Basic Structures of Matter

(Thesis about matter, space and time)

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The space in which we live and observe possesses underlying material structure in the micro-scale range, where some basic physical laws appear differently. All physical phenomena are explainable in 3D + 1 space-time dimensions if the material structures and physical laws in that particular range are understood.

From the author

Chapter 1. Introduction

The spectral information we obtain by the photons from distant galaxies brings the idea about a common origin of the Universe. Such origin, however, may not be the a point in a geometrical sense as stated by the Big Bang theory. What we observe in the present moment may be a secondary effect, while the primary processes might be completely hidden and not accessible at all. In such way only the logical extensions of the common sense may go further. Such conceptional vision requires more general analysis of the possible relations between, matter, energy, space and time. In such aspect, however, we need a broader vision in which the restrictions of some of the adopted postulates must be avoided. The formulated in such way tasks may be assigned to the category of unified field theories.

Attempts to connect the physical forces into one unified field theory are made from the beginning of 20th century. Now we have set of theories individually valid in their own particular range, but not well interconnected in the broader range of space and time. Among these theories are: the theories of the particle physics, the quantum mechanics, the theory of Relativity (General and Special) and the theory of Big Bang. One of the tendencies of the modern physics is to extend the individual range of the above mentioned theories in order to integrate them into one unified field theory. In such approach, however, number of problems appear.

One brief and reasonable characterization of the problems of the modern physics at the present is provided by F. Muller the director of NPA (Natural Philosophy Alliance). He emphasizes on the **three aspects of the process of nature understanding: the physical, the mathematical, and the philosophical.**

The Quantum mechanics achieved remarkable success relying on the mathematical aspect. Influenced by these achievements now the leading role in the theoretical physics is devoted on the the mathematical logic, while the physical aspect is undermind. In such approach the philosophical aspect is completely ignored. One of the reasons for degrading the physical logic in the contemporary physics is the underestimation of the causality principle and its replacement with a probability. In other words the cause is replaced by the chance. This works well for the quantum mechanical models, but could not be accepted as a universal rule in the Nature.

The underestimation of the physical logic could be demonstrated by the fact that the following questions never get logical answers:

- Why the light velocity is a constant?
- What is behind the space curvature around a heavy material object?
- What are the boundary conditions of the wavefunction describing the photon?
- How could the single photon be polarized?
- How could the single photon interfere with himself?
- How could energy exist separated from the matter? (Initial singularity in the Big Bang and final singularity in the Black holes)
- If the Universe contains a finite matter and some photons are emitted in empty space, what happens with their energy?

The last three problems in fact show infringement of the energy conservation principle.

In addition to the above mentioned theoretical problems, number of phenomena are not satisfactorily explained: the Casimir forces, the zero point energy of the vacuum, the physics of FQHE, the electrogravity, the levitation in superconductivity, the solar neutrino problem, the globular clusters, the alactic rotational curves and “dark matter”, the supermassive “black holes” in the galaxies (some of them emitting energy), the X-ray background, the Lyman alfa forest, the Gamma ray bursts and so on.

In order to avoid the logical explanation of the above mentioned questions and problems, number of postulates has been introduced as unexplainable rules. Large number of postulates in a form of rules has also been adopted in the quantum mechanics. Following this approach the theoretical physics accepted the mathematical aspect as a solely correct direction in the physical study of the matter. The equation of the quantum mechanics works by some magical way (of cause not for everything). As a result the opinion that the human logic fails and logical understanding is not necessary was broadly accepted. The mathematical physics provided a large number of highly abstractive theories.

Stepping on the mathematical model of the hydrogen atom the modern physics has built a stack of theories. Following only the mathematical logic many theoretical models works as black boxes providing some matching output results, but any attempt to infer the underlying physical structure leads to inconsistencies. For example: Despite of enormous efforts to bridge the gap between the classical physics and quantum mechanics, it still exists. The picture of the subatomic world built by the particle physics (standard model, quantum chromodinamics) is even more confusing: enormous amount of particles, subatomic particles with masses larger than the atomic masses, rules and violation of rules, infinities, time reversal and so on. In the same the time the absolute validity of the initially adopted postulates was never reexamined.

In the recent years the imaging technology based on tunnelling microscopy marked significant advances. The obtained resolution is comparable with the interatomic distances in artificially grown crystal layers. Relying on the existing mathematical model of the atom some researchers provided a conclusion that they see the wavefunctions, so the quantum model is a real physical model. Such conclusion, however, is not true. There is a hardware structure behind the image. Such kind of structure is necessary even from the common physical sense. If the Bohr model was a physical one, then there is not a physical explanation how the small nucleus of any heavy atom is able to support the specific configuration of electronic orbits, in order the spectral signature to be unique for every element. The Bohr model is mathematically workable (to some

extent) because it relies on the quantum energetic features of the atom. It is indisputable fact that every physical system could be described by more than one mathematical model. The Bohr model is a successfull mathematical modell providing correct energy levels, but the physical and the mathematical model are two completely different things.

The Bohr planetary atomic model suffer number of disadvantages in order to be qualified as a real:

- lack of boundary conditions
- intrinsically small nucleus and lack of physical support of the complicated orbits

One may say that the small nuclear radius finds support from the scattering experiments. But according to the BSM theory (based on an alternative concept about the physical vacuum, not explored so far), the mathematical model of these experiments does not include number of important features: the structured space, the structure of the electron (or positron) used as a scattering object, and the complicated processes in high energy scattering in structured space. If all these factors are not taken into account, the derived results from the scattering experiments may differ tremendously from the reality.

The BSM theory applies a different approach according to the simple conclusion: The nature has its own hard rules and the processes from micro to macro-world are not so probabilistic as admitted in the quantum physics. The common sence logic postulates that all the phenomena exist in three-dimensional space, and the time is not reversal. Consequently they must be understandable by the human logic, that God gave us. The initial goal of BSM theory was to find out what is behind the postulates and the rules. The postulates according to BSM should be reduced to a minimum number, leaving only these of them for which we have enough observational confidence. They could be the following:

- **The energy conservation principle**
- **The energy could not be separated from the matter**
- **The gravitation is attribute of the matter and is part of some intrinsic energy balance**

Based on these postulates all necessary rules should be derivable. Some of them could be named as secondary postulates for convenience (as the constant light velocity in a structured space environments) but they should be initially explainable.

What is the BSM main concept?

BSM relies on one alternative concept about space (physical vacuum) not explored in the history of physics. Searching for common subatomic particles involved in both, the physical vacuum and the elementary particles, BSM theoretically discovered two particles in level of matter organization much lower than the atomic level. They are two **hexagonal prisms of two different intrinsic matter substances** with dimensional ratio 2:3. Their calculated dimensions are between

(1 – 10) E-20 (m). They should have twisting anisotropy of their intrinsic gravitational fields that is a result of their lower level structure. This means that their intrinsic gravitational field will exhibit stronger axial component with clockwise or counter clockwise features. In a classical empty space they are attracted by **Intrinsic Gravitational forces that are inverse proportional to the cube of the distance**. The attraction between different types of substances is much smaller than between the same substances and in some proper ratio between their matter quantities it may

disappear (this possible phenomena is discussed in the final cahper 12). In the mathematical analysis of BSM concept a model of two types of hexagonal prisms - right and left handed twisted is used. The mathematical model of twisted prisms possesses features allowing a quite successful simulation of the behaviour of the two real prisms. In such aspect the lower level structure is temporally ignored. The geometry of the twisted prisms is quite convenient for analysis of complex interactions. The observable space, that is considered so far as empty is filled according to the BSM concept, with spatial structure named a **Cosmic Lattice (CL)**. So, this practically not empty space is called a **CL space**. The CL structure is formed by equally distributed alternative nodes of 4 prisms (right and left handed nodes). The structure is similar to the atomic crystal structure of diamond, but any left-handed node has neighbours of right-handed node and there is a gap between the prisms of the neighbouring nodes. In conditions of inverse cubic gravitational law every node has possibility to oscillate in a complex spatial mode. So the Cosmic Lattice modifies the empty space into CL space possessing Zero Point Energy. It has features of quantum space and allows formation of electrical, magnetic and gravitational fields. It allows also a photon propagation as a quantum wave.

The proton, neutron and electron are formed of complex helical structures build of same twisted prisms in a process of crystallization during an incubation phase of a protogalaxy. Any galaxy possesses a cycle characterized with active life, death and birth. We may observe only the phase of active life. The other phases are completely hidden because the intrinsic matter of the galaxy in this phase is separated from the CL space of the Universe. During the process of recycling the prisms are remoulded, but a low level memory preserves their handedness. For different mouldings (recycles) the quantity of the intrinsic matter is one and a same due to a quantized process of matter dosation, however, their length to diameter ratio may vary due to the difference between moulding forces (defined by the quantity of the total intrinsic matter). Because every galaxy builds own CL space the small differences in the prisms are responsible for the observed redshift in the Universe. We may obtain light only from connected CL spaces. The red shift is accumulated process because the crossing photons lose small portion of their energy in every interconnected zone between neighbouring CL spaces. The Universe acoording to this concept is stationary.

The interaction between the helical structures and the CL space are quite complex. The CL structure itself is very unique not resembling to any fluid and even quite different from an ideal gas. One distinctive feature is that the CL nodes are rexible. They can be partly folded and displaced from more dens structure. Such more dens structure exists in the elementary particles, built by same type of prisms. The process of folding, displacement and unfolding of the CL nodes appears responcible for the inertial features of the atomic matter. In the same time the Newtonian mass of the particle (the mass we know) appears as a pressure of the CL space on the more dens structure of the elementary particles. The Newtonian gravitation is propagated in CL space by the interconnected nodes. In such aspect the BSM theory gives an unique possibility to explore the relation between the inertial mass and weight of the elementary particles, atoms, molecules and objects formed from them. Such unique possibilities are not provided by any other theory or hypothesis.

The major goals of BSM thesis are the following:

- To explain any kind of observable phenomena by a classical approach. This includes the quantum mechanics and the relativistic phenomena. In the BSM approach the uncertainty principle is not needed for explanation of quantum mechanical phenomena.

- To provide a unified field theory valid from a micro to macro Cosmos, unveiling the relation between phenomena in micro and macroscale

- To unveil the fine material structure and dimensions of the subatomic particles

- To find the rules of the protons and neutrons arrangement in the atomic nuclei and to unveil the nuclear structure of the elements.

- To show how the atoms are connected in molecules

- To derive the parameters of the CL space and to express them by the physical constants

- To provide classical explanation of the relativistic phenomena

- To provide evidence about the cycle of the matter evolution in the galaxy (galaxy cycle) and to infer the hidden phases of the recycling of the atomic matter

- To propose hypothesis about the low level of matter organization (below the prisms level) and physical explanation of the Intrinsic gravitation as one of the most fundamental law in the Nature

Some of the most fundamental equations and models derived by BSM are the following:

- Equations for dynamical properties of the CL node (Chapter 2)
- Relations between CL space parameters and the basic physical constants (Chapter 2)
- Equation for the light velocity in CL space in function of CL space parameters (Chapter 2)
- Equations for a Static, Dynamical, and Partial pressure of CL space (Chapter 3)
- Mass (Newtonian mass) equation, valid only for the helical structures (from where the mass budget of proton is calculated) (Chapter 3)
- Quantum velocities of the electron (Chapter 3)
- Derivation of the relativistic gamma factor from the electron motion in CL space (Chapter 3)
- Equations for FQHE (Chapter 4)
- Equation for CL space background temperature (2.72 K) (Chapter 5)
- Relation between some parameters of Electroweak theory and the parameters of the internal lattice inside the helical structures (Chapter 6)
- Formula for overall proton shape (Chapter 6)
- Model of Balmer series (Chapter 7)
- Equation for quantum orbit length in free CL space (Chapter 3 & 7)
- Equation for vibrational levels in H2 and D2 molecules (Chapter 9)
- Equation for binding energy between the proton and neutron in Deuteron (Chapter 9)
- Approximate equation for vibrational levels in two atomic homonuclear molecules (Chapter 9)
- Equations for inertia of helical structures, atomic matter and macro objects in CL space (Chapter 10)

- Model of pulsar (Chapter 12)
- Signatures of galaxy death and galaxy birth (Chapter 12)
- Theoretical derivation of redshift-distance relation and comparison to the Hubble empirically derived relation (Chapter 12)
- Space time constant and its physical meaning (used in all Chapters)
- Origin of the primary time base (Chapter 12)

BSM provides physical models of three dimensional structures of the matter and lattice formations. The proposed structures and their properties are illustrated with numerous drawings. In the analysis of their properties a straightforward mathematical methods are used in which the real objectivity and the principle of causality are preserved. In this process number of new features, parameters and mechanisms (previously unknown) are discovered. They are given proper names using a possible analogy with some known effects from the classical physics. The new features or mechanisms are explained in the first time they appear, while later they are only referenced by their given names. For this reason the reader is advised to follow the Chapters order.

Despite the adopted classical approach BSM theory appears more general than the Newton's physics and the Relativistic theory. The fundamental laws and postulates of both theories could be derived from the general concept of the BSM theory when proper conditions are applied. The following laws, for example, are derivable: For the Newton's physics: the Newton's first and second law and the law of Universal gravitation. (The law of Universal gravitation is not explicitly derived, but is evident from the analysis, and especially from the derived mass equation). For the Theory of Relativity: relativistic effects from the General and Special Relativity, the constant light velocity in CL space, the relativistic gamma factor and and the physical explanation of the relativistic mass and time delay. BSM provides also a new physical interpretation of the equation $E = mc^2$. The obtained energy is a result of disappearance of the Newtonian mass properties. The matter does not disappear, so it is not annihilated.

Among one of the important discoveries of BSM theory is also the physical origin of the fine structure constant. It is embedded in the very low level structures of the intrinsic matter, much lower than the prism's level. Its signature, however, is propagated into the geometrical features of the upper level helical structures and appears in the interactions between atoms, molecules and even in the inertial features of any object moving in the structured vacuum space.

BSM thesis contains 12 Chapters and some Appendices. The most important appendix is The Atlas of Atomic Nuclear Structures.
Part I of the atlas provides the geometry and the internal structure of the basic atomic particles, consisting of helical structures. Part II of the atlas provides the atomic nuclear structure of the elements up to Z = 103. In order to simplify the complex three-dimensional configuration of the atom, symbolic notations are used for the proton, neutron, deuteron and helium. The electronic orbits are not shown, but their positions are well defined by the position and the proximity electrical field of the protons (or deuterons). The raw and column signature of the periodic table is well matched, the Hund's rules and Pauli exclusion principle are identifiable. Due to a drawing complexity, the twisting feature of the proton, neutron and atomic nuclei are not directly shown.

