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Inerton fields: A new approach in fundamental physics

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Structure of space. – Modern theories of everything, or theories of the grand unification of all physical interactions, try to reach an understanding of the structure of things of extremely small scale, starting from data obtained in the course of high-energy experiments. In collisional experiments, particles approach within 10^{-18} m, which allows researchers to predict the point of intersection of constants of electromagnetic, weak and strong interactions on the scale of10^{-30} m, Fig. 1.

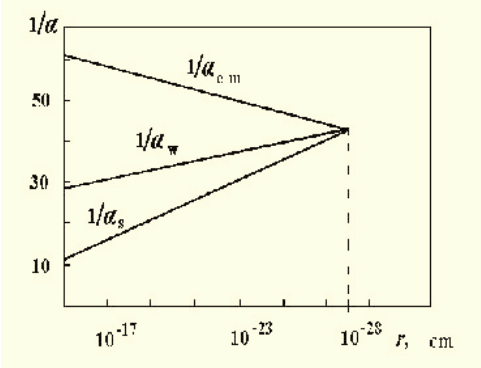


Fig. 1. Evolutional lines describing changes of the interaction constants with distance.

Thus on the scale of 10^{-30} m, approaching the Planck scale $\sqrt{\hbar G/c^3} \sim 10^{-35}$ m, physicists can only hypothesize about a microscopic structure of space. Quantum mechanic forbids determinism on the atomic scale, of 10^{-10} m, although general relativity discusses deterministic details of space-time from macroscopic to microscopic distances. How could we unify such different theories as quantum mechanics and general relativity?

Coming back to the fundamental physics of the beginning of 20th century, I must mention a key idea of Henry Poincaré [1]: the motion of a particle in the aether is accompanied by an aether perturbation. In 1924 Louis de Broglie developed the notion of a particle with wave properties, a particle guided by a real wave. De Broglie's concept was introduced some 15-20 years after that of Poincaré, although it reflected the same major idea: a moving particle is surrounded by excitations whose source is a sub quantum medium. In 1952 David Bohm further developed the initial ideas of de Broglie with the concept of a pilot wave, though his wave still remained abstract. In the 1990s the author proposed a sub-microscopic mechanics of real space and introduced the notion of excitations of space, which were called *inertons*.

Why do we need a substrate? I will show that the introduction of a this idea helps us reconcile certain modern concepts, in particular those of quantum mechanics and general relativity. Moreover, we would try to derive this substrate starting from the other significant knowledge base – that of fundamental mathematics: set theory, topology and fractal

geometry. This allows us to construct a physical world starting from a point and a local construction that may then be tessellated to a macroscopic scale which is operational both for quantum and classical mechanics. Such a submicroscopic concept provides a new approach for the construction of fundamental physics based on the constitution of mathematical space and combinational rules that are applied to this space.

In a series of papers Michel Bounias and the author [2-6] described the procedure for deriving real physical space from a mathematical space constructed as a tessellation lattice of topological balls, primary entities of set theory and topology – which was called the *tessel-lattice*. A lattice of balls in which only homeomorphic mappings are allowed represents a degenerate physical space and can be associated with an emptiness of ordinary physical space.

The appearance of a local deformation in the tessel-lattice is treated as an induction of mass in it. Then a deformed cell whose deformation obeys the rules of volumetric fractality can be treated as a massive particle (Fig. 2). Quantitatively, the notion of *mass* can be determined as the ratio of the initial volume of a degenerate cell to the volume of the same deformed cell,

$$m \propto V_{\text{degenerate cell}} / V_{\text{deformed cell}}.$$

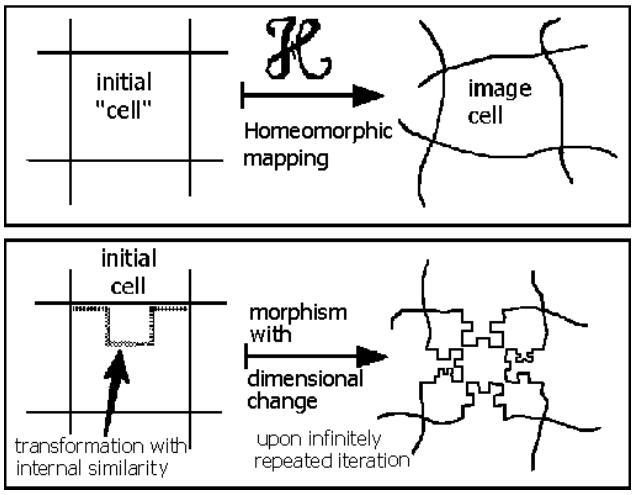


Fig. 2. The continuity of homeomorphic mappings of structures is broken if a deformation involves an iterated transformation with internal self-similarity, since this involves a change in the dimension of the mapped structure. Here, the first 2 or 3 steps of the iteration are sketched, where the new figure jumps from the dimention D to that equals approximately D + 1.45. The mediator of transformations is provided in all cases by empty set units.

Fragments of a local deformation may migrate, or can be distributed among other cells in many different ways, Fig. 3. These migratory fragments of local deformations represent a field of excitations of the tessellated space, i.e. mass excitations, or "*inertons*".

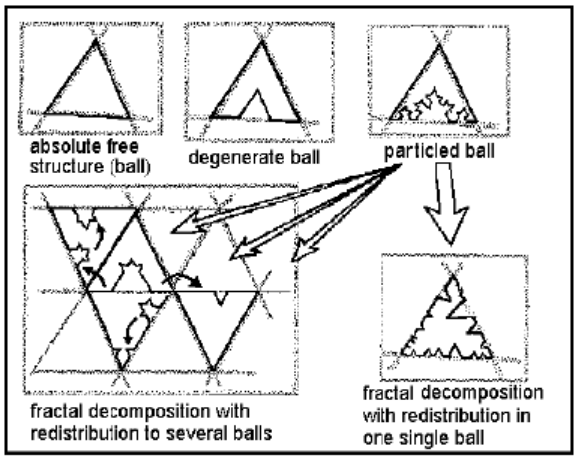
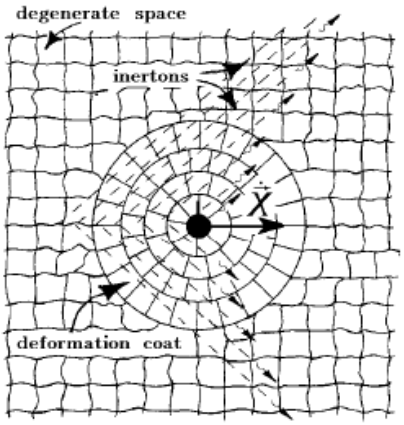


Fig. 3. A Topological ball (a cell) is represented as a triangle, using 3 dimensions, in a metaphorical form. A degenerate ball keeps the same dimension, in contrast with a "particulate ball" endowed with an fractal substructure. A complete decomposition into one single ball (k = 1) conserves the volume without keeping the fractal dimension. The von Koch-like fractal has been simplified to 3 iterates for clarity.

Mathematical characteristics, such as distance, surface and volume, generate in the fractal tessel-lattice the basic physical notions, such as : mass, particle, the particle's de Broglie wavelength, Compton wavelength and so on and the corresponding fundamental physical laws. In particular, the significant character of a massive particle may be associated with a volumetric fractal deformation of a cell, as shown in Fig. 2; Fig. 3 demonstrates a principal possibility for decomposition of the mass *m* of such particle.



The interaction of a moving particle-like deformation with the surrounding tessellated space involves a fractal decomposition process (Fig. 3), consistent with the existence and properties of *inerton clouds,* previously postulated, associated with particles (on this point the submicroscopic concept coincides with the above ideas of Poincaré and de Broglie), Fig. 4.

Fig. 4. Free-moving canonical particle in the tessellation space.

Submicroscopic mechanics. – The motion of a particle in the tessellated space was considered in detail by the author (see e.g. review article [7]). It was found that the cloud of inertons surrounding the particle spreads out to a range $\Lambda = \lambda c / \upsilon$ [7] from the particle where λ is its de Broglie wavelength, and υ and c are velocities of the particle and light, respectively. The Lagrangian, which characterises submicroscopic mechanics, has the following simplified form

$$L = m\dot{x}^2 / 2 + \mu\dot{\chi}^2 / 2 - \sqrt{m\mu}\,\dot{x}\chi / T$$

where μ and χ stand for the mass and coordinate of the particle's inerton cloud, T is the period of collision of the particle and the inerton cloud. The behaviour of the particle parameters derived on the basis of the Lagrangian above is displayed in Fig. 5.

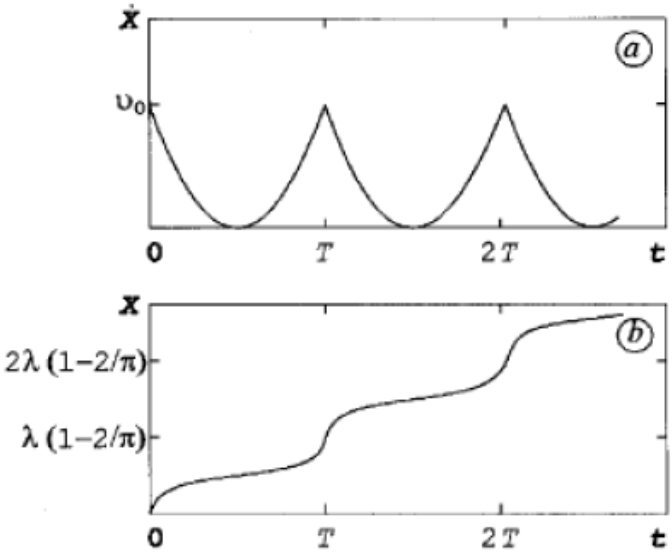


Fig. 5. Schematic representation of the solutions of the Euler-Lagrange equations for a particle that moves, interacting by means inertons with the tessellated space.

Submicrosopic mechanics allows us to interpret the wave ψ -function of a particle as a mass field, or the field of inertia of the particle. Only the range of space disturbed by the particle's inerton cloud represents the zone of action of conventional quantum mechanics, because beyond the amplitude Λ the wave function ψ must be equal to zero.

The quantum mechanical notion of spin is stipulated by the periodical pulsation of the shape of a particle along the particle's de Broglie wavelength, Fig. 6.

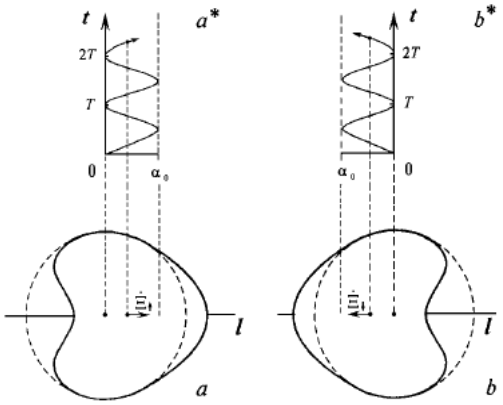


Fig. 6. To the notion of spin: the shape of the particulate ball is oscillated between the beanlike state and the spherical state.

The submicroscopic concept makes it possible to unify the Schrödinger and Dirac formalisms. In fact, 3 relationships may be given for a particle of mass *m* and the velocity υ,

the de Broglie wavelength: $\lambda = h/(m\upsilon)$

the Compton wavelength: $\lambda_{\text{Com}} = h/(mc)$

the range of inerton cloud: $\Lambda = \lambda c/\upsilon$.

These relationships allow us to obtain the following interesting dependency

$$\Lambda = \lambda_{\text{Com}}\, c^2/\upsilon^2$$

from which we can see that if $\upsilon << c$, the size of the inerton cloud Λ significantly exceeds the Compton wavelength that characterises the radius of the deformation coat of the particle (Fig. 4). Therefore, the measuring device, a detector of particles, fixes the inerton cloud, but its kinetic energy is equal to the kinetic energy of the particle $E = m\upsilon^2/2$. This is the case of the Schrödinger formalism.

If $\upsilon \to c$, the inerton cloud is locked in the range covered by the deformation coat, but its energy is equal to the total energy of the particle and hence in this case the measuring device fixes the whole deformation coat whose energy is $E = mc^2/(1-\upsilon^2/c^2)^{1/2}$. This is the case of the Dirac formalism.

Phenomenon of gravitation. – De Haas [8] noted: A combination of Gustav Mie's (1912) theory of gravity and Louis de Broglie's (1924) harmony of phases of a moving particle results in the principle of equivalence for quantum gravity. Mie's source of gravitational energy was linked by David Gilbert (1915) to the trace of an inertial stress-energy tensor that plays the role of the source of gravitational energy in modern concepts. De Haas stated that a particle moving through space deforms the metrics on a quantum local scale in a way that the

inertial energy flow $E_{\text{inert}}\upsilon_{\text{group}}$ becomes concentrated in the particle's wave packet, though the gravitational energy flow $E_{\text{grav}}\upsilon_{\text{particle}}$ grows dislocated in it.

Thus the gravitational and inertial energies of the particle show that the gravitational mass is completely allocated in the inertial wave that guides the particle. This means that the principle of equivalence of gravitational and inertial masses should now read as follows [8]:

> The equality $m_{\text{grav}} = m_{\text{inert}}$, which is held in a rest-frame of the particle in question, becomes invalid in a moving reference frame; in the quantum context, this equality should be transformed to the principle of equivalence of the appropriate phases, $\varphi_{\text{grav}} = \varphi_{\text{inert}}$.

Since inertons transfer not only the kinetic properties, but also mass, a dynamics of mass of a moving canonical particle has also been studied [9], which manifests itself in a deeper analysis of thermodynamics [10]. The studies show that the mass of a moving particle is distributed in real space in an oscillating motion, exactly in line with results discussed by de Haas [8]. A standing inerton wave is created with wavelength Λ and it is this wave that represents the origin of gravity.

The particle mass varies within the spatial period λ, i.e. the de Broglie wavelength, similar to the case of particle velocity which changes with the emission and re-absorption of inertons from υ to 0. Fig. 7 depicts what happens as λ varies to mass, which is treated as a fractal volumetric deformation.

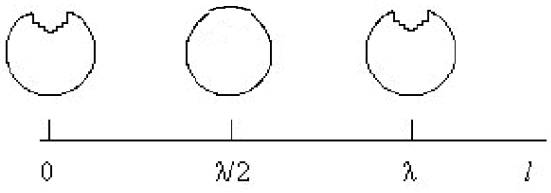


Fig. 7. Schematic fractal volumetric deformation of the particulate cell, i.e. mass *m* (positions 0 and λ in the particle path *l*), which transfers to tension ξ (position $\lambda/2$) where mass $m = 0$.

Now we can write the gravitational Lagrangian, which represents an extended version of the Lagrangian of submicroscopic mechanics,

$$L = -m_0 c^2 \{[\text{submicro mechanics}] + \\ + C_1(dm/dt)^2 + C_2(d\xi/dt)^2 - C_3(dm/dt)\,\text{div}\xi\}^{1/2}$$

where C_i are the constants needed for the correct dimension. The second line of the gravitational Lagrangian describes the behaviour of mass *m* and the tension ξ. The appropriate solution to the Euler-Lagrange equations shows the distribution of the mass field around the particle [9]

$$m(r,\ t) \ \propto\ 1/r \cdot \cos(\pi r/2\Lambda)\left|\cos(\pi t/2T)\right|$$

where $r \le \Lambda$ (the tension ξ changes in antiphase). This solution can be averaged in time and at $r << \Lambda$ we can present the distribution of mass field around the particle as follows

$$m(r,\ t)\ = \text{const}/r\ .$$

Multiplying both parts of this expression by a factor $-G/\text{const}$ where G is Newton's constant of gravitation, we obtain the potential of gravitational energy, or Newton's gravitational potential

$$U(r) = -G\ m_0/r\ .$$

So, the inerton cloud spreads as a standing spherical wave, which signifies the validity of the inverse distance law for the behaviour of mass, $1/r$. In other words, in line with this law, the deformation of space around the particle in question gradually decreases from the largest value at the location of the particulate cell to zero at the maximal distant point Λ to which inertons are able to reach. This dependence, $1/r$, accounts for Newton's gravitational law, because in a time when all ultrafast inerton processes have averaged – the velocity of inertons has been estimated as $92c$ [10] where c is the velocity of light. An external observer then sees a quasi-stationary pattern: the space around the particle (or a macroscopic object in general) appears as a deformed variant of the stationary, where the deformation obeys the law $1/r$, and which it is reasonable to associate with Newton's gravitational law.

Thus, we argue here that Newton's law may be derived from submicroscopic first principles. And what is especially interesting, the gravitational attraction comes from the internal motion available in the system in question, such that we may state: no motion, no gravity. The results discussed above show that quantization of the gravitation should be read as denoting the periodical process of emission and re-absorption of inerton clouds by a moving canonical particle. This process intrudes itself upon the space in which the motion takes place.

General relativity does not explain the origin of gravity; it only slightly corrects Newton's gravitational law $-G\ m_1 m_2/r$. The physical reasons for this correction are hidden in the necessity to take into account a tangential component of the gravitational attraction between objects, which is a small correction to the radial interaction $-G\ m_1 m_2/r$. A submicroscopic mechanism of the phenomenon of the totally correct gravitational interaction, which is dynamic and realised through inertons, will be presented in a separate study.

Electric charge. – The geometry of the elementary electric charge can be derived from the fractal geometry of cells of the tessel-lattice [11].

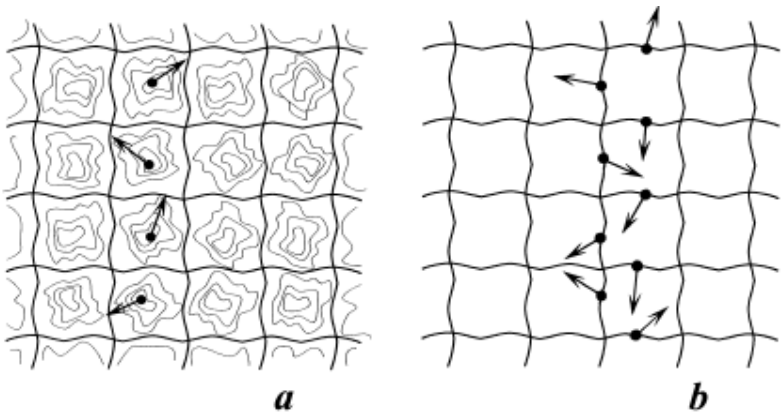


Fig. 8. Two kinds of superparticle vibrations in the degenerate space: (a) vibrations of the centre-of-mass of super-particles; (b) vibrations of the surface of super-particles.

Since the surface of cells can move independently from the cells' fractal volumetric motion (Fig. 8), we may associate the phenomenon of charge with the appearance of the

quantum of surface fractality of a cell. The transition to the charge state of a cell depicts Fig. 9.

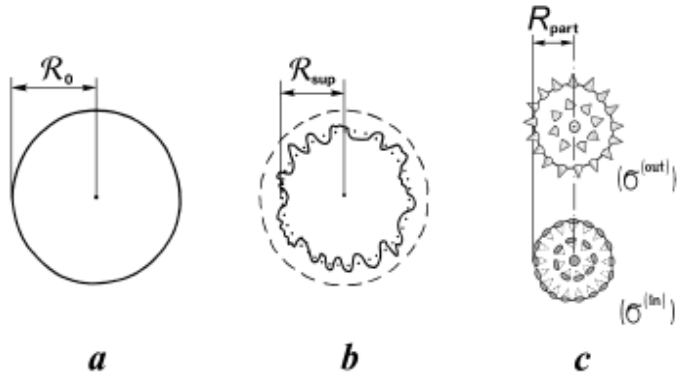


Fig. 9. Transitions of a topological ball from the wholly free state (a) to the degenerate state (b) in the space tessel-lattice and then to the state of the charged particle (c), either positive or negative.

The Lagrangian of the motion of charge has been proposed. It allows the derivation of the equations of motion, which show that within the particle's de Broglie wavelength λ the electric charge e periodically becomes transformed to the magnetic charge g, i.e. to the so-called monopole state (Fig. 10).

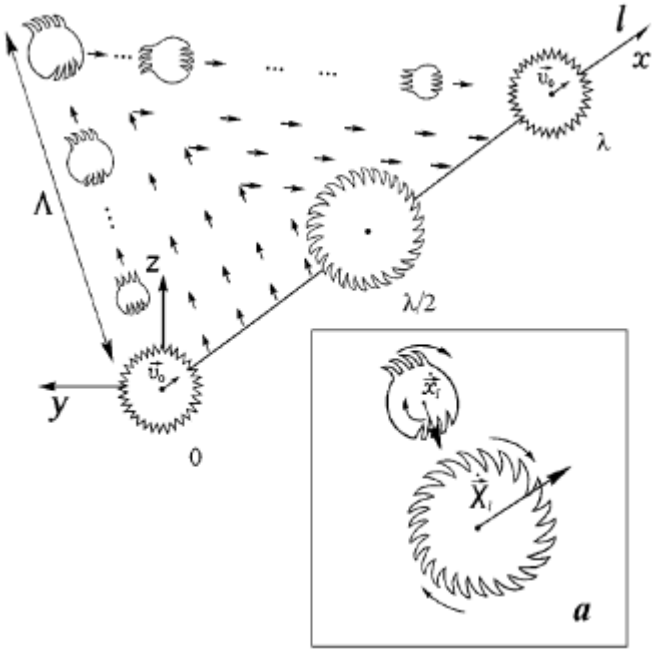


Fig. 10. Diagram of the motion of the positive charged particle. The particle is accompanied by electromagnetic polarized inertons, or inerton-photons, or simply photons (it is obvious that these particle's polarized inertons correspond to so-called "virtual photons" of quantum electrodynamics). (a) the moment of absorption of the ith inerton-photon by the particle.

Thus, Fig. 10 demonstrates the periodical conversion of the surface state of the particle kernel from the chestnut shape to the inclined needles shape, which corresponds to the electric charge and the monopole, respectively. Such motion results exactly in the Maxwell equations.

The behaviour of the inerton and the photon within the wavelength λ is displayed in Fig. 11.

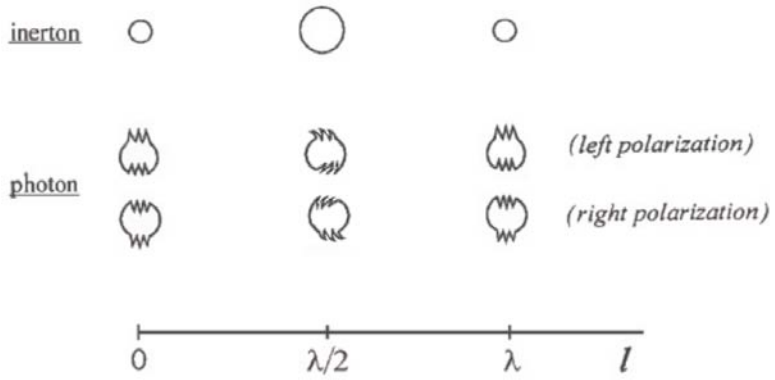


Fig. 11. Motion of two basic quasi-particles in space: the inerton and the photon.

In the case of a free photon (Fig. 11), which moves hopping from cell to cell, in the section λ known as its wavelength, the photon's electric polarization (which stands for fractal needles normal to the surface of an approaching cell) periodically transforms to the magnetic polarization (in this state fractal needles are inclined, such that they are tangential to the surface).

Experimental verification. – The existence of inertons has been proved in a number of experiments.

1. "Real inertons against hypothetical gravitons. Experimental proof of the existence of inertons" [12]. The impact of inerton waves on the behaviour of atoms in metals was studied theoretically and then observed experimentally in changes of the fine morphological structure of specimens by the high-resolution electron-scanning microscope in paper [10]. In the experiment we used a resonator of the Earth inerton waves, which represented a small projective model of the terrestrial globe. Since the Earth is rotated from the west to the east (proper rotations of the Earth), a flow of inertons must be available in this direction. These inerton waves are intensified in the projective model, i.e. a resonator. In particular, the Great Pyramid of Giza possesses all the properties required for a high efficiency resonator of the Earth inerton waves (Fig. 12).

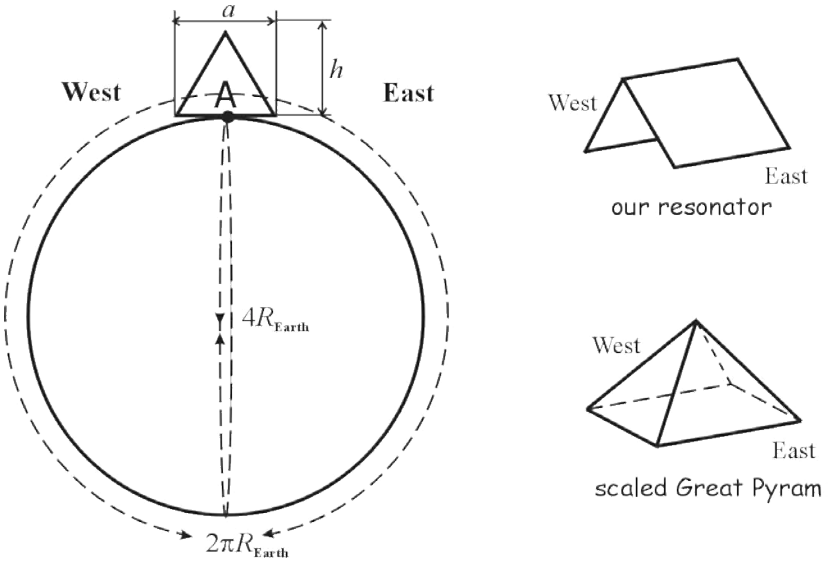


Fig. 12. Diagram shows why a geometrical figure whose cross-section along the west-east line is a triangle is a resonator of the Earth inerton waves: Two orthogonal inerton signals – along the diameter and along the equator – meet each other in the point A. The ratio of these two paths is: $2\pi R_{\text{Earth}} / 4R_{\text{Earth}} = \pi / 2$. The figure in the point A will be the effective resonator if the base and height possess the same ratio: $a / h = \pi / 2$.

We put a razor blade in a resonator (Fig. 13), which stayed there for a month. Then we investigated edges of a few blades by mean of the electron microscope. The results, i.e. micrographs, are shown in Fig. 14. In fact, changes in a metal caused by the influence of the Earth inerton field were fixed.

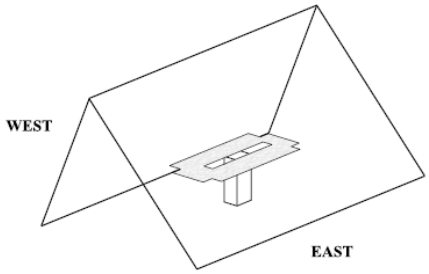


Fig. 13. Razor blade is the resonator of the Earth inerton waves.

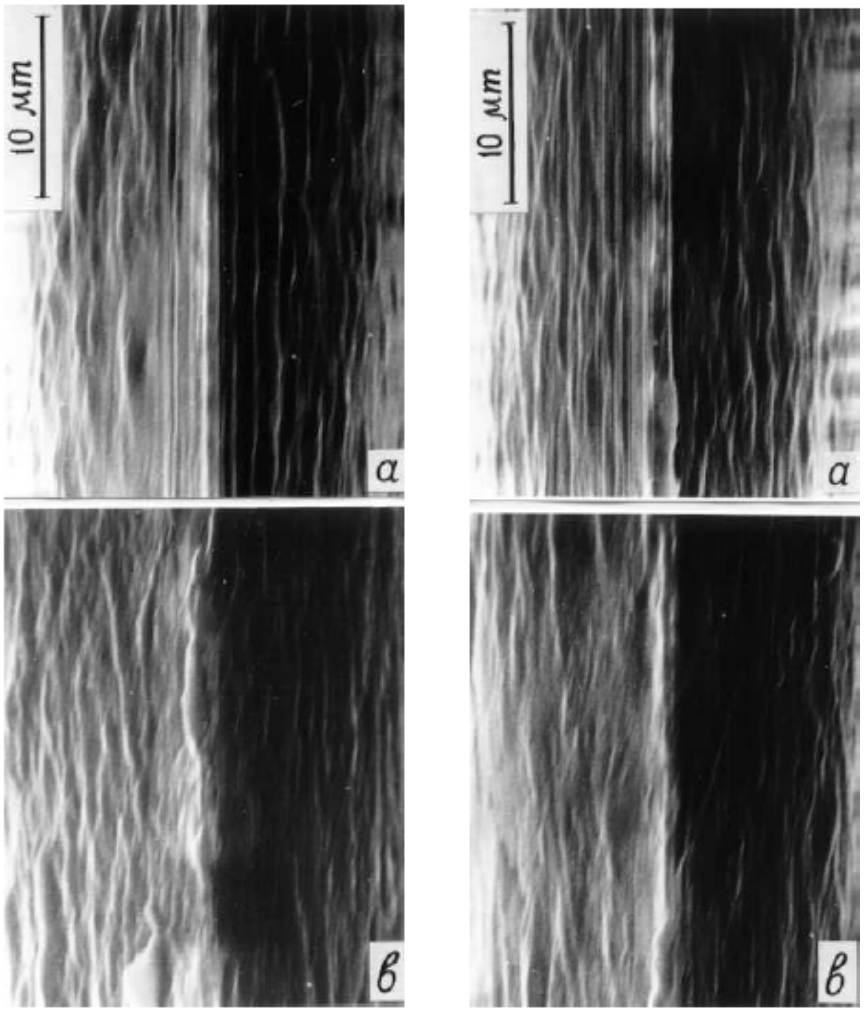


Fig. 14. Micrographs of the edge of razors blades. (a) control specimens, (b) after staying in the resonator for 30 days. The fine morpho-logical structure changed on micro-graphs "b", though the crude morphological structure was preserved.

During the last few years my colleagues and I have studied physical fields in the interior of a few model pyramids whose sizes varied from centimeters to maximum 8 meters. In particular, we measured the intensity of inerton field inside a pyramid made of flat slates whose base and height were equal to 5 m and 3.2 m, respectively (i.e. the ratio base / height = $\pi/2$ as is the case for the Great Pyramid of Giza, the thickness of a slate is 12 mm); four facets were oriented North, South East and West. The geographical situation of the pyramid is about 50 km from Kyiv, Ukraine. The device that was used to measure the inerton field was designed by my colleague V. Didkovsky and me (see below Fig. 20). The measurement at the frequency 13 kHz showed that inside the pyramid the intensity of the inerton field twice exceeded the intensity of the natural Earth inerton field recorded outside the pyramid along the west-east line. At the frequency of 5 kHz we could record an increase of intensity of 2.5-fold in the inerton field from the bottom to the top along the vertical axis of the pyramid.

2. "On the theory of the anomalous photoelectric effect stemming from a substructure of matter waves" [13]. In this paper electrons moving in atoms were treated as entities surrounded by their inerton clouds. The investigation of the interaction between such entities and a photon flux was carried out in detail. A particular feature of the theory proposed was that the effective cross-section of electrons was significantly enlarged as a result of their surrounding inerton clouds. It was shown that a number of different experiments aimed at the study of laser-induced gas ionization were in agreement with the theoretical results prescribed by the inerton theory, though other theories failed to account for those data.

3. "Collective dynamics of hydrogen atoms in the $KIO_3 \cdot HIO_3$ crystal dictated by a substructure of the matter waves associated with hydrogen atoms [14]. The inerton concept was applied to explain a fine dynamics of hydrogen atoms in the $KIO_3 \cdot HIO_3$ crystal whose FTIR spectra in the 400 to 4000 cm^{-1} range showed unexplainable sub maxima. (Fig. 15). Features observed in the spectra were attributed to the effect of induced mean inerton fields contributing to the paired potential of hydrogen-hydrogen interaction. Such additional interaction is thought to lead to the formation of clusters of hydrogen atoms.

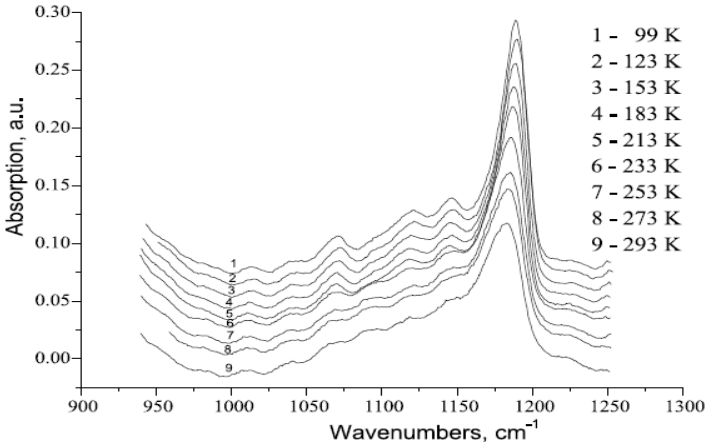


Fig. 15. Appearance of sub maxima is interpreted by the inerton interactions between hydrogen atoms, which results in formation of clusters of hydrogen atoms. Clusters introduce changes in the spectrum, namely, they add sub maxima.

4. "On the behaviour of physical parameters of aqueous solutions affected by the inerton field of Teslar® technology" [15]. Here, we examined the phenomenon of irradiation of aqueous solutions by scalar waves generated by the so-called Teslar® technology. Our study justified that the Teslar watch produces neither electromagnetic, nor ultrasound radiation. They generate inerton radiation by a special electric circuit embedded in the watch. Two superimposed electromagnetic waves whose amplitudes are shifted to 180^o are cancelled, but an inerton flow, which continues to transfer the energy, remains.

5. "Heavy electrons: Electron droplets generated by photogalvanic and pyroelectric effects" [16]. We carried out experiments on the generation of electron clusters from the surface of the $LiNbO_3$ crystal and could show it was the inerton field that bound emitted electrons together (Fig. 16). The size of a cluster was about 100 μm, it included about 10^{10} electrons and moved freely with the velocity ~ 0.5 cm/s in the air near the surface of the crystal experiencing the Earth gravitational field. The inerton field plays the role of a restraining force, a substructure of the particles' matter waves, which can withstand the Coulomb repulsion of electrons in a cluster. It has been shown that electrons in the cluster are heavy electrons whose mass exceeds by millions of times the rest mass of free electrons.

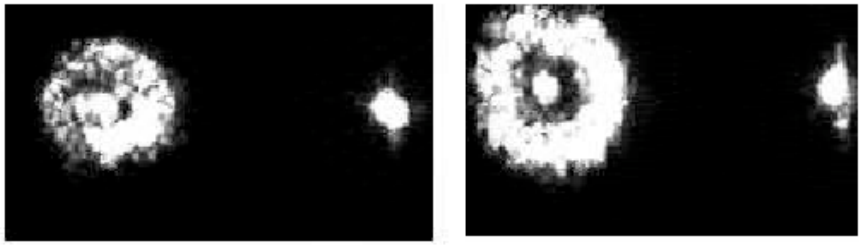


Fig. 16. Electron droplets.

6. "A first step of inerton astronomy" (with V. Didkovsky, 2004-2007, in preparation). Using our device that measures the inerton radiation, i.e. flow of mass that falls on the unit srface per one second, we have measured the inerton radiation of the Earth (Figs. 17, 18).

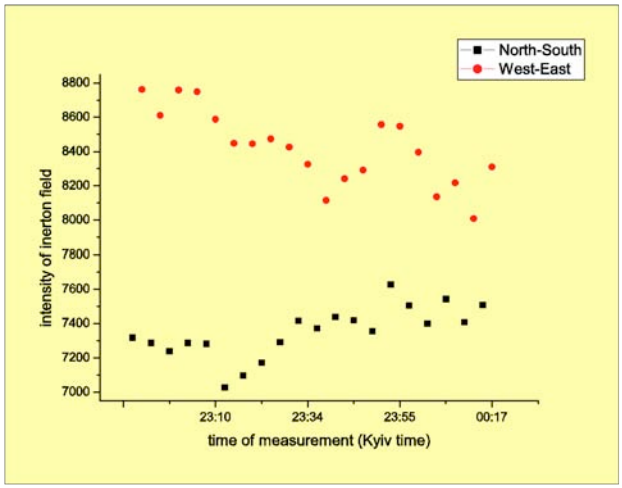


Fig. 17. First measurements in inerton astronomy: the antenna is tuned along the North-East line (bottom points) and along the West-East line (upper points). Night-time in Kyiv, June 2006.

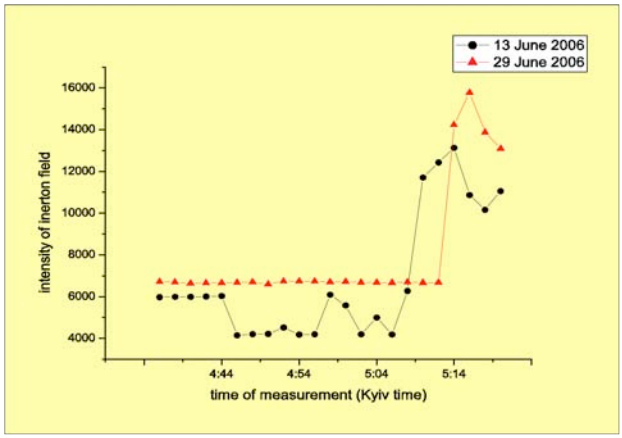


Fig. 18. First measurements in inerton astronomy: the antenna is tuned along the West-East line. The moment of sunrise corresponds a significant increase of the absorbed intensity of inertons (Kyiv, June 2006).

The intervention of the Sun inerton field at the moment of sunrise explains Fig. 19.

Fig. 19. Earth is shielding the Sun's inerton shell until sunrise

The device that measures inerton fields, which can be used also for astronomical measurements, is shown in Fig. 20.

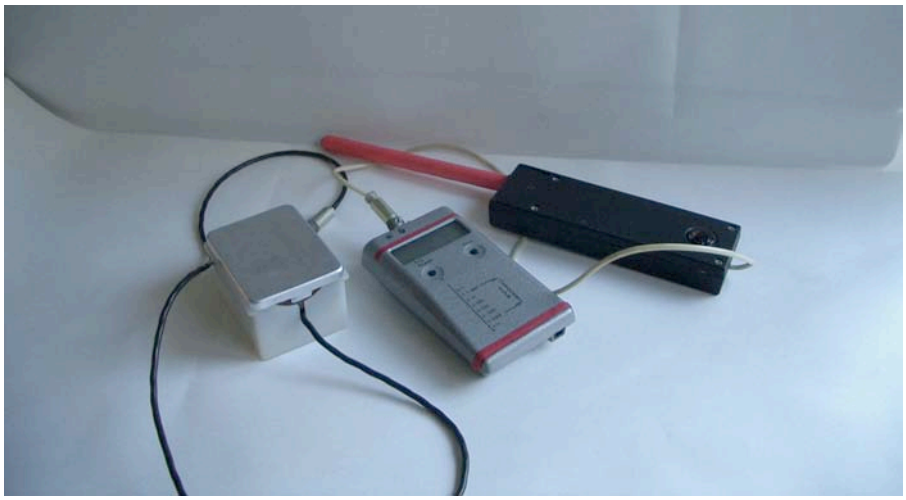


Fig. 20. Device that measures inerton fields.

Industrial applications. – There is a possibility to develop a few technologies in the area of clean energy involving the inerton field. A company entitled *Indra Scientific* was founded in Brussels (2006) and it deals with applications of inerton fields.

The knowledge base of the ancients. – It is interesting to note that the Vedic literature has been decoded in terms of physical entities, by Dr. R. J. M. Roy and Dr. S. Kak. In Roy's *Vedic Physics* [17] for example, he suggests that a few verses from *The Rigveda* may be deciphered as follows: "The electric charge is kept and plays on the surface of a particle", which exactly corresponds to our finding above. Then, the three steps of God Vishnu (the universe) have been explained by Roy as the space web, which consists of 1) indivisible cells, 2) their interface and 3) the observer space, i.e. the aggregation of cells; this also absolutely coincides with our model of real physical space considered as the tessel-lattice. In *The Bhagavad-Gita* we can find the description of a primary element of Nature, a subtle particle; this also in agreement with the tessel-lattice that is made of topological balls (cells, or super-particles). The same information on the existence of a primary brick of Nature one can find in Democritus who introduced such notions, as the aether and atoms (note he travelled a lot and for a long time was living in India where he studied the Vedic heritage with Brahmans). It seems, the conquest of India by Alexander Macedonsky destroyed the scientific ground of Indian culture and their knowledge base was lost up to the present time. But now we are able to come back to the true constitution and laws of Nature. Very recently in Ukraine archaeologist Dr. Yu. Shilov and colleagues have made a sensational discovery of a very ancient civilization dated about 6000 B.C. That was Aratta, the mother of all ancient civilizations, such as Sumerian, Egyptian, Greece, Indian, far East and others. The citizens of Aratta possessed a unique knowledge and, in particular, invented 80% of symbols that modern civilizations use today.

Conclusions. – The theory of real space, as a tessellation lattice of primary topological balls, allows the derivation and the determination of all the fundamental physical parameters, such as mass, particle, motion, time, positive and negative charge, monopole, de-Broglie wavelength, Compton wavelength, and spin. The introduction of the notion of motion is equivalent to the appearance of time. The notion of a massive particle is associated with a fractal volumetric deformation of a cell of the tessel-lattice. The motion of such a particulate

cell is accompanied by the motion of spatial excitations called *inertons* that migrate by a relay mechanism, i.e. hopping from cell to cell. Inertons carry fragments of the particle's velocity and mass and are responsible for **both** the uncommonness of quantum mechanics and the phenomenon of the gravitational attraction.

The proposed mathematical approach makes it possible to derive a primordial physical substrate, space (*loka* in Sanskrit, which was called an aether by Democritus), starting from pure mathematical notions. The grand authorities who made the major contribution to this concept, which entirely formalises fundamental physics, were three great French scientists: Henri Poincaré (topology of space and the aether, which was separated from the notion of space yet, but in which particles moved surrounded by the aether's excitations), Louis de Broglie (a moving particle is guided by a real wave whose origin is in a sub-quantum medium and such motion generates relationships $E = h\nu$ and $\lambda = h/(m\upsilon)$) and Michel Bounias (the constitution of mathematical space as such, and the construction of the physical space as a consequence of mathematical space).

The de Broglie wavelength λ has been interpreted in relation to the spatial period of a moving particle. Within the section λ, due to the emission and re-absorption of the particle's inerton cloud, parameters of the particle undergo periodical changes, namely, they vary as follows:

velocity	$\upsilon \rightarrow 0 \rightarrow \upsilon$;
mass	$m \rightarrow 0 \rightarrow m$ and the tension $0 \rightarrow \xi \rightarrow 0$;
electric charge	$e \rightarrow 0 \rightarrow e$ and the magnetic charge, i.e. monopole state $0 \rightarrow g \rightarrow 0$;
particle shape:	beanlike $\rightarrow$ spherical $\rightarrow$ beanlike (such internal motion manifests itself in conventional quantum mechanics as a half-integer spin).

The submicroscopic concept of the physical world presented in this work supposes a complete deterministic description of the quantum system studied, which enables us to cast a glance at the science behind the pattern constructed by conventional quantum physics.

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Questions after the presentation

Question: What about Heisenberg's uncertainties?

Answer: In conventional quantum mechanics an undetermined "wave-particle" is further substituted by a package of superimposed monochromatic abstract waves. It is this approximation that gives rise to the inequality of wave numbers Δk_i and the position Δx of the package under consideration, which then results in Heisenberg's uncertainties. However, the tessellation space allows another presentation for a particle: the moving particle appears as two subsystems: the particulate cell (the particle kernel) and the inerton cloud that accompanies it and such system cannot be imagined as a package of abstract waves.

Question: Can the concept presented shed light on the situation with dark matter?

Answer: Modern physics still does not pay any attention to the fact that real physical space is not emptiness but a substrate. In modern cosmology the universe is treated as a set of stars separated by distances. However, such an approach resembles rather the study of the behaviour of fishes (small, smaller, big and bigger) in an ocean but not the investigation of the ocean as such. In the concept presented here, particles, planets and stars are an integral part of the tessellated space. That is why we must treat particles and stars as excitations in the tessel-lattice, which requires a consideration of their interaction with the tessel-lattice and such interaction is a mandatory requirement. Nevertheless, this interaction is still missing from modern physics. Without doubt, the interaction with the tessel-lattice would significantly clarify the situation with dark matter.