressure of CL space is exercised only on structures containing RL structures, because it is not penetratable even for folded CL nodes.

Feature explanation:

The **features from 1) to 4)** are obvious and don't need any explanation.

Features (5): The intrinsic gravitational force between prisms in empty space is given by Eq. (2.1) discussed in §2.2.2. The validity of the inverse cubic law will become more apparent through the course of BSM theory.

Feature (6): The gravitation we know is a far field propagation of the intrinsic gravitation between ordered system in lattice space. It is propagated mainly through the cylindrical part of the prisms (twisted prisms model). In this case the effective range is extended. The gravitational force in such conditions appears proportional to inverse power of second order of the distance between objects. Detailed prove will be not presented here, but only some insight about this feature. For this reason a simple example will be demonstrated by using iron rods and permanent magnet. If we make consecutively serial connections of one, two and 3 iron rods to a magnet (even with small gaps between them), the field range is extended along the direction defined by the rods. If we make consecutively parallel connections, with the rods between a magnet and iron, the effective force become proportional to their number. If the rods are arranged in equal distances, the attractive force appears inverse proportional to quadrature of the rod distance.

In the provided example the set of rods could be spatially ordered in order to simulate the prisms arrangement in CL nodes. The guided magnetic field through the rods simulated partly the anisotropic propagation of IG forces by the prisms. In the case of CL space, however, the gaps between the prisms of the neighbouring nodes are also important.

Feature (7): The IG forces between objects containing intrinsic matter and put in a void space is proportional to inverse cubic power of the distance. When two particles or smooth massive bodies are in very close distance in CL space, the leaking IG forces are strongly dependable of the distance. In this case, the resultant attraction force is a combination of the leaked IG forces, the normal gravitational forces and EM field forces. Then for a small distance range the resultant attractive force, becomes inverse proportional to the distance at higher power. Fig. 2.8 a. and b. shows the proximity IG filed in function of distance respectively for empty space and for CL space. While in the empty space the IG force is proportional to inverse cubic low of the distance (case a.), in CL space the degree of the inverse power law becomes larger. Practically it could appear detectable only below some critical small distance (case b.) that will depend also of the shape of the proximity objects.

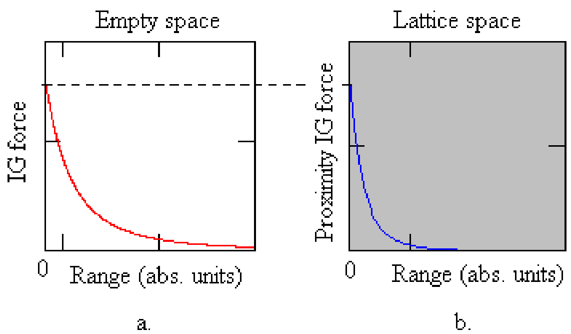


Fig. 2.8
Proximity IG forces between two objects of intrinsic matter: a. - in empty space; b. - in lattice space

The Wan der Wall forces, depending on the distance and are known as a retarded and not retarded forces (for closer distance), according to the London theory (F. London, 1930), (D. Langbein, 1974). The pure attractive forces at close distances are demonstrated as a Casimir effect Casimir itself regarded the attracted forces as a retarded Wan Der Wall forces. The theory of Lifshitz additionally treats the problem. The Casimir forces are experimentally confirmed, and even a change of the power law of the attractive forces at closer distance is observed. The explanation of this change as a transition between retarded and not retarded Wan Der Walls forces is not very convincing. The change of the power law is observed by J. Israelashvili and D. Tabor (1972), by experiment with two crossed mica cylinders. The transition occurs between 12 nm and 50 nm. R. Forward (1984) cites the observed effect and writes: "The data show good agreement with the $1/a^4$ Lifshitz law from 30 to 20 nm with a break in slope at 15 nm changing to a $1/a^3$ London - Van der Waals law from 10 down to 1.4 nm" (*a* is the separation distance). The $1/a^3$ law from the provided experiment becomes pure apparent below 10 nm.

According to BSM, the IG forces are involved in the Wan der Waals attraction. While in the larger separation the IG forces are dimmed by the EM effects, at smaller one they become predominant. The IG forces apear as Casimir forces but with inverse cubic power low. The proton, according to the BSM analysis, has a shape of Hippoped curve with dimensions: 0.667 A - length; 0.193 A width, and 8.85E-15 m thickness. It contains number of helical structures with internal rectangular lattices. This is significant amount of intrinsic matter. In the experiment of crossed mica cylinders, having in mind that the distance between oxygen and Si atoms in SiO_2 molecule is roughly about 3 proton lengths (see the Atomic nuclear atlas), the distance of 10 nm at which the inverse cubic law is detected corresponds to about 50 nuclear diameters. So we may expect, that the measured force is a leakage of IG force in CL space at close distance.

The features from (12) to (20) are related to the dynamical properties of the gravitational lattices. They are more complicated and require detailed analysis. This is done in the next paragraph describing dynamical property of the lattice space.

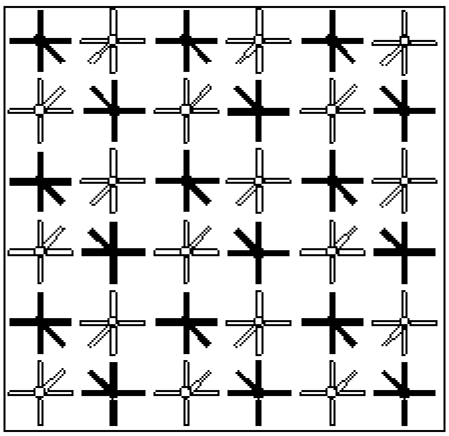
2.6.4 Boundary and interface layers

2.6.4.1 Boundary layers

The boundary layer is the last layer between the lattice and the empty space. Every type of lattice may form a boundary layer, if the stable conditions for existence are met. The boundary layer is formed by the same nodes, but some of the prisms are deviated from their usual positions.

In the case of cosmic lattice facing an empty space, no any prism should be pointed out to the empty space. If we look at the drawing shown in Fig. 2.7, the boundary layer nodes will be in the same positions, but the upper level nodes (white) will be rotated 180 deg to the normal of the drawing Then the free end of the prisms of this nodes will be directed toward the internal part of lattice space and pretty away from other node prisms. The lower level nodes may go lower and its prisms may even touch the prisms of the neighbouring nodes. The node angles of black and white nodes of the layer will also be deviated from 109.5 deg. The neighbouring layers below the boundary layer also might be distorted. This will cause severe deviation from the normal oscillation properties of the nodes. For this reason we may consider that the CL ends towards the empty space with a **boundary zone** with finite thickness. The oscillation property of the CL node belonging to the boundary zone are disturbed. Such zone could not reflect properly the radiated energy it gets. The lattice stiffness of the boundary zone should be much larger than the stiffness of the normal CL space. The importance of the boundary zone and its features are additionally discussed in Chapter 12 Cosmology, §12.B.5.5.

The mono rectangular lattice also may contain a boundary layer if the conditions for a stable lattice existence are met. The boundary layer of first order rectangular lattice is shown in Fig. 2.8.a. The left and right handed nodes and prisms are shown as black and white.



Baundary layer of first order cubic lattice

Fig. 2.8.a

The nodes of the rectangular lattice contains 6 prisms. Every four nodes of the boundary layer have one prism deviated by angle. The free ends of these prisms from four neighbouring nodes form a connection node. Two rectangular layers with different node distances could be interfaced by their connection nodes.

2.6.4.2 Interfacing layers

The interfacing layers connect two lattice domains with different parameters: We may distinguish four types of interfacing conditions:

(1) between mono rectangular lattices in a cylindrical space

(2) between mixed lattices in a spherical space

(3) between CL and rectangular latices

(4) between two CL spaces made of prisms with slightly different dimensions

The first type of interfacing appears in the internal lattices of first order helical structures

The second type of interactions appears in hypothetical conditions of particle crystallization discussed in chapter 12.

The third type of interfacing is very week, due to the lattice mismatch.

The forth type of interfacing appears between the CL spaces of the neighbouring galaxies (Chapter 12).

The configuration of the rectangular interface layer is similar as the boundary layer but with the difference that the deviated prisms become points of connections between the two RL structures.

2.7. Helical structures and ordered systems.

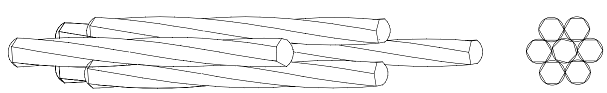
The atoms are composed of protons, neutrons and electrons. These are the basic stable atomic particles. All the atomic and subatomic particles are composed of helical structures. The helical structures itself are built by the both type of prisms. Their configuration, however is not simple. They are distinguished by a helical order, by the type of internal rectangular lattices they posses and their common spatial arrangement.

The helical structures and ordered structures are built in a process similar to a crystallization. Such conditions exist only during the incubation process of the protogalaxy. Two basic physical laws are essentially important during this process: the low of intrinsic gravitation and the energy - matter balance. The process is not simple, but involves a number of phases and mechanisms, the natural conditions for which exist only during a particular phase of the matter evolution. The process of particle crystalization is self regulated and leads to the final result with a very high probability. A possible scenario of this process is described in chapter 12 of BSM. The crystallization process and the phases of matter evolution take place in a space of Universe that is invisible during this phase. Universe. They could be inferred only if the form of matter organization in the visible Universe are well understood. For this reason the analysis of the hidden evolutional processes of the matter is left for the last chapter 12. In such aspect, the configuration of the **helical structures**, without discussion of the process of their crystallization, is presented in the next paragraph.

The term “**ordered system**” is used for a more general category the helical structures that appear as building blocks of the elementary particles. The ordered system may include stable and not stable particles built of helical structures. While any static configuration of helical structures posses a charge, the charge of composite ordered system could be dynamically compensated in order to apear as neutral in a far field. In such aspect any single atom or molecule could be considered as an ordered system.

2.7.1. Elementary helical structure

The elementary helical structure is a helix built of prism of same type (substance and handedness). The radial section of the wire of such helix contains 7 axial sections of prisms of same type. In any helical structure we may identify a **helical core element** (or core node element) comprised of seven prisms as illustrated in Fig. 2.8. The thickness of the helical core is equal to three prism’s diameters. Any one of the prisms in the helical core element has an equivalent spatial position in respect to its neighbouring prisms. The helical core element shown in Fig. 2.8 is comprised of right handed prisms.



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

Fig. 2.8.B

The basic geometrical features of the core node element and the assembly of such nodes are the following:

a. The prisms of the node are stacked together along their length and touch themselves by the hexagonal corner edges.

b. Any prism of the node has longitudinal displacement to its neighbours at 1/3 and 2/3 of the prism’s length.

c. The little bumps in the peripheral part of the prism shown in Fig. 2.1 facilitate the correct attachment of the prisms during the process of crystalization.

d. In order to form a stable node, the following condition has to be met: The common length between two attached prisms (2/3 of the prism length) should be larger than the prism diameter.

e. The neighbouring nodes are stacked together along their axis forming a node assembly without axial gaps between their prisms ends.

f. A stable node assembly can be formed only by prisms of same handedness (substance)

g. A long node assembly can be twisted in a clockwise or counter clockwise direction and kept stable in such arrangement by the IG forces. The twisting of such long assembly is possible due to the slight axial disalignment between the prisms. In such way a helical structure is formed.

The above mentioned features are obvious from a geometrical point of view.

2.7.2 Type of helical structures

We can distinguish few types of helical structures by the following attributes:

- by the type of prisms, they are made of: left and right handed

- by their common position: internal and external

- by the helical order: first; second; third

- by the overall shape: straight, twisted, toroidal

- by the number of repeatable turns: single turn (or coil), multiturn

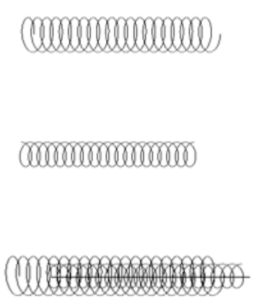
The combination of the above mentioned structures, are included in the atomic particles: proton, neutron, electron. (positron). All they are built during an unique crystallisation process.

Figure 2.9 shows first order straight helical structures. The radius of right and left handed first order structures is determined by the size of the prisms and the condition expressed by Eq. (2.8), discussed later in §2.8.1. The ratio between prisms lengths is equal to the ratio of the structure radii. The first order left handed structure can be freely inserted inside the first order right handed structure as shown in Fig. 2.9.c. The helical cores of the both structures, however, do not touch, because every first order structure has its internal rectangular lattice. Inside of the left handed (smaller envelope diameter) structure only a straight core of right handed prisms could be inserted. According to the core node formation, the core diameter of the structures is equal to three prisms diameters.

If the structures shown in Fig. 2.9 are long enough, they will be bent by the intrinsic gravitational forces. The bending of the structure core is possible, because the prisms are held only by IG forces. If bending of enough long first order structure occurs, a second order helical structure is formed. The radius and the step of the second order structure is more dependent on the external lattice parameters than the first order structure. It is equivalent to say that the stiffness of the higher order helical structure is lower. The stiffness, however, is not defined by the helical core stiffness, but by the internal modified rectangular lattice. The structure core provides also a boundary conditions for the internal rectangular lattice.

Figure 2.10.a shows a second order helical structure of left handed prisms, inside of which is a core of a first order structure from right handed prisms. The stiffness of this structure is defined by the stiffness of its internal rectangular lattice.

Figure 2.10.b shows a compound structure formed by two second order structures, one inside the other. In this case, the second order handedness may be dominated by the external right handed structure if the stiffens of its internal rectangular lattice is stronger.

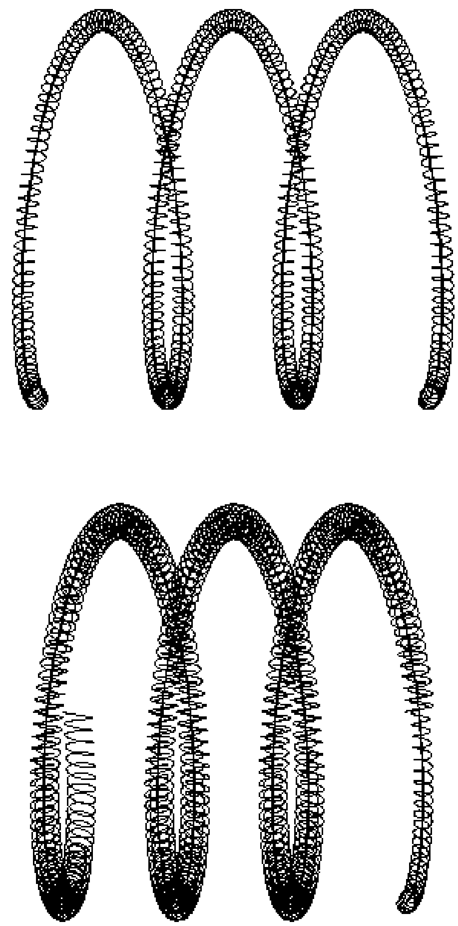


right handed a.

left handed b.

left-handed with a central core inside of right-handed c.

Fig. 2.9 First order helical structures



a.

b.

Fig. 2.10
Second order helical structures a. - single with a central core, b. - combined

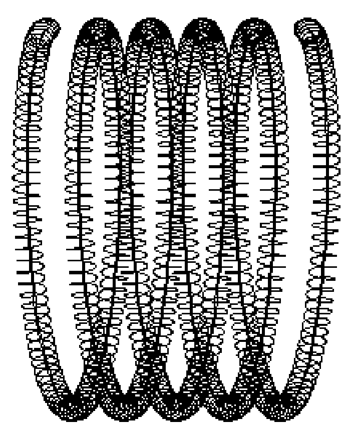


Fig. 2.12
Second order helical structure with a central core and smaller second order helical step

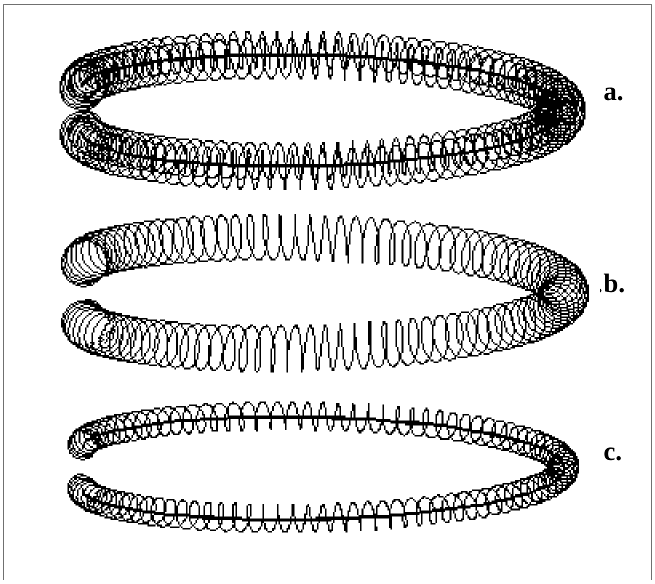


Fig. 2.13
Single turns of second order helical structure

This structure could be obtained from multiturn second order structure in a "burning process" involving continuous destruction of the internal RL structure. It might be obtained also by increased vibration of the second order structure when passing through CL environment with different parameters (change of node distance). In number of experiments a "burning" process takes place, according to BSM, and the obtained single turn structure is trimmed to exact length and radius. The radius is defined by the structure interaction with the CL space.

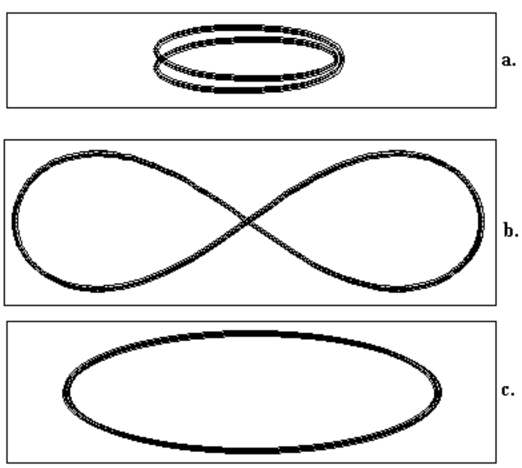


Fig. 2.14
Higher order helical structure in three different overall shapes

Figure 2.13.a shows a compound single coil structure made of one turn of right-handed second order helical structures in which one turn of second order lefthanded helical structure is inserted in which one single turn of right-handed structure is inserted. In some conditions the single turn structure may loose its internal structure as in the cases **b**. and **c.** The core stiffness of a single turn structure becomes a dominant factor, and the handedness of the structure, shown in Fig. 2.13.c is defined by the core handedness. The handedness of the single turn structures in case **b**. is defined by the internal rectangular lattice that has a memory from the case **a.** Consequently, the structures, shown in case **a, b, c** have one and a same second order handedness. This means, that the structures **b.** and **c.** are able to recombine again into a structure **a**.

A second order structure with a large number of turns will bend and may form a third order helical structure. One turn of the third order helical structure with connected ends may form a toroidal structure.

In Fig. 2.14 a possible overall shape of high order toroidal structure is shown.

Based on simple mechanical properties we can formulate the following static features of the helical structures.

- **Helical structures of first order without internal core posses the handedness of the prisms they are built of.**
- **The stiffness of the helical structure is defined by the stiffness of its internal rectangular lattice.**
- **The lower order helical structures have larger helical stiffness than the higher order structures.**
- **The handedness of a compound higher order helical structure containing structures of both type prisms is determined by the handedness of the lowest order structure (because it possesses a higher helical stiffness).**
- **Structures composed of a few helical substructures one inside another are built by the prisms whose handedness follows the rule: right, left, right (in direction from inside to outside). The central core if existing is always from right handed prisms (if the right hand prism is the larger one).**

- **The smaller radius and step of structures of different prisms have different dependence on the lattice parameters.**
- **Different types of external lattices should influence the helical step and radius of the helical structure to a different degree, due to the different coupling between the external and internal lattice parameters. For this reason, a long second order helical structures may have different step and radius in RL and CL type of lattice space.**

2.7.3.2 Symbolic notation of the helical structures.

Simple symbolic notation are introduces for notation of the different types of structures (or shells of a composite structure). **Later we will see, that the prism handedness is related to the charge polarity.** This does not mean, however, that the handedness and the charge is one and a same thing. The charge is a kind of modulation of the CL space parameters from the helical structure. It is discussed later in this chapter. In order to annotate the handedness, however, we need to associate one type of prism with the positive and the other with the negative charge. In this approach the probability of correct assignment is 50% (if additional considerations are not a priory present). Therefore, we may provide two systems of symbolic notation for formations of helical structures: **by handedness** or **by charge**. The first one is more descriptive, but the second one is more convenient if the assignment of the handedness is not correct (in fact some considerations about the assignment exists, but they are discussed later).

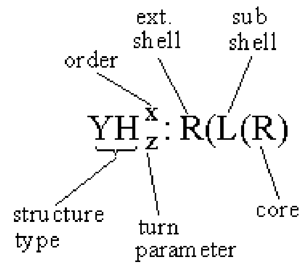
Let to select:

right handed prisms - related to the negative charge

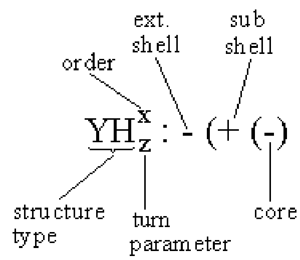
left handed prism - related to the positive charge

Note: **The selected notations by charge do not mean that the prisms itself posses a charge. However they become associated to the selected charge when the helical structure is put in a CL space environment.**

In Fig. 2.15 the both systems of notation are shown (by handedness, and by charge notation). For a handedness notation, if the handedness determination later appears wrong, all the symbols for handedness has to be reverted. The charge notation, however, will be not affected from a possible wrong assignment of the handedness.



Notation by prism type



Notation by charge

Fig. 2.15
Notation systems of complex formations of helical structures

Notation parameters:
H - a helical structure of twisted prisms
x - order of the structure (0 to 3):
Y - type of the structure:
S - straight type
T - torus type (Fig. 2.11)
FT - folded torus (Fig. 2.14.a)
TT - twisted torus Fig. 2.14.b)
CT - curled torus
z - turn parameter: s - single coil
m - multiturn
- number of turns
R - right handed prisms
L - left handed prisms

Table 2.1 provides examples of complex formations of helical structures by using the two types of notations.

Notations of formations of helical structures Table 2.1

Notation by prism type	Notation by charge	Description
H_m^0:R	H_m^0:-	Zero order structure of right prisms (straight core)
SH_m^1:R( )	H_m^1:-( )	First order structure without core (Fig. 2.13.a)
SH_m^1:R(L(R)	H_m^1:-(+(-)	First order structure with core (Fig. 2.9.c)
SH_m^2:L(R)	H_m^{2-}:+(-)	Second order structure with ext. shell of L prisms (positive charge) with core of R prisms (Fig. 2.10.a)
SH_m^2:R(L(R)	H_m^{2-}:-(+(-)	Second order structure with ext. shell of R prisms (negative charge) with core of R prisms (Fig. 2.10.b)
SH_1^2:R(L(R)	SH_1^2:-(+(-)	One turn of second order structure (Fig. 2.13.a)
SH_m^3:L(R)	H_m^3:+(-)	Third order structure with positive external shell and negative core
TH_1^3:L(R)	TH_1^3:+(-)	Torus structure made of one turn of third order helix with core
TTH_1^3:L(R)	TTH_1^3:+(-)	Twisted torus from third order structure (shape as Fig. 2.14.b)
FTH_1^3:L(R)	FTH_1^3:+(-)	Folded torus from third order structure (shape as Fig. 2.14.a)

2.7.A Identification of the atomic and subatomic particles

2.7.A.2 Primary particles. Identification of atomic and subatomic particles.

Ones the galaxy is born, the crystallisation process of the atomic particles is over. Consequently, two major particles are product of the crystalization: a torus shaped particle with a positive external shell: TH_1^3:+(-), named by BSM as a protoneutron and a negative particle H_1^1:-(+(-) that is the electron system (known as electron).

The primary atomic and subatomic particles in the end of crystallization process with their structures are given in Table 2.1.A

2.7.A.2.1 Electron system

The electron system H_1^1:-(+(-) is composed of external shell, made of negative prisms and containing inside internal shell of positive prisms. The latter one is the external shell of the positron. So the positron structure is H_1^1:+(-). Both, the electron and positron shells have internal rectangular lattices (RL). Any one of this lattice contains much larger number of prisms than the helical shell. Therefore, the structure of internal lattice keeps the stiffness of the structure, while the external helical core provides the boundary conditions that is necessary for the existence of the internal lattice. In the same time, the internal lattice is able to modulate the external CL space due to the highly ordered radial aligned prisms, possessing anisotropic axial IG field with a left or right handed twisting.

Table 2.1.A

Name	Notation	External shell	Internal structures
electron system	e^-	H_1^1:-(+(-)	e^-
positron	e^+	H_1^1:+(-)	H_1^0:(-)
degenerated electron		H_1^1:-( )	missing
pion (+)	π^+	CH_m^2:+(-)	
pion(-)	π^-	CH_m^2:-(+(-)	
Kaon	K_L^-	SH_m^1:-(+(-)	
protoneutron		TH_1^3:+(-)	# pair pions, kaon
proton	p	TTH_1^3:+(-)	# pair pions, kaon
neutron	n	FTH_1^3:+(-)	# pair pions, kaon

The both types of internal RL structures of the electron also allow the positron to vibrate. In some extreme conditions the positron may even come out as a free positron. In such case, the electron system converts to a degenerated electron. It still posses a negative charge, but does not have the oscillations properties of the normal electron. The positron is more difficult to lose its core, but if it is lost, it could be regenerated by the trapping hole effect if suitable external conditions exist.

When the composition of the helical structure is not needed to be mentioned, we may use the following simple notations:

FOHS - stands for: First Order helical Structure

SOHS - stands for: Second Order Helical Structure

2.7.A2.2 Protoneutron and its internal structure. Conversion to proton or neutron.

The protoneutron has a shape of torus. It's external shell is a TH_1^3:+(-) type structure. The overall shape of the protoneutron was shown in Fig. 2.14 c. The third order torus structure is formed of second order structure (shown in the Fig. 2.12) containing a lot of number of turns, while the latter is formed of curled FOHS of positive prisms with a central core of negative prisms. In such aspect the external shell of the protoneutron contains a positive FOHS with internal mono rectangular lattice and one central core of negative prisms. The external shell forms the envelop of **protoneutron core.** Inside of this envelope, there are pions and one central kaon. The analysis, provided by BSM and the calculations in Chapter 6 show that the most probable number of pions are two: one negative and one positive. The pions are curled FOHSs. The negative pion, however, contains inside a positive FOHS. The central kaon is a negative FOHS, but contains inside a positive FOHS. Every FOHS contains own mono rectangular lattice. The radial section of the protoneutron core with two pions and one central kaon is shown in Fig. 2.15.A., while the axial core section is shown in Fig. 2.15.B.

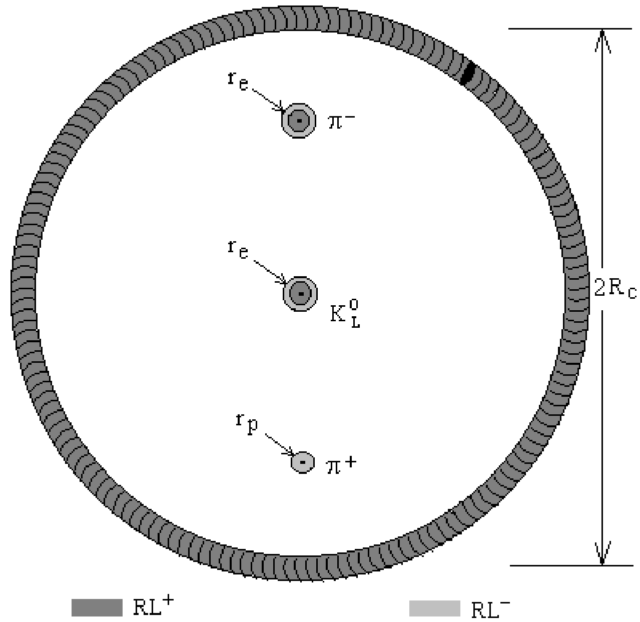


Fig. 2.15.A
Radial section of a protoneutron core

The internal pions, having second order helicity, are centred around the central kaon. The core section of the protoneutron in Fig. 2.15.A is approximately in scale. The proton and neutron, both have one and a same internal structures and consequently the same core section. Two question may arise from a first gland:

- how the internal pions and kaon are kept in their positions?

- why the FOHS diameter is so small in comparison to the core envelope?

The replies of these questions are not so simple, but the complete understanding of the problem becomes apparent after the reader is acquainted with the BSM theory.

The pions and kaon structures are fixed in their positions by their electrical fields.

The FOHS diameter seams small, but it is kept by the internal rectangular lattice, that is much more dense, than the CL structure.

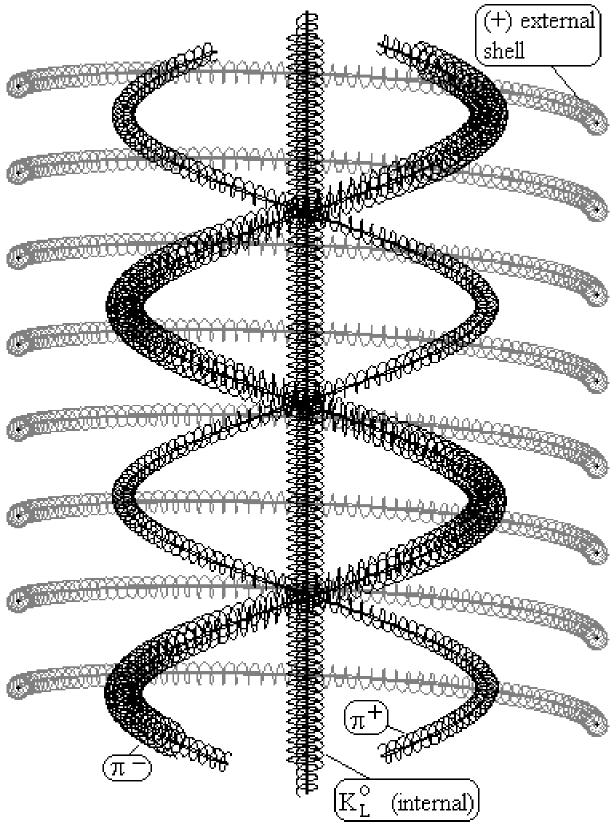


Fig. 2.15.B.
3D axial sectional view of a protoneutron structure showing the two internal pions and the central kaon (The proton and neutron, both have the same internal structure)

The gaps between the FOHS turns of the external positive shell are large enough in order to allow a free penetration of CL structure inside the protoneutron (proton, neutron) envelope. So the internal space between the FOHS's is occupied also by the CL space.

The protoneutron shape of torus is not stable in CL space environment. Once the protoneutron is in such environment, twisting forces appear. They arise mainly from the internal pions and kaon, whose mono rectangular lattices get a hellical modification in CL space. The balance of the interaction forces between the FOHS with its rectangular layer, from one side, and the CL space from the other (see Eq. (2.8) from the next paragraph §2.8) leads to appearance of twisting forces. Then the whole torus structure get twisting in one preferable direction, obtaining a shape, shown in Fig. 2.14.b. **This is the proton**. **The preferable twisting direction defines the proton handedness.** The proton is stable particle in CL space. The process of conversion, however, is accompanied with the following effects:

- a small volume shrinkage of the FOHS of the pions and kaon is obtained, due to the cell modification of the internal rectangular lattices
- an appearance of a far field electrical charge

In Chapter 3 we will see that the volume of the FOHS defines the apparent mass of the particle. So the first effect leads directly to a small mass change.

The second effect is related to appearance of a detectable (far field) charge and generation of an opposite quasiparticle wave - a so called Beta particle. **The Beta particle is a reaction of the CL space to the born positive charge. For such reason the Beta particle possesses opposite handedness of this of the proton**.

The proton additionally could fold and get a shape shown in Fig. 2.14.a. This double folded protoneutron is a neutron. The neutron alone has a limited time of stability in CL space, unless it is not combined with a proton. When combined with the proton, it takes a symmetrical position over the proton saddle. This is the deuteron. Its shape is shown in Fig. 2.15.C)

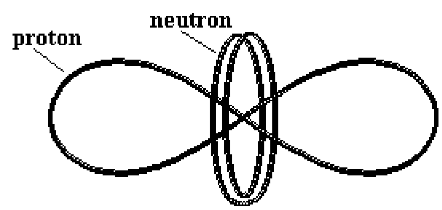


Fig. 2.15.C
Shape of Deuteron

The neutron in the deuteron is stable due to the interactions between the IG fields of the two particles. The neutron is kept centred around the proton due to the interactions between their proximity fields (in CL space environments only), whose energy is also supplied by the IG energy of the system.

The conversion of the proton to neutron is accompanied with similar effects of small mass change and far field charge disappearance with generating of Beta particle. The Beta particle according BSM is a reaction of the CL space to the birth or death of the electrical charge and always have an opposite charge value. It is a quasiparticle wave (it will be discussed in details later). The opposite handedness of the Beta particle in respect to the proton twisting is a normal reaction of the CL space. **This effect, known as a parity violation so far, is a normal physical interaction of the helical structures of the proton (or neutron) in CL space environment, according to BSM theory.**

2.8 Modified rectangular lattice in the internal space of the hellical structures

A modified version of rectangular lattice is possible in a cylindrical space if the axial length is much larger than its radius. In the real case the cylindrical space is the internal space of a hellical structure, built of same type of prisms.

2.8.1 General features

The process of internal lattice formation follows the process of hellical core formation by crystallization. When the hellical core, becomes quite long, it start to bend and continues to grow as a helix. After this helix get a length beyond some critical value, conditions for building of internal mono rectangular lattice are created. Cubic nodes of same type of prisms are attracted to the core in the internal side. In the same time, the created internal lattice provides pull-in forces, which tend to shrink the hellical structure radius. The bending of the hellical core, although, meets the resistance of the IG forces between the prisms of the hellical core. It is evident that the radius of the structure with completed internal lattice will be determined by the balance between all forces according to Eq. (2.8):

$$F_{int} = F_{hst} - F_{ext} \qquad (2.8)$$

where: F_{int} is the equivalent internal force, trying to shrink the hellical structure diameter;

F_{hst} is the reaction force of the hellical structure, caused by the bending of the hellical core

F_{ext} - is the opposing external force from the IG interaction between internal rectangular lattice and external lattice space.

The configuration of the internal rectangular lattice could be inferred by analysis of the possible axial configuration. For this reason two options for possible axial configurations are shown respectively in Fig. 2.16: a. and b., while c. shows the radial configuration.

In case **a.** the nodes are aligned only to the hellical core of the windings, while in case **b**. the space between the windings is also filled with nodes. It is difficult to judge which one is valid for the real case, but the mass analysis, done by BSM shows, that the CL space exercises a pressure on the volume enclosed by the envelope of the FOHS. Such result points to accept the case **b.** as a real one.

One conclusion is clearly evident: the helical core provides simultaneously the boundary conditions of internal RL structure and the helicity, as well. This lattice is built of same type of prisms as the hellical core. The first order helical structure of any type, discussed in the previous paragraph, has internal rectangular lattice. It is also evident from the shown configuration, that the unit cell of the internal RL structure is not exactly rectangular, but distorted.

We may identify concentric layers. The number of the radial stripes in any one of the concentric layer is a constant but different for the different layers. For the smallest radius of any layer, the gaps between tangentially aligned prisms approach zero, while for the max radius they approach the sum of the two prisms length. The radial stripes of one layer do not possess gaps. Any neighbouring layers are connected by a thin interfacing layer, discussed in the previous paragraph. The radial thickness of any internal layer is half of the thickness of the surrounding external layer. If scanning from the boundary radius to the center, this condition is valid for all layers, until reaching another boundary condition of the cylindrical space. If a first order structure with smaller radius is inserted, the boundary condition is defined by its external radius. In the region closer to the centre there are not conditions for layer because of the finite size of the prism. Therefore, the RL configuration will be terminated with a central hole, as shown in Fig. 2.16. The size of the hole can not be smaller than six axial prisms.

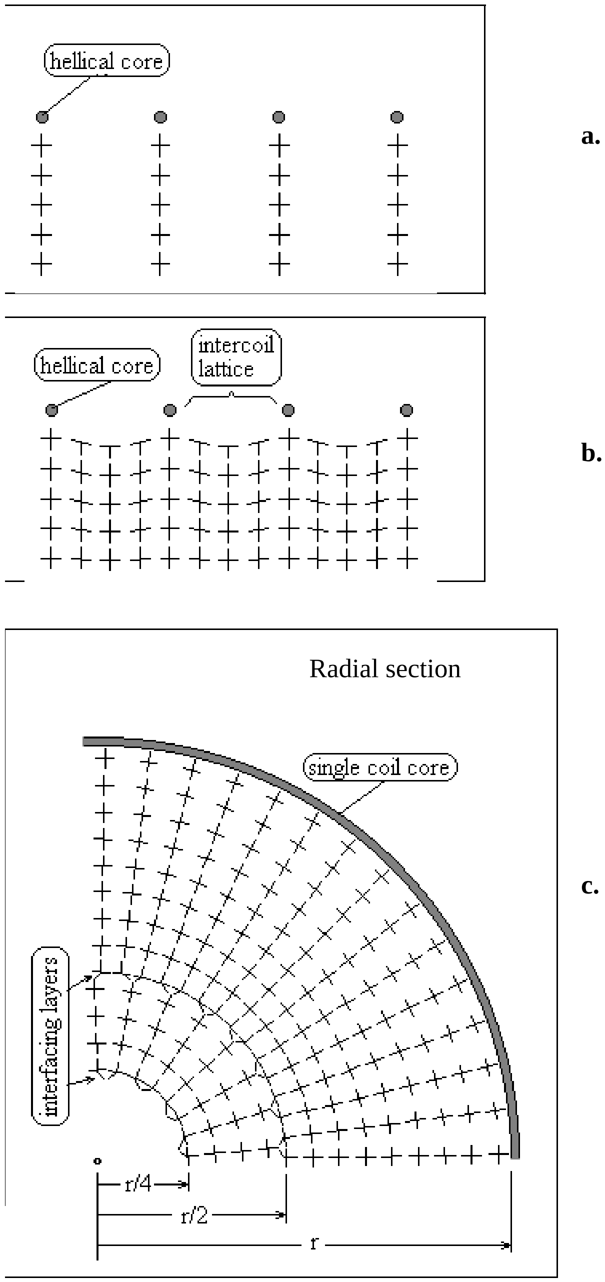


Fig. 2.16
Axial and radial section of internal rectangular lattice

The rectangular lattice from prisms of same type posses very unique features.

- **The IG forces from the central part of the prisms are symmetrical, so their external influence is self compensated**
- **The IG forces from the twisted part of the prisms are highly spatially ordered but their external influence is not self compensated. This provides significant modulation effect on the dynamical parameters of the external CL space.**

Long formation of second order hellical structures also form a cylindrical space, but the boundary conditions in this case are not so uniform. In result of this a mixed type of rectangular lattice may be formed. It also can be terminated by a central hole.

2.8.2 Trapping hole.

When the rectangular lattice is terminated with the smallest radius, it forms a trapping hole. Such formation of RL structure exhibits a trapping mechanism. The further analysis indicates that only the positive FOHS terminates with a small trapping hole, while the negative FOHS terminates with hole with much larger diameter in which a positive FOHS is inserted. This difference is due perhaps to the different intrinsic parameters of the both types of prisms, and the force balance, according to Eq. 2.8 in a phase of crystalization.

The trapping mechanisms in the FOHS with a same type rectangular lattice is very strong. It plays essential role in a process of formation of smaller FOHS inside of larger FOHS or SOHS. The highly ordered internal lattice of FOHS provides a focusing of the IG field of the twisted part of the prisms, onto the hole. In such case the twisted IG field in the hole volume is significantly enhanced. Such hole obtains ability to attract selectively prisms or node of opposite handedness. In the trapping hole volume the trapped prisms or nodes are able to stack and form long core inside the trapping hole. When the formed core becomes long enough it begins to bent and get helicity. Simultaneously the internal RL structure gets some twisting. This feature is propagated to the host FOHS, so the whole structure start to get helicity. Then at proper external condition the FOHS creates a SOHS. If the turns of SOHS are closed enough it create a new cylindrical space in which new environment for RL might be created. We may even expect that the obtained new cylindrical space may create conditions for a mixed rectangular lattice of type illustrated in Fig. 2.17.

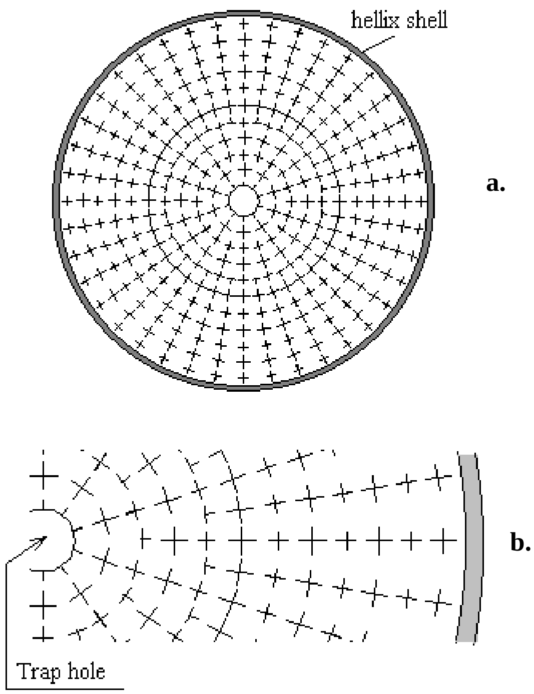


Fig. 2.17
(a) RL formation from both type of nodes and trapping hole.
(b) Magnified section

Such formation also ends with a trapping hole in the central zone, but its properties are distinguished from the trapping holes of the same type RL formation. However it may play a termination role in the process of the particle crystalization. In the analysis provided in Chapter 12 it becomes evident that mixed lattice may exist only in a phase of crystalization (but not in a later phase when the crystalized helical structures are immersed in CL space

The trapping hole mechanism is further discussed in this chapter and in Chapter 12.

2.8.2.A. Stiffness of internal RL structure and its influence on the external structure radius

The radial section of RL structure may contain number of sublayers of same type prisms but with different thickness. The radial thickness of any internal sublayer is a half of the thickness of the external one. Therefore, the number of sublayers depends on the ratio between prism length and the external radius. Smaller ratio means a large number of sublayers. The ratio used for the drawing in Fig. 12.16.c is quite larger than the real one.

Let analyse the stiffness in the radial section of RL formed of prisms of same type. In order to simplify the analysis we may assume that all RL nodes from the radial section lie in one plane. Then for a such section we may define two types of linear stiffness:

- a radial one
- a tangential one

The radial stiffness is defined for any direction passing through the centre of the section.

The tangential stiffness is defined for any tangent at fixed radius in the radial section.

Any type of stiffness could be expressed by the node distance along the defined direction.

Assuming that the radial aligned prisms touches each other the radial stiffness should be not dependent of the radius. The tangential stiffness for every sublayer, however, should vary between min and max value. It is also determined by the node distance in the tangential direction. This dependence is illustrated in Fig. 12.17.A.

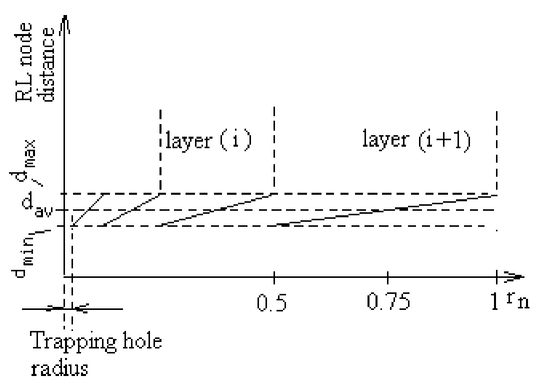


Fig. 2.17.A
Tangential node distance in function of normalized radius

The tangential node distance for any one concentric layer varies between its maximal and minimal value, respectively d_{max} and $d_{min.}$ The boundary node distances, expressed by the length L_R, of the longer (right handed) prism, are respectively:

$$d_{min} = \frac{5}{3}L_R \qquad d_{max} = 2d_{min} = \frac{10}{3}L_R \qquad d_{av} = \frac{5}{2}L_R \quad (2.9)$$

According to the IG law the tangential stiffness is inverse proportional to the cube of the node distance, so it has non linear dependence of the radius. Consequently, the tangential stiffness of the most external layer is strongly dependent of the external radius, that is the radius of the hellical structure. Then the condition (2.8) could become fulfilled at proper radius of the hellical structure.

- **The steeper radial dependence of the tangential stiffness in the most external layer in combination with Eq. (2.8) provides boundary value of the external radius of the new formed hellical structure, grown in conditions of external rectangular lattice.**

Let to assume, that a new structure of left handed prism is formed inside of structure of right handed prisms. According to above condition, if the radius of the internal structure appears to satisfy the condition (2.8) in the range of 0.5 to 1 of the external structure radius, then it should be between 0.5 and 0.75 (see Fig. 2.11). From the BSM analysis, such value for the case of electron positron system, is found to be 2/3.

After the new structure with its internal lattice is completed, the obtained radius is kept stable by its internal rectangular lattice. The radial alignment of the stripes between different sublayers of same type of RL is kept due to the interfacing nodes of the intermediate boundary layers. In such aspect the interfacing nodes are supporting elements for keeping the integrity between the sublayers with different radii. This kind of support is possible only between layers of same type (left or right handed).

2.8.3 Hellical structures in different space environments

The first order hellical structures (FOHS) may apear in two forms:

- open structure: the both ends are free
- closed structure: the both ends are connected

In Chapter 12 it will be shown, that many hellical structures are built by crystalization process in environment of external cylindrical space, where RL space environment initially exists. If an open structure appears in an external CL space, its FOHS, should get modification, according to Eq. (2.8), because the external force F_{ext} is changed. The modification affects not only the hellical structure radius, but the internal lattice configuration as well.

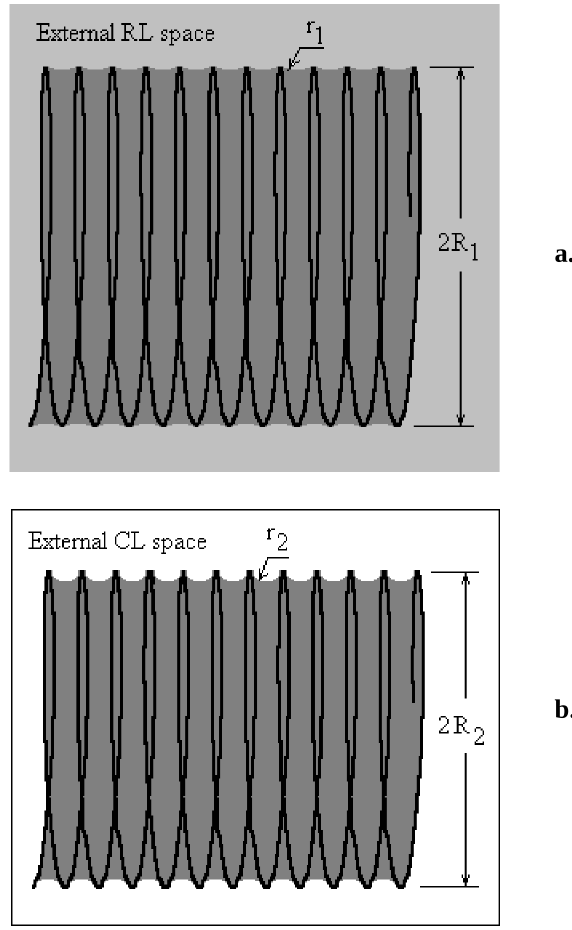


Fig. 2.18
Open first order hellical structure in different external space environment

Fig. 2.18 shows FOHS in two space environments: **a.** in RL space and **b**. in CL space. Two parameters, relevant to the external shape are affected: the radius of the helix R and the envelop radius of the intercoil lattice r. The radius r_1 in case **a.** is smaller than the radius r_2 in case **b.** In case **a**., part of the intercoil nodes are connected to the external RL nodes, while in case **b.** such connection is impossible due to a lattice mismatch (between the internal RL and external CL lattices).

The internal lattice of the structure is also affected. It gets additional twisting. In result of that, the radial stripes, are not any more normal to the hellical core. This is illustrated by Fig. 2.19, where the radial section of one and a same structure, but in different external environments is shown.

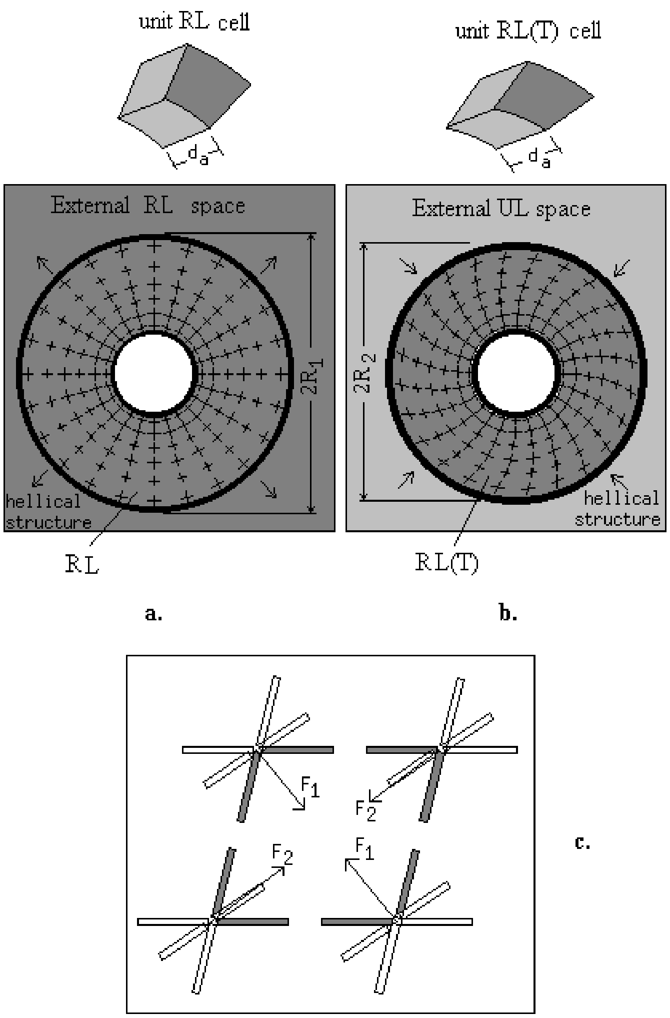


Fig. 2.19
Effect of hellical structure radius dependence from the external lattice environment

Above the structure sections, the shape of the distorted unit cells are shown. They additionally departs from the rectangular shape. We may denote the modified RL as **rectangular lattice - twisted** [**RL(T)**]. In Fig. 2.19.c the IG forces in a distorted cell are shown. The difference between F1 and F2 forces is responsible for the additional twisting. They are balanced with the core force, opposing the bending of the helical core beyond some point. In result of this, some gaps between the nodes may be created. This gives a freedom of the RL(T) nodes and their prisms for self adjustment. Then all prisms of the lattice get proper alignments due to axial prisms interaction. Consequently:

- **The twisted rectangular lattice [RL(T)] of FOHS in CL space, provides enhanced external IG field, with a handedness defined by the type of the prisms, from which the hellical structure is built.**

The process of twisting is characterized by squeezing of some nodes in the intercoil domains of the internal rectangular lattice. This means flipping and realignment of the prisms of that nodes. Consequently once the environment conditions are changed, the structure obtains a new but stable helical radius R_2 as shown in Fig. 2.18. In this modification the radial integrity and stability are preserved.

Let to analyse a FOHS with internal lattice terminated by a trapping hole. Analysing the radial dependence of the tangential node displacement in result of the twisting, we see, that it is much larger for the external negative layers, than for internal positive one. For the layer near to the trapping hole, the tangential change is insignificant. The unit cell in this region could be considered not distorted. Then the axial length is also unchanged. This means, that the twisting will cause additional wounding of the FOHS, but its total length will be the same. Consequently, we arrive to the following important conclusion:

The twisting modification of FOHS in external CL space environment causes a radius and hellical step change of this FOHS, while the overall length is unchanged. In result of this, the volume of the open FOHS is slightly reduced.

The volume change is important feature, because it is directly related with the apparent mass change (see mass equation derivation in Chapter 3.

The described above effect of radius and volume change is possible only for open FOHS. If the structure is closed (both ends connected), the number of turns is fixed. Consequently such structure could not change its hellical parameters and volume in CL space. It will get only internal tension. If, however, the structure is cut, it undergoes this volume change, right away. This is just what happens, in the pion to muon decay, after braking the proton (see Chapter 6). A closed loop structure, however, may also undergo some degree of twisting (or additional twisting) if its overall shape is folded or twisted.

Every higher order hellical structure is built of low order structures. Then, the following important conclusion can be made:

- **If a closed hellical structure get broken in CL space, it undergoes a volume, and consequently a mass change (according to mass equation derived later in this chapter).**

The direction of RL twisting is in agreement with the handedness of the hellical structure, that is the same as the handedness of FOHS core.

If one hellical structure with own RL(T) is inside of opposite handedness structure with own RL(T), every one of both lattices is stronger connected to the hellical structure that defines its upper boundary radius. The both lattices, in this case, can not have interface connection between themselves, due to their opposite handedness. Then the internal structure may oscillate in the lattice hole of the external one. Obviously such system will have a resonance frequency. The lattice of the external structure in this case has the following important features:

- serves as an ideal not frictional bearing for the axial motion of the internal structure

- the twisted IG field of internal structure RL(T) is not able to propagate through the RL(T) of external structure due to the different handedness

Consequently:

- **A system of two hellical structures with internal twisted rectangular lattices, is able to oscillate with its resonance frequency and accumulate a kinetic energy**
- **When one FOHS is inside another FOHS, the twisted IG filed of the internal RL(T) structure is shielded by the external one, and could not apear in the external space. Only the IG field of RL(T) of the external FOHS is able to appear in the external space and to modulate its parameters.**

The above made conclusions helps to explain the electron, as a system of FOHSs of different types, and its properties in CL space. Detailed analysis of electron is provided in Chapter 3.

2.8.4 Hellical structure with internal RL in empty space

Despite the fact that such situation is unusual, it is temporally possible in some conditions of temporally lattice destruction. Such temporally conditions, according to BSM, are created during the nuclear weapon explosion.

In empty space the external force F_{ext} is zero.

The closed and open hellical structures will be affected in a different way.

The closed hellical structures (neutron, proton), have large internal stiffness that is able to keep them stable. When appearing in empty space such type of structure could lose the electrical field only, but could not be destroyed. So the neutron and proton will be not affected significantly if appearing temporally in empty space (they are in a similar conditions in the phase after crystallization).

The situation for a open hellical system, as the electron is little bit different, when it appears in empty space. The electron is a compound single coil structure shown in Fig. 2.13.a. In empty space it loses the electrical field due to absence of CL nodes. So it loses the interaction forces with external space. The single coils structures, however, have larger stiffness than multiturn structures. So we may expect, that the electron system (electron) may undergo a small modification only of its hellical step. The electron posses significant kinetic energy as an oscillating system. In a lack of external EM filed we may consider, that this energy will be preserved. However, during the transition process, the whole or fraction of its energy might be dumped. It seams, that all features of the electron will be restored, when appearing again in CL space, but it may need some finite adaptation time, if its kinetic energy is dumped. There is another possibility also that the internal positive structure is biased during the transition time. Then large oscillations could be invoked, leading to CL space pumping and emission of X-ray (the emission of X-rays from the electron is discussed in Chapter 3).

2.8.5 Intrinsic mass contained in the first order hellical structure (FOHS) with internal lattice

Knowing the node density distribution, and having the dimensions of the hellical structure, approximative calculations for the amount of prisms can be made. Calculations made for positron show, that the number of prisms, from which the helical core of FOHS is built is insignificant in comparison to the total number of prisms contained in its internal rectangular lattice. In the same time we will see that the apparent inertial and gravitational mass depends only on the FOHS volume (mass equation). In this case the intrinsic mass of the internal lattice appears undetected. Consequently a **vast amount of the intrinsic matter carried by the hellical structures in CL space appears hidden**.

The average node density of the internal rectangular lattice is larger than the node density of the external CL space. This means, that a large energy should be applied in order to crash such system. This conclusion helps to explain why so large energies are necessary in the particle coliders in order to obtain Rege resonances. (Detailed discussion about this issue are presented in Chapter 6).

2.8.6. Mixed rectangular lattice in a spherical space

In the final chapter, we will see, that such space may exist during the phase of the crystallisation. More accurately this could be a part of spherical space closed between two concentric shperical shells.

For a section passing through the geometrical center the mixed RL will have a similar layer configuration as the radial section of a mono rectangular layer in a cylindrical space. The mixed RL, however, will have one distinguishable feature: If the radial stripes are without gaps, then the right handed nodes will be connected (without gaps), while the lefthanded nodes will be separated by gaps (due to the shorter lefthanded prisms). Then only the lefthanded nodes will have freedom to vibrate and to posses a kinetic energy. This feature plays an important role in the process of the helical structure crystallization, which is possible and take place in one of the hidden phases of the galactic evolution. This is discussed in Chapter 12.

