Fundamental discoveries of the space-time quantum (quanton) and superstrong electromagnetic interaction (SEI)

Professor Vladimir Leonov

The quantum of space-time (quanton) was discovered by me in 1996. Quanton is a real particle of time that sets the pace of the spatial clock. Quanton is a real particle of time that sets the pace (rhythm) of a spatial clock. It is a volume electromagnetic resonator with elastic properties like an oscillating clock spring. Quanton counts Leonov's time, which are 10 orders of magnitude slower than Planck time. Quanton occupies an elementary volume in space and has dimensions (Leonov's length), establishing the discreteness of quantized space-time. Leonov's length is a new fundamental length that is 10 orders of magnitude greater than the Planck length. A quanton consists of four integers quarks: two electric and two magnetic, located at the vertices of the tetrahedron inside the spherical particle. These integer quarks have no mass but have a charge. The magnetic quark was introduced into physics for the first time in the theory of Superunification. Only four quarks inside a quanton determine the electromagnetic structure of quantized space-time and its electromagnetic symmetry between electricity and magnetism. Colossal electromagnetic energy is accumulated inside the quanton. If you activate one cubic meter of quantized space-time (space vacuum), then this energy will be equivalent to the energy of the material part of our universe. We have finally found the source of energy for the Big Bang, if this fact has take place in reality. But we do not know who quantized our universe? The colossal energy of the quanton confirms that the quanton and quantized space-time is the carrier of superstrong electromagnetic interaction (SEI). SEI is the fifth fundamental force (Superforce) that unifies gravity, electromagnetism, nuclear and electroweak forces.

Keywords: quantum of space-time, quanton, superstrong electromagnetic interaction, fifth fundamental force, Superforce, quantized space-time, quark, electric quark, magnetic quark, Leonov's length, Planck length, Planck time, Leonov's time, elementary magnetic charge – Leon [L].

This article is part 1 published in my book:

1. Leonov V. S. Quantum Energetics. Volume 1. Theory of Superunification. Cambridge International Science Publishing, 2010, 745 pages. https://www.abebooks.com/9781904602750/Quantum-Energetics-Volume-1-Vladimir-1904602754/plp

2. V.S. Leonov. Quantum Energetics: Theory of Superunification. Viva Books, India, 2011, 732 pages. http://www.vivagroupindia.com/frmBookDetail.aspx?BookId=7922

Download free. Leonov V. S. Quantum Energetics. Volume 1. Theory of Superunification, 2010. http://leonov-leonovstheories.blogspot.com/2018/04/download-free-leonov-v-s-quantum.html [Date accessed April 30, 2018].

Please draw your attention to the formula 1.1 that I developed in 1996:

$$g = C_0 e = 4.8 \cdot 10^{-11} \text{Am} \quad (\text{L or Leon}) \quad \neq \text{Dr} \qquad (1.1)$$

Formula 1.1 establishes the correct relationship between the elementary magnetic charge g and the elementary electric charge e in SI system. C_0 is the speed of light. **Unit magnetic charge – Leon [L].** Unit electric charge – Coulomb [C]. My early unit of measurement of magnetic charge in Dirac [Dk] is abolished and henceforth the dimension of the magnetic charge is measured in Leon. Read my article: "**Unit of measurement of magnetic charge – Leon."**.

Since I cannot make these changes in the texts of already published books, I ask you to take my corrections into account when using the unit of measurement of magnetic charge in Leon in your publications.

1.1. The need for introducing the space-time quantum into physics

Fundamental science has accumulated a sufficiently large amount of knowledge to support the very fact of the discovery of the space-time quantum (quanton) and superstrong electromagnetic interaction (SEI). The concept of Superunification was formulated by physicists. Many physicists do not doubt that electromagnetism, gravitation, nuclear and electroweak forces are the manifestation of the united origin. The concept of the unified field was formulated by Einstein and he devoted 30 years to the development of this concept in the path to unification of gravitation and electromagnetism. He succeeded within the framework of the general theory of relativity (GTR) to combine space and time into the single space-time substance. Already at the end of his life, Einstein concluded that it is necessary to use discrete approaches to the problem of space-time and unification of the interactions within the framework of quantum theory.

There are various approaches to solving these problems in theoretical physics. This also concerns the problem of unification. We can go along the path of finding some universal formula (or a set of formulas) describing the fundamental interactions by mathematical methods, or along the path of finding a universal unifying particle. The alternate path was less attractive to investigators because physics did not know such a particle and the possibilities of discovering this particle were not clear. However, this second approach has been selected in the path to unification of interactions. This also determined the logics and expected success.

The positive example provided by Einstein in the path of unification of space and time created completely new possibilities in theoretical physicist. However, progress has been made only in the geometrisation of gravitation. The physicists require new particles for further development of the theory. Therefore, the physicists started to study the theory of quarks and quantum chromodynamics (QCD) and the strings theory. However, these are hypothetical objects and experimental verification requires colossal amounts of energy. Naturally, the concept of finding new particles which would solve the given physical problem has also become attractive for the theory of Superunification.

However, can we think that there is only one universal unifying particle forming the basis of all known interactions? Primarily, physics is an experimental science and if a new particle is introduced to theoretical physicists, this would require experimental confirmation. Naturally, in the area of physics of elementary particles this confirmation can only be indirect. Nobody has ever held even the well-known electron. Its charge and mass were measured by indirect methods. However, prior to these measurements, it was necessary to justify the reality of the electron.

In this respect, the discovery of the quanton started with the realisation of its reality. The concept of the space-time having a structure and a structure that is finer than that of the atomic matter, was around throughout the entire 20th century. The mechanistic gas-like aether was rejected by physics on the basis of experiments carried out by Michaelson and Morley. However, which other matter determines the structure of cosmic vacuum, if it cannot be observed in experiments? In particular, the structure of vacuum remained a grey area in science, delaying the development of physics and Superunification theory.

Nevertheless, experimental snags were encountered and they related to the symmetry of Maxwell equations in a vacuum. Electricity and vacuum magnetism in an electromagnetic wave manifested themselves completely equivalently to the same extent and simultaneously.

Figure 1.1 of the electromagnetic wave in vacuum shows that the electrical and magnetic fields (vectors $\mathbf{E}_x$ and $\mathbf{H}_y$) exist and change in the direction of speed **C** together and simultaneously, without any phase shift with respect to time. The vectors $\mathbf{E}_x$ and $\mathbf{H}_y$ are only orthogonal to each other in space, but in time they exist at the same time. This is an undisputed experimental fact. However, how shall we interprete it? In order to justify the independence of the electromagnetic wave which appears not to need its own carrier, theoretical physicists have ignored experimental facts. According to their views, the propagation of the electromagnetic wave in vacuum is due to the fact that the electric field generates the magnetic

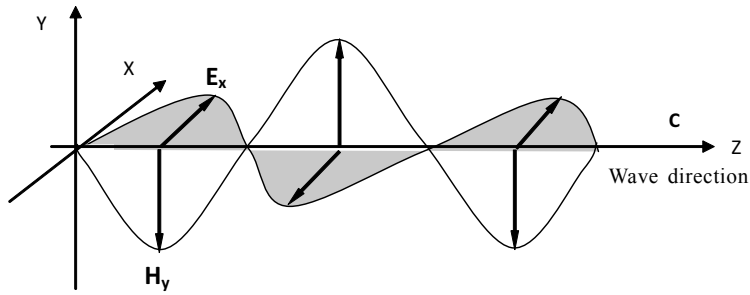

Fig. 1.1. Electromagnetic wave in vacuum with transverse polarisation of the quantised space-time.

field and vice versa. However, this is only possible in one case if there is a phase shift with respect to time between the variations of the electric and magnetic fields of the wave. In experiments, the phase shift with respect to time has not been observed. In transformers the phase time shift does occur but the theory of the transformer cannot be transferred in mechanically to the electromagnetic wave in vacuum.

This was the first snag in the path of experimental substantiation of the suggestion that the cosmic vacuum has a structure which is a carrier of electromagnetism. Figure 1.1 shows that electromagnetism exists as an independent category which links simultaneously electricity and magnetism into a single substance. This means that electricity in the electromagnetic wave does not generate magnetism and vice versa. Magnetism and electricity in the electromagnetic wave appear and change simultaneously. This experimental fact can be explained only by having its own independent carrier of electromagnetism which belongs to space vacuum or, more accurately, to the quantised space-time.

The unification of electricity and magnetism into a single substance – electromagnetism – is the first stage in the path of unification of interactions from which the Superunification theory starts. This first stage of unification was missed. Further development of the Superunification theory is not possible without the first stage of unification.

In order to be more convincing, attention should be given to the fact that rotors of the electrical and magnetic fields have not been detected in the electromagnetic wave in vacuum. Try to introduce rotors into the graph in Fig. 1.1. Nothing will happen and the graph will be destructed. This means that in a vacuum the rotor of the electrical field does not generate the rotor of the magnetic field, and vice versa. It would seem that the theory of electromagnetism was completed at the beginning of the 21st century. However, discrepancies between theory and experiments cast doubts on

the suggestion that the theory of electromagnetism is complete. Electromagnetism requires an intrinsic carrier, like electricity the electrical charge, and magnetism the magnetic charge.

If the situation regarding the electrical charge was sufficiently explained, problems remained with the magnetic charge. The magnetic charge has not been detected by experiments in the free state. Magnetism is evident only in a combined dipole form. This is an experimental fact. Thus far the theory combined the appearance of electromagnetism with dynamic electricity i.e., with current, the independence of the magnetic charge was a secondary problem. However, this does not represent a scientific approach to the problem when the causality of the phenomenon is rejected and in principle the reason for the phenomenon should occupy the first place. It appears that due to the incomprehensible topology of space, the electrical current generates magnetism. To eliminate unnecessary questions, it is essential to know the topology and structure of space-time. The origin of magnetism then becomes clear. One does not have to be clairvoyant in order to see that magnetism belongs to vacuum only, i.e., to the quantised space-time.

However, if magnetism belongs only to quantised space-time, then electricity, because of the symmetry of Maxwell equations in vacuum, should also belong to the vacuum. Space vacuum in the concept of quantised space-time must be the carrier of magnetism and electricity at the same time, i.e., it must be the carrier of electromagnetism, independent substance showing its electromagnetic properties. In the introduction, we already mentioned the electrical asymmetry of the quantised space-time when the manifestation of electricity does not have the form connected with the structure of the quanton.

Thus, analysis of the current state of the theory of electromagnetism and theoretical discrepancies with the experimental facts logically bring the physics to the introduction of an independent carrier of electromagnetism. For this purpose, it is necessary to combine electricity and magnetism into a single substance whose carrier is, as indicated later, the quanton – the space-time quantum.

The suggestion that the quanton is a real particle, carrier of electromagnetism in vacuum, is confirmed indirectly by all electromagnetic processes taking place in vacuum. Vacuum behaves as an electromagnetic medium which shows electrical and magnetic properties in polarisation. For example, the dielectric medium in electrical polarisation shows its dielectric properties and is characterised by dielectric permeability. The magnetic medium in magnetic polarisation shows its magnetic properties and is characterised by magnetic permeability. Naturally, the processes of

electrical and magnetic polarisation take place through the vacuum which represents the unifiedd electromagnetic medium and is characterised by electrical and magnetic parameters (constants ε_0 and μ_0).

The capacity of vacuum for electromagnetic polarisation enables us to describe the structure of the quanton. In the equilibrium state, this should be an electrically and magneto-neutral particle whose electrical and magnetic properties become evident when the electrical and magnetic equilibrium is disrupted, i.e., in electromagnetic polarisation. This is possible in one case only, if the quanton includes two dipoles – electrical and magnetic, linking electricity and magnetism into a single substance. However, to obtain two dipoles included in the structure of the quanton, we must have electrical and magnetic charges of positive and negative polarity forming the dipole.

Thus, the realias of the magnetic charge, as the electrical charge, have been reflected in the structure of the quanton which will be described in detail in the next chapter. The initial building blocks are referred to as quarks. These are massless particles having no mass and acting only as charge carriers. To form a quanton, one must have only four quarks, i.e., four elementary charges: two electrical (+1*e* and –1*e*) and two magnetic charges (+1*g* and –1*g*). To connect electricity and magnetism inside a quanton into a single substance it is necessary to introduce the superstrong electromagnetic interaction (SEI), with the quanton being the carrier of this interaction. The electromagnetic substance cannot exist without the realias of SEI.

Figure 1.2 shows schematically the structure of a quanton, including four quarks separated by different shading and denoted by: electrical (+ and –) and magnetic (*N* and *S*). The particle which includes all four charges – quarks, is an electromagnetic quadrupole, not known previously in the theory of electromagnetism. As shown later, the electromagnetic perturbation of the quadrupole (quanton) as a result of its electromagnetic polarisation forms the basis of all electromagnetic phenomena. The quanton represents the field form of weightless matter, being the carrier of electromagnetism and superstrong electromagnetic interaction.

Figure 1.3 show schematically the structure of the quantised space-time as a result of electromagnetic quantisation with filling of the volume with quantons. In the equilibrium state it is a neutral medium having electrical and magnetic properties which become evident as a result of electromagnetic perturbation (polarisation). These processes are discussed and described mathematically in detail in the following chapter. The quantons, having the capacity of bonding together through the charges with opposite signs, form an elastic quantised medium (EQM) being the carrier of superstrong electromagnetic interaction.

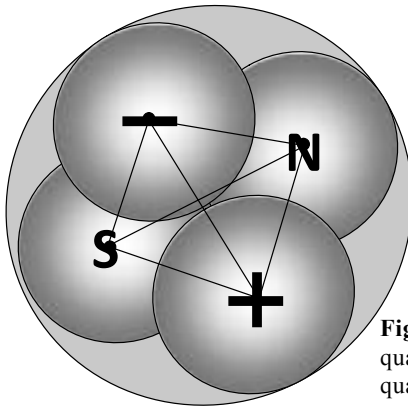

Fig. 1.2. Schematic representation of the space-time quantum (quanton) in the form of an electromagnetic quadrupole.

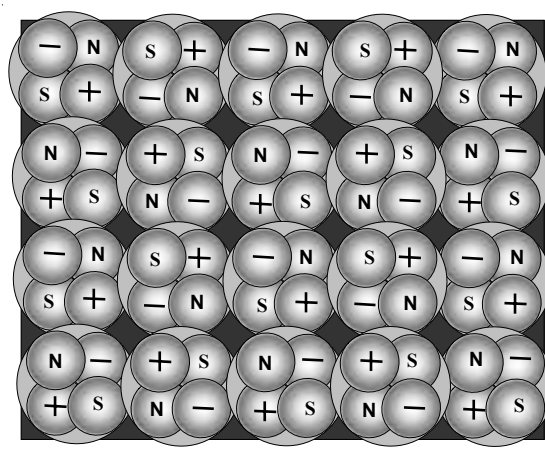

Fig. 1.3. Schematic representation of the structure of quantised space-time as a result of electromagnetic quantisation.

Now it becomes clear that the quanton is the universal particle, not only the carrier of electromagnetism, but also the carrier of space-time, occupying a specific volume. Time itself is enclosed in the quantum, which is a cavity electromagnetic resonator, defining the rate of motion to the three-dimensional clock. The clock ticks at every point of space. Naturally, in compression of the quantum the rate increases and in extension it decreases. This was already substantiated by Einstein who determined the slowing down of time in the region of strong gravitational fields associated with the tensioning of quantons in the external region of the deformed space-time. Gravitation forms during deformation (distortion according to Einstein) of quantised space-time, as the secondary manifestation of the superstrong electromagnetic interaction.

Thus, the introduction of the quantum of space-time (quanton) to physics enabled the realisation of the first stage of unification of electricity and magnetism into an independent substance, i.e., electromagnetism, and consequently represent the quanton as the carrier of time and space as a result of its electromagnetic quantisation. This was followed by the discovery that the quanton is also the carrier of gravitation which is manifested as a result of the deformation (distortion) of the quantised space-time. Both gravitation and electromagnetism are also based on the superstrong electromagnetic interaction.

No mathematical calculations have been mentioned so far because it is important, although briefly, to describe the declarative concept of the unification of gravitation and electromagnetism on the path to the Superunification theory through the introduction of an unifying particle – the space-time quantum (quanton). It was found that the quanton is actually the universal unifying particle and as shown by all theoretical and experimental facts, the quanton does not contradict these facts thus providing the scientistwith a powerful tool for study of matter.

1.2. Main problems on the path to the Superunification theory

1.2.1. Problem of energy levels

The introduction into theoretical physics of the space-time quantum (quanton) as the unifying particle, being the base of the Superunification theory, required revision of a number of assumptions regarding the problem of world creation. The development of elementary particle and atomic nucleus physics showed that when going into the depth of atomic matter, we are concerned with the colossal increase of energy concentration. In this respect, the quantised space-time is not an exception. However, if the dimensions of atomic matter do not exceed 10^{-15} m, the dimensions of the quanton are ten orders of magnitude smaller ($\sim 10^{-25}$ m). This means that the quantised space-time is a concentrator of colossal superenergy, the carrier of superstrong electromagnetic interaction. It has been possible to determine more accurately the energy levels in vacuum, assuming that the cosmic vacuum has the maximum energy level accepted as the starting point in counting. All the remaining energy levels are connected for the sake of their reduction relative to the energy level of vacuum, strictly observing the energy hierarchy and the laws of energy conservation.

1.2.2. Problem of motion

Figure 1.3 show schematically the structure of the quantised space-time densely filled with quantons. As already mentioned, this is the field form of weightless matter. However, it resembles more the solid state structure with colossal tension. Therefore, the main problem on the path to the theory of Superunification has been the solution of the problem of motion of a solid (particle) in a superhard and superelastic medium. This motion cannot take place from the viewpoint of classic mechanics.

However, the quantum theory breaks all the usual stereotypes. From the viewpoint of classic mechanics, the solid (particle) is an isolated object.. In the theory of Superunification, as quantum theory, in accordance with the principle of corpuscular-wave dualism all the particles (solids) represent open quantum-mechanical systems, being a continuous and integral part of the quantised space-time. The mass of the particle is regarded as the domain of the spherically deformed space-time. Consequently, the transfer of the mass of the particle in the quantised medium should be regarded as the wave transfer of spherical deformation of quantised space-time. This approach provides clear information on the motion as a complex quantum exchange process, describing the wave transfer of mass in the superhard and superelastic quantised medium.

1.2.3. Problem of mass

From the classic viewpoint, the mass is the basis of matter. Paradoxically, the quantum theory also breaks this stereotype, showing that mass is only spherical deformation of quantised space-time, i.e., its distortion (according to Einstein). The energy of spherical deformation is the equivalent of mass. This is the electromagnetic energy of the superstrong electromagnetic interaction. Simply, the mass is expressed in other measurement units. Therefore, in liquidation of mass, for example in annihilation processes, the elastic energy of spherical deformation of the quantised space-time changes to the photon radiation energy.

1.2.4. Problem of relativity

The formation of the mass of a particle as a result of spherical deformation of quantised space-time has enabled the formulation of the principle of spherical invariance, extended to any object having mass. The quantised space-time, having colossally high elastic properties, is a unique medium whose properties are not similar to any of the material media (gas, liquid,

solid, plasma). Only the quantised space-time retains the spherical symmetry of its deformation around the elementary particle in the entire speed range, including relativistic speeds. To an exterior observer it appears that the given sphere is compressed in the direction of motion. However, this is only a reaction to relative measurement.

It has been established that the speed of light in the quantised medium changes with the variation of the gravitational potential. In accordance with the spherical deformation principle, the gravitational field of the Earth retains its form, irrespective of the speed of motion, retaining the variation of the gravitational potential in individual directions. This means that there is no difference in the variation of the speed of light in the direction of movement of the Earth and across this direction. This was also observed in the experiments carried out by Michaelson and Morley who, in fact, justified by experiments the principle of spherical invariance in accordance with which the principle of relativity is the fundamental property of quantised space-time.

Thus, the problems of energy, motion, mass and relativity are the main problems, breaking the stereotypes of classic mechanics, and they have been solved during the development of the theory of Superunification described in the following chapters.

The space-time quantum, as shown schematically in Fig. 1.2, was discovered of January 10, 1996. This was a fundamental discovery together with the subsequent discovery of the superstrong electromagnetic interaction (SEI) which was then used as the basis for the theory of Superunification.

To provide more information regarding the theory of Superunification, I now present the popular science article 'The universe: Boiling 'bouillon' of quantons', published on the Internet. More information on the theory of Superunification can be found in the following chapters.

1.3. The universe: Boiling 'bouillon' of quantons

1.3.1. Introduction

In my studies, the problems of cosmology are considered only indirectly because the main direction of investigations had been the development of the theory of Superunification of fundamental interactions: gravitation, electromagnetism, nuclear and electroweak forces, and also investigations of the physics of elementary particles (their structure) as open quantum-mechanical systems. The applied field of research is the development of new energy and cosmic technologies, gravitational communication channels.

At the same time, the development of the theory of Superunification

enables new knowledge to be applied to inflationary cosmology. I should mention that the well-known Russian physicist Andrei Dmitrievich Linde works in this area at the Stanford University in the USA [1–4]. In particular, his lecture 'Inflation, quantum cosmology and anthropic principle', delivered at the conference devoted to the 90 years birthday of the well-known theoretical physicist John Wheeler, has been used as the starting point for my comments in the area of quantum cosmology. It appears that the inflationary theory may be also useful in describing the quantisation of the universe at the moment of its birth.

In particular, attention should be given not only to differences but also to finding general approaches to cosmology which link together the inflationary and quantum theory. In fact, Andrei Linde outstripped time, regarding inflation as expansion of the universe (or of its individual fragments, or a set of universes) at the moment of its origin when there were no single elementary particles.

Inflation resembles to me the process of growth of a beautiful rose from a small indivisible seed assuming that up to this moment, the information on the rose had been stored in the double DNA helix. After all, this is a very rough although colourful comparison, taking into account the fact that we do not know all mechanisms of the blooming of the rose, to say nothing of the universe.

Nevertheless, it is evident that we shall never know the actual picture of birth of the universe, but with the development of science and new knowledge we shall proposed and discuss always new theories and hypothesis, providing suitable food for the flight of fancy. Naturally, although very seldom, hypothetical considerations of the universe will be confirmed by experimental investigations, for example, as was the case with the discovery of the red shift and relict microwave radiation. At the same time, experiments confirm the accelerated recession galaxies but even with the most intensive flight of fancy physics does not have any suitable explanation for this phenomenon.

The development of the theory of Superunification at the boundary of the centuries, as the fundamental quantum theory, based on the discoveries of the space-time quantum (quanton) and superstrong electromagnetic interaction divided physics into old (the physics of the 20th century) and new (physics of the 21st century) [5–13].

The new physics of the 21st century is the physics of open quantum-mechanics systems, and the old physics of the 20th century is the physics of closed quantum-mechanics systems which simply do not exist in nature. In this respect, the physics of the 20th century suffers from the metaphysical considerations of world creation, regardless of the 'coarse' materialistic

base, regarding the elementary particles and solids as isolated objects. However, this does not agree with the principle of corpuscular-wave dualism in which the particle (solid) shows both the wave and corpuscular properties, being the inseparable and compound part of the quantised space-time.

Only the physics of open quantum-mechanical system has made it possible to discover the structure of the main elementary particles: electron, positron, proton, neutron, neutrino, photon and the nature of nuclear forces within the framework of the theory of Superunification. However, for this purpose it is necessary to determine the vacuum structure of the quantised space-time as the primary matter, forming the basis of our existence.

Naturally, I was interested in the question: 'who quantised the universe and how did this take place'? I did not find any answer and simply concluded that the space-time is quantised and has a discrete structure. This is confirmed indirectly by all the available experimental facts, interpreted in the framework of the theory of Superunification. Evidently, we shall never know who quantised the universe and whether this was somebody's idea. However, we may attempt to imagine how this took place, by which scenario. Here, the inflationary theory is quite attractive for describing the development of the universe.

The inflationary theory, proposed for the first time by the Russian physicist A.A. Storobinskii and subsequently developed further by Andrei Linde, was known to me a long time ago but si nce cosmology is not my specialisation, I treated it with care. The impetus for writing this popular science article was to me not only the desire to find an answer for myself to the question of the scenario of development of quantisation of the universe but also to focus the attention of the scientists who, in contrast to myself, are far more experienced in these subjects.

One of the main shortcomings of the inflationary theory was the metaphysical approach. Inflation describes the development of the universe at the moment of its birth when there were no currently known elementary particles: electron, positron, proton, neutron, photon, and others. So what could then expand? The theory of Superunification provides the materialistic basis for the inflationary theory in the form of the quantised space-time whose appearance is associated with the birth of the universe.

1.3.2. 'Bouillon' from quantons

As mentioned previously, the main problem in the world creation has always been the problem of the primary matter. What did exist prior to the time when there were no elementary particles? Now we have a strictly scientific answer with indisputable experimental confirmation. **Primary matter is**

the quantised space-time.

To breathe new life into the inflationary theory, it is necessary to investigate how the theory operates in the quantised space-time. The inflationary theory lacked the materialistic base. According to the logics of things it is obvious that there should be primary matter. So if something expanded when there were no elementary particles, something must have existed. I do not agree that emptiness can be expanded, in the understanding of emptiness as the category of free from matter and energy.

Unfortunately, the physics of the 20th century regarded the space vacuum as the absolute emptiness with the zero energy level. The quantum theory attributed very carefully but in any case to the vacuum the small level od energy of fluctuations under the effect of indisputable facts of formation of elementary particles from vacuum. Of course, the particles cannot form from nothing. Only the theory of Superunification returned the cosmic space to its initial position of primary matter. The quantised space-time is the high-potential vacuum medium, characterised by the maximum gravitational potential C_0^2 (not with the zero potential as originally thought) and the maximum energy level.

The main achievement of Einstein is that he was the first one to propose the concept of the unified field, replacing the old mechanistic aether with no experimental substantiation by the four-dimensional space-time. However, at that time, with the exception of the apparatus of the general theory of relativity (GTR) Einstein did not have any other tools. Nevertheless, in the last 30 years of his life, regardless of the criticism and absence of results, he fought vigorously over the development of the theory of the unified field, and at the end of his life he proposed the concept of quantisation of space-time (see the Einstein posthumous phrase).

Analysing the failures of Einstein on the road to the theory of the unified field, it has been established that he omitted an important stage in the path of unification of gravitation and electromagnetism. In particular, it was necessary to unify electricity and magnetism into a single concept, i.e., electromagnetism, assuming that this new unified electromagnetism is in reality the Einstein unified field which is not only the carrier of electromagnetism but also of gravitation. To make this happen, it was necessary to obtain building bricks for the base of the United field.

In physics, the building bricks are represented by quarks, i.e., weightless charges. Unfortunately, the beautiful concept of the quarks as the initial material was erroneously directed to explaining the structure of nuclear matter in quantum chromodynamics (QCD) instead of the formation of primary matter. This was an attempt to bypass the non-investigated stage. Science does not pardon inconsistent actions. At the present time, the QCD

faces a large number of unsolved problems and cannot even come close to explaining the generation of mass at nucleons, to say nothing of other elementary particles. Most importantly, the QCD operates with fractional quarks – electrical charges with the relatively integral elementary charge **e** which have not been detected in experiment. The apparently detected indirect manifestations of fractional charges may have a different explanation.

Thus, to sutdy closer the structure of primary matter, it was necessary to have new quarks and not only whole quarks. This removed all the contradictions because the presence of the whole electrical charge **e** with both positive and negative polarity was the experimentally confirmed fact with the accuracy to 10^{-20} *e*. The elementary electrical charge **e** is the most stable constant in nature and no better basis is available for constructing a new theory.

Thus, two whole quarks ($-1e$ and $+1e$) were already available in physics in the form of electrical carriers of charges at the electron and the positron. However, the two whole quarks were not sufficient for producing the first building brick of primary matter, i.e., the space-time quantum.

In fact, in order to isolate the space-time quantum, it is necessary to isolate its minimum volume which cannot be divided any further. Only four coordinates points 1, 2, 3, 4, are required for this purpose. One point is simply a point, two points can be used to draw a line, three points to produce a surface, and four point to isolate the volume. The four coordinates points are geometry. In transition from geometry to physics, the points must be replaced by physical objects, i.e., quarks. The four quarks have been planned by nature itself in the form of four weightless (massless) monopole charges: two electrical ($+1e$ and $-1e$) and two magnetic ($+1g$ and $-1g$), connected inside the electromagnetic quadrupole (Fig. 1.4). The monopole elementary charges are represented by the elastic spheres 5 of different shading, with the centre containing the source (drain) of the electrical (magnetic) field.

The electromagnetic quadrupole, shown in Fig. 1.4, has not as yet formed as the space-time quantum. It is evident that under the effect of the colossal forces of mutual attraction between the monopole charges, the electromagnetic quadrupole must be compressed into a spherical particle forming a quanton as the space-time quantum (Fig. 1.5). The quanton is protected against collapse by the properties of the monopoles: their finite dimensions and elasticity. In particular, the electricity and magnetism inside the quanton are connected by the superstrong electromagnetic interaction (SEI), merging into a single substance. The arrangement of the centres of the monopole charges at the tips of the tetrahedron inside the quanton forms a superelastic and stable structure.

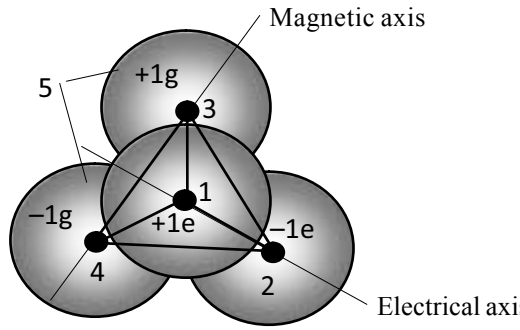

Fig. 1.4. The electromagnetic quadrupole (top view).

It may be seen that two magnetic quarks (+1g and –1g), the so-called Dirac monopoles, added to the two whole electrical quarks (+1e and –1e). The Dirac monopoles are connected by the relationship:

$$g = C_0 e = 4.8 \cdot 10^{-11} \text{A·m (or Dc)} \tag{1.1}$$

where $C_0 = 3 \cdot 10^8$ m/s is the speed of light in the quantised space-time, not perturbed by gravitation; $e = 1.6 \cdot 10^{-19}$ C is the elementary electrical charge.

In the Superunification theory, calculations are carried out in the SI system. Therefore, the dimension of the magnetic charge in the SI system is amperes per metre [Am], because the dimension of the magnetic moment is [Am^2]. According to Dirac, the magnetic and electrical charges have the same dimension [Coulomb]. This is very convenient because it determines the symmetry between the electricity and magnetism which in the ideal case would be expressed in the complete equality of the values of the magnetic and electrical monopoles. However, Dirac made an error in the calculations because he selected incorrectly the initial values, obtaining $g = 68.5e$. The true relationship (1.1) between the magnetic and electrical charge was obtained only by analysing the Maxwell equations in vacuum.

In the SI system, the dimensions of magnetism are determined by the electrical current. Therefore, the equality between the magnetic and electrical charges in (1.1) is connected by the dimensional multiplier C_0. Taking into account pioneering studies by Dirac in the area of the magnetic monopole, I propose that the dimension of the magnetic charge in SI [Am] should be referred to as Dirac [Dc]. At the present time, it is the extrasystem nic dimension but I assume that with time it will be accepted officially.

Having a quanton consisting of four quarks, it is possible to produce a 'buillion' of primary matter, filling the volume with quantons (Fig. 1.3). As a result of the tetrahedral distribution of the charges inside a quanton, it would appear that there is a complete chaos inside the separated volume.

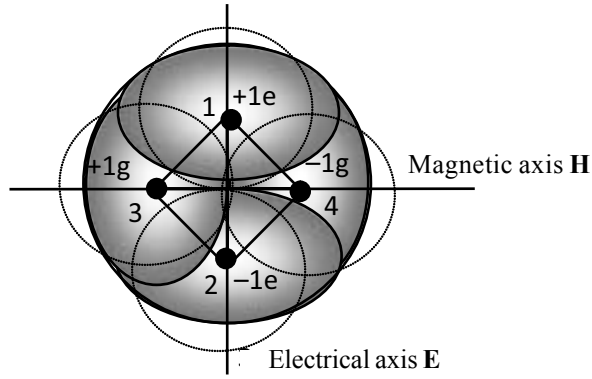

Fig. 1.5. The quanton in projection (rotated in space).

The charges with positive signs try to attract each other, and the single-pole charges repulse each other. The calculated diameter of the quanton is very small, of the order of 10^{-25} m.

If we could glance into the domain of the ultra-microworld of quantons, we would see that quantons oscillate. These chaotic oscillations of quantons resemble boiling. It is possible that these fluctuations also determined the tone of relict radiation which is not the residual echo of the Big Bang and it is the natural fluctuations background of the quantised space-time.

As a result of the tetrahedral distribution of the charges inside a quanton, the quantised space-time structure has the minimum level of the chaos which prevents in space the definition of a specific electrical or magnetic direction, i.e., excludes anisotropy. The electrical and magnetic charges balance each other. Therefore, in the macroworld domain, the space-time is treated as a homogeneous, isotropic and neutral vacuum medium.

The quantised space-time is also a weightless primary matter thus far free from mass (elementary particles). As shown in the Superunification theory, the quantised space-time is the carrier of the superstrong electromagnetic interaction, the fifth force which was the subject of research in the 20th century. To combine the known four forces (electromagnetism, gravitation, nuclear and weak forces), the superforce (SEI) was necessary. Only the superforce can combine other, weaker forces in itself. This is the golden rule of physics which will not be discussed here.

The calculations show that the quantised space-time, as the carrier of the superstrong electromagnetic interaction, has a colossal energy capacity, approximately 10^{73} J/m^3. If only one m^3 of the energy of cosmic vacuum is activated, this would be sufficient for generation of another universe as a result of a big bang. At the present time, physical science possesses data

according to which the energy corresponding to the Big Bank exists in nature, together with us (and inside us). However, whether a big bang would occur, is the problem which requires constant study. It is not possible to release the energy of the quantons by splitting the quanton into individual charges because in nature there are no forces capable of this. The absence of free magnetic charges (Dirac monopoles) confirms this. However, how can we explain the presence of free electrical charges in nature?

In particular, the presence of the free electrical charges determines the entire variety of ponderable matter. This is possible only in the case of the electrical asymmetry of quantised space-time. However, the structure of the quantum is characterised by electromagnetic symmetry, i.e., by two pairs of electrical and magnetic charges, balancing each other. Evidently, the problem of the generation of electrical asymmetry of the universe can also be answered by the inflationary theory. Apparrently, in the period of expansion of the universe, the emission of quantons was accompanied by the emission of the electron neutrinos containing a pair of electrical quarks (charges).

1.3.3. How to weld elementary particles

In the usual concept, the bouillion consisting of quantons, shown in Fig. 1.3, does not yet contain any elementary particle. The quarks, as the basis of primary matter, are not regarded as elementary particles, although as matter of fact the elementary particle are not so elementary, and the quarks are elementary as regards their basis. This caused complications in the terminology in the area of elementary particles even in the period in which the complicated structure of the elementary particles was not yet known.

Having a boiling bouillon of quantons, it is now quite easy to weld an elementary particle, for example, an electron. For this purpose, the bouillion should be filled with a quark of negative polarity whose presence is determined by the electrical asymmetry of the universe. In fact, if a weightless electrical perturbing charge is injected into the quantised space-time, the quantons start to travel to the central electrical charge. Specks of dust also travel to an electrified comb in the same manner.

However, what happens to the quantised space-time? Evidently, in the vicinity of the perturbing central charge, the quantised space-time is compressed, being an elastic medium. However, this is possible only as a result of tension in movement away from the central charge. The results of compression and tension are separated by some gravitational boundary. The process of spherical deformation of the quantised medium has taken

place. The deformation energy is the equivalent of the particle mass. In spherical deformation of the medium (our bouillon) the quark acquired the mass *m* and degenerated into an elementary particle, i.e., the electron, a carrier of the elementary electrical charge *e* and mass *m*.

The energy *E* of spherical deformation of the medium at generation of the rest mass *m* of the elementary particle is determined by the work (integral) in transition of the mass *m* from the region with the zero gravitational potential to the quantised space-time which, as mentioned previously, is the high potential and is characterised by the gravitational potential $\varphi = C_0^2$:

$$E = \int_0^{C_0^2} m d\varphi = mC_0^2 \tag{1.2}$$

The integral (1.2) is the simplest and easiest to understand conclusion of the Einstein equation $E = m C_0^2$, defining the equivalence of the energy and mass. In order to avoid confusing *E* (1.2) with the strength of the electrical field *E*, in the Superunification theory the energy is denoted by the symbol *W*. Returning back to (1.2) it is confirmed that the quantised space-time is characterised by the gravitational potential $\varphi = C_0^2$. If this is not the case, then doubts can be cast on the Einstein equation which has the indisputable experimental confirmation.

Thus, the equivalence of mass and energy proves that the mass is also energy only it is measured in arbitrary measurement units proposed previously when the mass was determined on a balance, i.e., by weight.

Paradoxically, however, regarding the mass as the energy of spherical deformation of the quantised space-time, we realise that the mass is a secondary formation in primary matter. However, current physics teaches that the mass, as the base of ponderable matter, is primary. At the present time, the Superunification theory removes one of the main errors of contemporary physics, regarding the movement of mass as the wave transfer of spherical deformation of the quantised space-time. The mass as such simply does not exist in nature. There is only the energy of deformation of the quantised space-time which we regard as the mass.

According to Einstein, spherical deformation of the quantised space-time is only is a distortion which can be represented by Lobachevski spheres of different curvature, threaded on each other. If we use this path, we obtain a relatively complicated geometrical theory of gravitation represented in the general theory of relativity (GTR).

However, the quantised space-time can also be characterised as some scalar field, with the distribution of the quantum density of the medium (*x*, *y*, *z*). The quantum density of the medium is the concentration of the

quantons in unit volume. Consequently, the previously described process of generation of an elementary particle as a result of compression–extension of the medium from the position of vector analysis is nothing else but the divergence of the gradient of the quantum density of the medium. Consequently, we have obtained a new concept of the Poisson gravitational equation characterising the elementary particle in the quantised space-time:

$$\operatorname{div}(\operatorname{grad}\rho) = k_0\rho_m \tag{1.3}$$

where k_0 is the proportionality coefficient, ρ_m is the density of matter, kg/m^3.

Equation (3) includes the deformation vector **D** of the medium for the case in which the scalar field ρ (x, y, z) changes during deformation into the effect of field, characterising the formation of gravitation:

$$\mathbf{D} = \operatorname{grad}\rho \tag{1.3a}$$

Thus, equation (1.4) shows convincingly that gravitation is based on the deformed quantised space-time (Fig. 1.3) being the carrier of the superstrong electromagnetic interaction. In its basis, gravitation has electromagnetism. In explanation, the gravitational principle of the Poisson equation (1.3) and (1.4) will become evident.

The two-component solution of the Poisson gravitational equation (1.3) in statics for the spherically deformed space-time was proposed for the first time in the theory of Superunification for the distribution of the quantum density of the medium ρ_1 (tension region) and ρ_2 (compression region):

$$\begin{cases} \rho_1 = \rho_0\left(1-\dfrac{R_g}{r}\right) \text{ for } r \geq R_S \\ \rho_2 = \rho_0\left(1+\dfrac{R_g}{R_S}\right) \end{cases} \tag{1.4}$$

where R_S is the radius of the gravitational boundary (radius of the particle), m; r is the distance from the centre of the particle in the region ρ_1, m; R_g is the gravitation radius of the particle without the multiplier 2, m; P_0 is the quantum density of the non-deformed medium:

$$R_g = \frac{Gm}{C_0^2} \tag{1.5}$$

where G is the gravitational constant.

It should be mentioned that the Poisson equation (1.3) and its solution (1.4) also include the time factor (t), but in the hidden form. This will be shown later. The equation (1.3) and its solution (1.4) describes the

gravitational state of the particle in the four-dimensional space-time. The fact is that the quantum (Fig. 1.5) is an elastic volume electromagnetic resonator defining the lapse of time at every point of space-time (Fig. 1.3). In deformation of the medium, the spatial lapse of time also changes accordingly. However, this will be discussed later.

Figure 1.6 shows the generalised model of an elementary particle with mass in the quantised space-time, corresponding to the Poisson gravitational equation (1.3) and its two-component solution (1.4). As already mentioned, the non-deformed space-time is characterised by the quantum density ρ_0. We introduce a sphere with a radius R_0 and start to compress it uniformly together with the medium to the radius of the gravitational boundary R_S. The quantised space-time inside the gravitational boundary is compressed to quantum density ρ_2 (dark region). In the external region, the space-time is expanded to the quantum density ρ_1 (light region). Moving away from the particle $\rho_1 \rightarrow \rho_0$ the field weakens, characterising the distribution $\rho_1 = f(r)$ of the relative curvature R_g/r of the space-time.

It should be mentioned that the gravitational interface is not any rigid dimension of the particle but it is the boundary formed as a result of spherical deformation of the quantised space-time freely letting in quantons and releasing them in the wave transfer of mass. Any wave is also transferred by the same mechanism. The wave does not transfer its content, it transfers deformation. In fact, the gravitational interface is the wave boundary. The

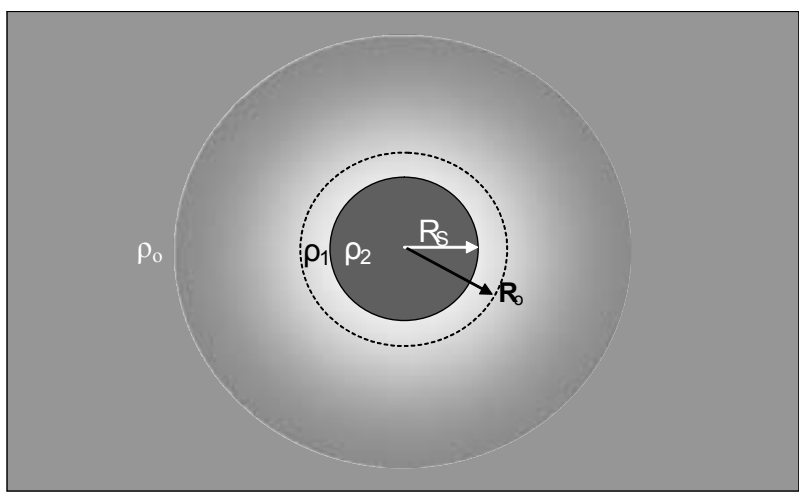

Fig. 1.6. Modelling of elementary particles in the form of regions of spherically deformed quantised space-time. R_S – the gravitational interface of the medium; ρ_1 – the region of expansion (light) and ρ_2 – the region of compression (dark).

elementary particle is a single volume wave in our bouillon of quantons, with the soliton regarded as a rough analogue of this wave,

The mass of any elementary particle is a variable quantity and depends on the quantum density of the medium in which it is located, and the speed of movement in the medium. With increasing speed, the wave gravitational boundary captures increasing numbers of the quantons from the external medium, increasing the quantum density ρ_2 (dark region) and reducing ρ_1 on the outside (light region) of the medium. This is equivalent to the increase of the energy of spherical deformation of the quantised medium and, correspondingly, the particle mass.

Usually, the increase of the particle mass in relation to speed v is taken into account by the classic relativistic factor γ which leads to infinite solutions of the mass and energy of the particle when the latter reaches the speed of light. The problem of infinity was solved in the Superunification theory by introducing the normalised relativistic factor γ_n, restricting the limiting parameters of the particle:

$$\gamma_n = \frac{1}{\sqrt{1-\left(1-\frac{R_g^2}{R_S^2}\right)\frac{v^2}{C_0^2}}} \tag{1.6}$$

As a result of introducing the normalised relativistic factor γ_n (1.6) into (1.3), the Poisson equation and its solution (1.4) change from the static to dynamic state, including movement at the speed of light. The limiting parameters of the mass m_{Max} and energy W_{max} of the relativistic particle at $v = C_0$ are obtained:

$$m_{\max} = \frac{C_0^2}{G} R_S \tag{1.7}$$

$$W_{\max} = \frac{C_0^4}{G} R_S \tag{1.8}$$

In accordance with (1.7), if a proton is accelerated to the speed of light, its mass will be finite and will not exceed the mass of an iron asteroid with a diameter of 1 km.

The Poisson equation (1.3) and its two-component solution are connected with the quantum density of the medium which is an analogue of the gravitational potential ($\rho_0 \to C_0^2$, $\rho_1 \to \varphi_1 = C_0^2$; $\rho_2 \to \varphi_2$). Consequently, we transfer from the gravitational Poisson equation and its two-component solution by representing the parameters of the particle by the gravitational potentials taking into account normalised relativistic factor γ_n (6):

$$\operatorname{div}\operatorname{grad}(C_0^2 - \varphi_n\gamma_n) = 4\pi G\rho_m \tag{1.9}$$

$$\begin{cases} \varphi_1 = C^2 = C_0^2\left(1 - \dfrac{R_g}{r}\gamma_n\right) \text{ at } r \geq R_S \\ \varphi_2 = C_0^2\left(1 + \dfrac{R_g}{R_S}\gamma_n\right) \end{cases} \tag{1.10}$$

The Poisson equation (1.9) and its two-component solution (1.8) characterise the dynamic state of the particle in the four-dimensional quantised space-time in the entire speed range, including the speed of light. A relative special feature of the four-dimensional Poisson equation (1.9) and of its solution (1.10) is the absence in the equation and its solution of the distinctive time coordinate (t), as accepted in the four-dimensional representation. The time component has already been included in (1.9) and (1.8) and the appropriate calculation procedure has been developed. Using equations (1.9) and (1.8), this procedure makes it possible to separate the time parameter as the independent function of distribution of the time scalar field for the moving particle in the entire speed range.

In the past, the transition to four-dimensional gravitation would have made it possible to obtain completely new results, with the main result being the one which shows that gravitation distorts space-time. However, the introduction of every additional measurement into the equation complicates the equation to such an extent that they become accessible to only a small number of experts. My task was to develop calculation procedures which would make it possible to transform the multidimensional systems to the conventional three-dimensional system. Additional gravitational potentials would have to be introduced for this purpose:

1. C_0^2 – the gravitational potential of the non-perturbed quantised space-time;
2. C^2 – the gravitational potential of the action (replaces the Newton potential φ_n);
3. φ_2 – the gravitational potential inside the gravitation boundary;
4. φ_n – the Newton potential (as the imaginary potential).

Previously, the gravitational theory operated with only one Newton potential φ_n. The calculation possibilities of this potential are limited. In order to determine the exact state of the particle (1.4) in the entire speed range, without taking into account C_0^2, C^2 and φ_2, it would have to be necessary to adjust the calculation apparatus to such an extent so that the latter becomes quite heavy and still would not provide the exact solution.

From (1.8) we obtain the balance of the gravitational potentials through the action potential C^2 for the elementary particle in the external region of the space-time (Fig. 1.6, grey region):

$$C^2 = C_0^2 - \varphi_n \gamma_n \tag{1.11}$$

Multiplying the balance of the gravitational potentials from (1.11) by R_S/G at $r = R_S$, we obtain the balance of the dynamic mass m of the particle in the entire speed range, including the speed of light:

$$\frac{C^2}{G} R_S = \frac{C_0^2}{G} R_S - \varphi_n \frac{R_S}{G} \gamma_n \tag{1.12}$$

Equation (1.12) includes the limiting mass $m_{\max}$ of the particle (1.7), its hidden mass m_s and the relativistic mass m:

$$m_s = \frac{C^2}{G} R_S \tag{1.13}$$

$$\frac{\varphi_n}{G} R_S \gamma_n = \frac{G m_0}{R_S} \frac{R_S}{G} \gamma_n = m_0 \gamma_n = m \tag{1.14}$$

Taking into account (1.13) and (1.14) we can write the mass balance (1.12) in a simpler form:

$$m = m_0 \gamma_n = m_{\max} - m_s \tag{1.15}$$

Multiplying the mass balance (1.15) by C_0^2 we obtain the dynamic balance of the energy of the particle in the entire speed range, including the speed of light:

$$W = W_0 \gamma_n = W_{\max} - W_s \tag{1.16}$$

Equation (1.16) includes the hidden energy $W_s = m_s C_0^2$ of the particle as the component of the quantised space-time, and its limiting energy $W_{\max}$ (1.8).

In the range of low speeds $v << C_0$, the normalised relativistic factor γ_n (1.6) changes to the classic factor γ which can be expanded into a series and, rejecting the numbers with the higher orders, the balance (1.16) can be transformed to the standard form:

$$W = W_{\max} - W_s = m_0 C_0^2 + \frac{m_0 v^2}{2} \tag{1.17}$$

In this context, the kinetic energy of the particle is in fact the increase of the spherical deformation energy with the increase of the speed of the particle inquantised space-time. The kinetic energy in the equivalent is directed to increasing (decreasing) the mass of the particle during its acceleration (deceleration).

The previously described balances of the gravitational potentials (1.11), mass (1.15) and energy (1.16), (1.17) confirm convincingly that the elementary particle, being the integral part of quantised space-time, is in fact the open quantum-mechanical system characterised by complicated exchange processes in movement in quantised space-time. The hidden mass and energy can transfer to its real parameters, increasing with increasing speed.

Usually, physicists, describing the four dimensional state, use the concept of action *S* according to Lagrange, for example, Andrei Linde:

$$S = N\int d^4x\sqrt{g(x)}\left(\frac{R(x)}{16\pi G} + L(\phi(x))\right) \tag{1.18}$$

However, the action (1.18) can also be used to describe the state of the elementary particle at a specific point of space-time. Equation (1.18) results in the formation of an unbalanced force, instability of the particle, instability of space-time and in its collapse. Only the two-component solutions (1.4) and (1.10) make it possible to separate the gravitation boundary and balance its forces acting from the external and internal sides, ensuring the stable state of the system and preventing its collapse. However, for the inflationary state, the action (1.18) is fully justified because the presence of the unbalanced force results in the expansion of the universe.

To understand the approximate nature of the calculation apparatus of four-dimensional gravitation, it is sufficient to compare the dynamic balance of the gravitational potentials (1.11) with the four-dimensional interval ds^2

$$ds^2 = (C_0\,dt)^2 - (dx)^2 - (dy)^2 - (dz)^2 \tag{1.19}$$

For this purpose, we transform (1.19)

$$\left(\frac{ds}{dt}\right)^2 = C_0^2 - \left(\frac{dx}{dt}\right)^2 - \left(\frac{dy}{dt}\right)^2 - \left(\frac{dz}{dt}\right)^2 \tag{1.20}$$

Equation (1.20) includes the equivalents of the speeds *C* and *v*, in the form of their squares:

$$\left(\frac{ds}{dt}\right)^2 = C^2 \tag{1.21}$$

$$\left(\frac{dx}{dt}\right)^2 + \left(\frac{dy}{dt}\right)^2 + \left(\frac{dz}{dt}\right)^2 = v^2 \tag{1.22}$$

Taking the equations (1.21) and (1.22) into account, we obtain the balance of the gravitation potentials formed as a result of the transformations of the four dimensional interval ds^2 (1.19):

$$C^2 = C_0^2 - v^2 \tag{1.23}$$

Comparing the precise balance (1.11) with balance (1.23) we may clearly see that the four dimensional interval ds^2 describes approximately the gravitational state of the particle in the four-dimensional space-time, since the dynamic potential $\varphi_p\gamma_p$ in equation (1.11) is not equal to the square of the speed d^2 in (1.23). Equation (1.11) shows that the precise balance is represented by the squares C^2 and C_0^2, and the dynamic gravitational potential $\varphi_n\gamma_n$ has the dimension identical with the square of speed [m^2/s^2]. In this context, the formal unification of the linear coordinates (x, y, z) and time t through the Pythagoras quadratic equation (1.19). However, this solution was only approximate. The further development of this direction in the four dimensional geometrical theory of gravitation was also only approximate.

We could present here the analytical conclusion of the wave equation of the particle in quantised space-time but this will be carried out in Chapter 3.

To conclude the popular description of the behaviour of the particle in the quantised space-time it is necessary to present its gravitational diagram (Fig. 1.7) which characterises the distribution of the gravitational potentials (1.8) or the quantum density of the medium (1.4). The gravitational diagram is the two-dimensional analogue of the three-dimensional representation of the particle (Fig. 1.6). The region of compression is indicated by the dark tone, the expansion region by the light tone. The gravitational boundary R_S is characterised by a jump of the gravitational potential and quantum density of the medium $2\Delta\rho_1$. The gravitational diagram shows the curvature of the space-time in the external (grey) region and the presence of a gravitational well at the particle which was discovered for the first time in the Superunification theory. It is characteristic that the gravitational field of the particle is not described by the Newton potential φ_n and is described by the action potential C^2, ensuring the balance of the gravitational potentials (1.11).

The theory of Superunification describes the structure of the main elementary particles: electron, positron, proton, neutron, electronic neutrino, photon, as open quantum-mechanics systems. The quantised space-time is a vessel used for 'cooking' not only elementary particles, forming atoms and molecules, but also a vessel for 'cooking' the entire matter, forming planetary systems and where stars are born and disappear. Naturally, in a popular article, it is not possible to embrace all aspects of the theory of Superunification but its main elements, relating to cosmology, must be shown. However, prior to doing this the electromagnetic properties of the quantised space-time should be discussed.

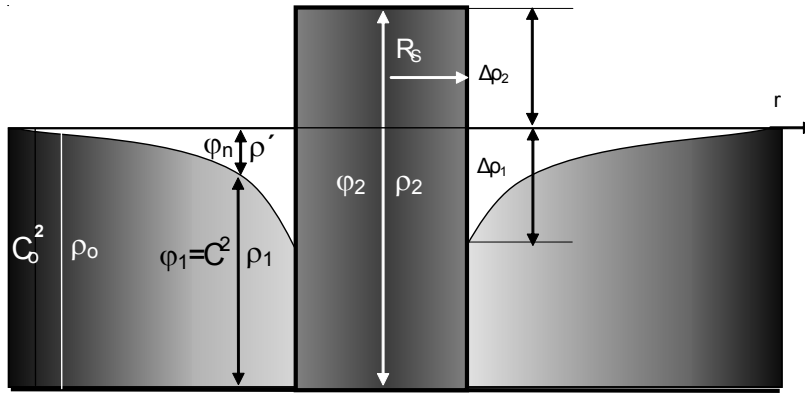

Fig. 1.7. Gravitational diagram of an elementary particle in quantised space-time.

1.3.4. Return to the light-bearing (luminiferous) medium

The quantised space-time, as the carrier of the superstrong electromagnetic interaction, returns to physics the light-bearing (luminiferous) medium, unjustifiably rejected in the 20th century. There were both objective and subjective reasons for this. It should be mentioned that Maxwell, deriving the equations of the electromagnetic field in vacuum, took into account the realias of the luminiferous medium, referring to the medium as electromagnetic aether. Maxwell presented these equations, without describing analytical derivation. Here, we write the Maxwell equations in the form in which they are used today in vacuum for the strength of the electrical **E** and magnetic **H** fields, and the densities of the electrical $\mathbf{j}_e$ and magnetic $\mathbf{j}_g$ bias currents:

$$\mathbf{j}_e = \mathrm{rot}\,\mathbf{H} = \varepsilon_0 \frac{\partial \mathbf{E}_x}{\partial t} \tag{1.24}$$

$$\mathbf{j}_g = \frac{1}{\mu_0}\mathrm{rot}\,\mathbf{E} = \frac{\partial \mathbf{H}_y}{\partial t} \tag{1.25}$$

where ε_0 is the electrical constant of the vacuum; μ_0 is the magnetic constant of the vacuum.

In particular, because of the rotor form of the equations (1.24) and (1.25) the concept of the luminiferous medium was rejected assuming that the rotor of the magnetic field generates the rotor of the electrical field and, vice versa, ensuring transfer of the electromagnetic wave in vacuum. It would appear that the electromagnetic wave represents an independent

substance which does not require an additional carrier in the form of the luminiferous medium.

However, in experiments, the electromagnetic field in vacuum did not contain rotors and, in addition to this, the vectors of the electrical **E** and magnetic **H** fields exist at the same time (Fig. 1.1). This means that the rotor of the magnetic field cannot generate the rotor of the electrical field and vice versa.

The analytical derivation of the Maxwell equations and removal of the resultant errors became possible for the first time in the theory of Superunification, analysing the electromagnetic polarisation of the quantons (Fig. 1.5) in quantised space-time.

Figure 1.8a shows a quanton in the equilibrium state. Taking into account the fact that the quanton is situated inside the quantised space-time (Fig. 1.3), all the remaining quantons are also in the electromagnetic equilibrium. There is no external manifestation of the electrical and magnetic fields. The electrical and magnetic axes of the quanton are orthogonal in relation to each other.

The passage of an electromagnetic wave is accompanied by electromagnetic polarisation of the quanton and disruption of its electromagnetic equilibrium. Figure 1.8b shows that the electrical charges inside the quanton are displaced from the equilibrium state, stretching the quanton along the electrical axis, and this is accompanied by the displacement of the magnetic charges, compressing the quanton along the magnetic axis, and vice versa (Fig. 1.8c). Further, it will be shown that the quanton itself is not stretched in the electromagnetic processes and that only charges inside the quanton are displaced. The simultaneous displacement of the charges results in the disruption of the electrical and magnetic equilibrium of the medium and in the formation of the external electrical **E** and magnetic **H** fields whose strength vectors exist at the same time and remain orthogonal in relation to each other **E**⊥**H**. This fully corresponds to the nature of the

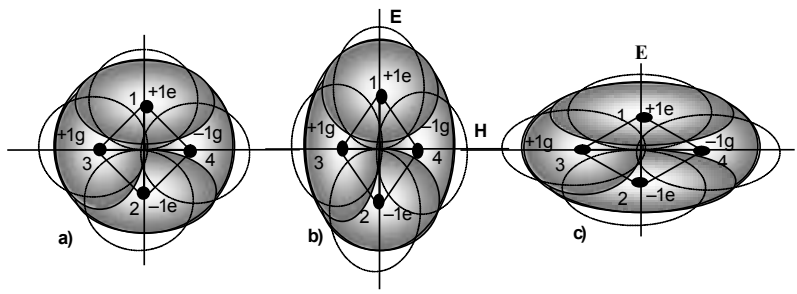

Fig. 1.8. Electromagnetic polarisation of the quanton during the passage of an electromagnetic wave.

electromagnetic wave in vacuum (Fig. 1.1). The displacement of the electrical and magnetic charges inside the quanton results in the formation of real currents of electrical and magnetic displacement in vacuum, which were already described by Heaviside.

In the Superunification theory, the problems of passage of the electromagnetic waves through the quantised space-time were studied quite extensively and this resulted in the analytical derivation of the Maxwell equations which in the case of vacuum are reduced to one vector and roptor equation, connecting together three orthogonal vectors: **E**, **H**, **C** (where **C** is the vector of speed of light) (Fig. 1.1):

$$\varepsilon_0 \left[\mathbf{C}_0 \dot{\mathbf{E}} \right] = -\dot{\mathbf{H}} \tag{1.26}$$

Thus, analysis of the electromagnetic perturbation of the quantised space-time confirms that it is the real luminiferous medium without which the propagation of electromagnetic waves is not possible.

In order to provide a more convincing confirmation, we study the two-rotor structure of the photon resulting from the relativistic Maxwell rotor equations (1.24) and (1.25). The rotors do exist in the electromagnetic wave but they also exist simultaneously on the wave sphere:

$$\mu_0 \left| \mathbf{C} \cdot \mathrm{rot}\, \mathbf{H} \right| = \mathrm{rot}\, \mathbf{E} \tag{1.27}$$

Figure 1.9 shows the diagram of simultaneous circulation of the vectors **E** and **H** in the form of rotors (1.27) on the sphere of the electromagnetic wave in orthogonal cross-sections. The source of the spherical electromagnetic wave is situated in the centre 0. Any two orthogonal sections of the sphere of the wave form two diagonal points *a* and *b* with arbitrary coordinates. At the points *a* and *b*, the vectors **E** and **H** are orthogonal in relation to each other and the rotors themselves (1.7) circulate in the orthogonal planes Z0X and Y0X, satisfying equation (1.27). Regardless of the arbitrary coordinates of the diagonal points *a* and *b* on the wave sphere,

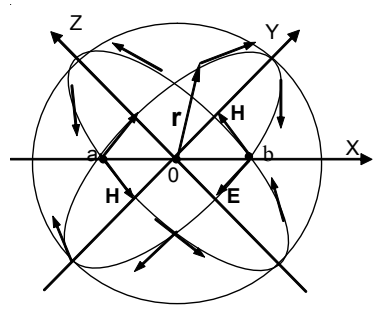

Fig. 1 .9. Simultaneous circulation of the vectors **E** and **H** on the sphere of the electromagnetic wave in orthogonal cross-sections.

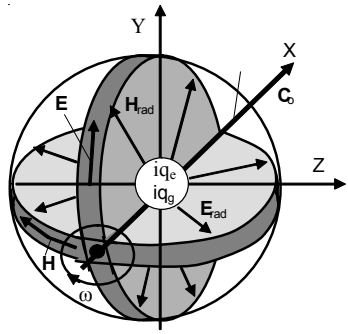

Fig. 1.10. The two-rotor structure of a low-energy photon emitted by an orbital electron.

the pattern of the electromagnetic field of the spherical wave is represented by the scheme in Fig. 1.9 for an arbitrarily rotated pattern in space.

Figure 1.10 shows the two-rotor structure of a low-energy photon emitted by an orbital electron, when the diameter of the photon is equal to the wavelength of the electromagnetic field of the photon. The structure of the photon is formed at the moment of emission of the relativistic electron at the speed close to the speed of light. Two-rotor radiation (Fig. 1.9) of the electron in the relativistic domain cannot produce an expanding spherical way. In accordance with the relativism rules, the spherical wave is 'frozen' at the speed of light. The wave does not expand and transforms to the relativistic wave particle – photon. It should be mentioned that two orthogonal rotors of the photon – electrical and magnetic, form the ideal gyroscopic system ensuring the directional movement of the photon in the quantised space-time in the direction of the major axis.

The two-rotor structure of the photon explains its behaviour, including in optical media with partial dragging during movement of the medium (Fizeau experiment). We shall discuss the formal explanation of the reason for the deceleration of light in optical media and partial dragging of the photon by the moving medium.

As mentioned, the photon is a two-rotor electromagnetic formation in quantised space-time and, having gyroscopic properties, travels in the straight direction with the speed of light C_0.

The optical medium is also a component part of the quantised space-time because the medium consists of molecules and atoms and they consist in turn of elementary particles. As already mentioned, the elementary particles are the component part of the quantised space-time.

Inside the optical medium, the photon is transferred due to the quantised space-time, i.e., the luminiferous medium. However, the optical medium

and, more accurately, atomic centres of the lattice of the medium cause perturbations in the movement of the photon deflecting it periodically from the straight path. Consequently, as shown by the calculations, the photon moves inside the optical medium along a trajectory close to sinusoidal (cosinusoidal), slowing down in the straight direction.

The photon moves in the optical medium with the speed of light $\mathbf{C}_0$ in the direction of the vector $\mathbf{C}_0$ (along the major axis of the photon). The deflection of the photon from the straight direction does not change its speed $\mathbf{C}_0$ because this wave speed is determined by the luminiferous medium, i.e., by the quantised space-time. However, in contrast to the straight line, the movement along the sinusoid extends the path of the photon in the optical medium (Fig. 1.1a). Let it be that along the straight line it is ℓ_z, along the sinusoid ℓ_y. The speed of light $C_0 = \text{const}$. Here, $\ell_y/\ell_z = n_0$, where n_0 is the refractive index of the stationary medium. The phase speed C_{po} of the photon is determined by the time t_y of movement of the photon along the sinusoid (or another periodic trajectory):

$$C_{p0} = \frac{\ell_y}{t_y} = \frac{\ell_z n_0}{t_y} = \frac{C_0 t_y}{t_y} n_0 \tag{1.28}$$

From (1.28) we obtain the well-known equation according to which the refractive index of the medium is determined by the ratio of the speed of light C_0 to the phase speed C_{p0} and, more accurately, by the ratio of the length of the trajectory of the photon along the sinusoid to the length of the trajectory along the straight line:

$$n_0 = \frac{C_0}{C_{p0}} = \frac{\ell_y}{\ell_z} \tag{1.29}$$

Thus, the movement of the photon in the optical medium can be described by two wave equations: for the electromagnetic field with the speed C_0, and for transverse oscillations of the photon in relation to the director of movement with the phase speed C_{po}. The two-rotor structure of the photon explains the electrical and magnetic polarisation of light and rotation of the polarisation plane during movement of the photon in optical media.

In movement in flowing water (Fizeau experiment), the photon is partially carried away by water with the speed lower than the speed of movement of the water v_b (Fig. 1.11b). This is caused by the constant speed of light C_0 in quantised space-time. Using the Einstein equation of the composition of the velocities for the system with the constant speed of light $C_0 = \text{const}$, we determine the speed of the photon C_p in flowing water:

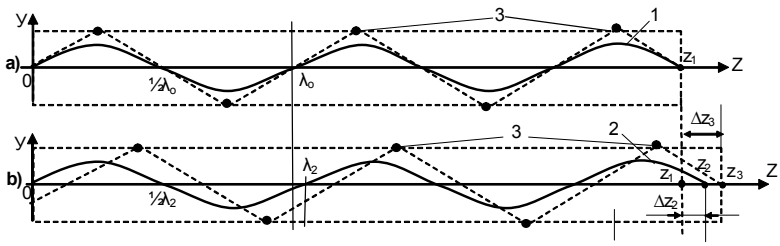

Fig. 1.11. Movement of the photon in the optical medium along the sinusoidal trajectory 1 in a stationary medium (a) and 2 in a water flow (b). 3 – the centres of the molecular lattice of water.

$$C_p = \frac{C_{p0} + v_b}{1 + \dfrac{C_{p0} v_b}{C_0^2}} \tag{1.30}$$

From equation (1.30) we obtain the well-known Frenel equation for the dragging of light in the Fizeau experiment:

$$C_p = C_{p0} \pm v_b \left(1 - \frac{1}{n_0^2}\right) \tag{1.31}$$

Equation (1.31) can be derived by other methods differing from the Einstein equation (1.29), but all the derivations are based on the constancy of the speed of light in quantised space-time in its local domain.

In order to end the eternal dispute regarding the origin of the luminiferous medium, it is necessary to comment on the experiments carried out by Michaelson and Morley which appeared to have excluded the luminiferous medium from physics. At the same time, physicists, including Lorentz, did not distinguish between the luminiferous medium and the mechanistic gas-like aether. The luminiferous medium, as shown previously, is weightless quantised space-time, the carrier of superstrong electromagnetic interaction (SEI). The mechanistic gas-like aether is a hypothetical ponderable substance filling the cosmic space and, as shown in the Superunification theory, this substance that does not exist in nature. Therefore, we cannot accept any dragging of light, as observed in the Fizeau experiments, in the gas-like non-existent aether.

So, what was recorded in the experiments carried out by Michaelson and Morley in the measurement of the speed of light in the direction of movement of the Earth and across the movement which proved to be identical?. For this purpose, we would have to have the formula of the speed of light in the gravitational field of the morning Earth. No such equation was available at that time. This equation was derived only in the theory of Superunification from the balance of the gravitational potentials (1.11):

$$C = \sqrt{\varphi_1} = C_0 \sqrt{1 - \frac{\gamma_n R_g}{r}} \tag{1.32}$$

According to (1.32), the speed of light in the gravitational field of the Earth depends on the distance r from the centre of the Earth. On the surface of the Earth, the speed of light in the direction of movement of the earth and in the direction normal to this direction remains the same. This was also observed in the experiments. However, equation (1.32) was derived from (1.11) for a spherically symmetric system which retains its spherical symmetry throughout the entire speed range thus substantiating the principle of spherical invariance. In particular, the principle of spherical invariance determines the fundamental nature of the relativity principle. This was also recorded in the experiments carried out by Michaelson and Morley. For an independent observer, measurements give the compression of the field in the direction of movement. However, one should not confuse the theory of relative measurements with the relativity principle. These are different concepts. At the present time, the theory of Superunification proposes procedures which enable measurements of the absolute speed of movement in quantised space-time.

1.3.5. Gravity. Inertia. Black holes

The Poisson gravitation equation (1.9) and its two-component solution (1.10) were obtained for the elementary particle for the formation of the particle mass as a result of spherical deformation of the quantised space-time. Gravitation starts with the birth of the elementary particles. However, the principle of superposition of the fields operates in nature in which the summation of the fields from the entire set of the elementary particles, included on the composition of the solid or cosmological object, determines its gravitation parameters.

In this context, the Poisson equation (1.9) and its two-component solution (1.8) can also be extended to cosmological objects. The gravitation interface R_S may already be regarded as the radius of the cosmological object. At the present time, the solution (1.10) does not take into account the distribution of the gravitational potential or quantum density of the medium inside the gravitation boundary R_S. However, this is of no principal importance for the analysis of the reasons for gravity in the external gravitation field of the object.

For the spherically symmetric system, the distribution of the Newton gravitation potential φ_n is described by the equation:

$$\varphi_n = -\frac{Gm_1}{r} \tag{1.33}$$

Formally, in the law of universal Newton gravity, the perturbing Newton potential φ_n (1.33) determines the gravitational force $\mathbf{F}_m$, acting on the trial mass m_2 ($\mathbf{1}_r$ is the unit vector with respect to radius):

$$\mathbf{F}_m = m_2 \operatorname{grad} \varphi_n = G\frac{m_2 m_1}{r^2}\mathbf{1}_r \tag{1.34}$$

The theory of Superunification shows that the Newton potential φ_n is fictitious, and the action potential C^2 (1.10), (1.11) acts in the quantised space-time. The gravitational force is expressed by means of the action potential C^2 (1.11) at $\gamma_n = 1$:

$$\mathbf{F}_m = m_2 \operatorname{grad}(C_0^2 - \varphi_n) = G\frac{m_2 m_1}{r^2}\mathbf{1}_r \tag{1.35}$$

As indicated by (1.30), the substitution of the Newton potential φ_n (1.33) by the action potential C^2 (1.11) does not change the Newton law. The point is that the gradient from the constant C_0^2 in (1.35) is equal to zero. Differential calculus in the gravitational theory has a significant shortcoming. Using the increments, it is very difficult to find the limiting value of the unification constant C_0^2. The theory of Superunification operates with the limiting parameters of the field.

Taking into account the equivalence of the gravitation potentials to the quantum density of the medium, the gravitational force (1.35) can be expressed by means of the deformation rector **D** (1.3a) of the quantised space-time:

$$\mathbf{F}_m = \frac{C_0^2}{\rho_0} m_2 \operatorname{grad}(\rho) = \frac{C_0^2}{\rho_0} m_2 \mathbf{D} \tag{1.36}$$

The deformation vector **D** in (1.36) is an analogue of the vector of the strength **a** of the gravitation field (**a** is freefall acceleration):

$$\mathbf{a} = \frac{C_0^2}{\rho_0}\mathbf{D} \tag{1.37}$$

Figure 1.12 shows that the trial mass m_2 is situated in a heterogeneous gradient field of the Earth. Quantum density ρ (action potential C^2) weakens at the Earth surface. However, the function ρ and C^2 do not determine the gravitational force and determine its gradient (1.36) i.e., deformation **D** (1.3a) of the quantised space-time. The theory of Superunification changes our views on gravity which cannot form outside the quantised space-time. Einstein connected gravity with the distortion of the space-time. It can

now be said that the gravity is based on the real deformation of the quantised space-time.

As already mentioned, the quantised space-time, regardless of its electromagnetic nature, which is also gravitational in its basis, is characterised by the gravitational potential C_0^2. In the absence of a gravitation perturbation, the potential C_0^2 is uniformly distributed in space and there are no gradients and forces. Only the presence of gradients leads to the formation of a non-balanced force.

Figure 1.7 showed the gravitation diagram of the elementary particle inside a gravitation well. The gravitation well forms in exactly the same manner around any object, having a perturbing mass. Figure 1.13 shows that formally the trial mass rolls into the gravitational wave towards the perturbing mass, ensuring their gravity. The theory of gravitation has never considered the presence of gravitation dwells inside the quantised space-time during its gravitational perturbation.

From the gravity field of the perturbing mass m_1 (Fig. 1.12) we transfer the trial mass m_2 to a separate diagram in Fig. 1.14, without changing the heterogeneity of the gravitation field inside the gravitation interface of the trial mass. Consequently, the deformation rector **D** is not affected and this vector can be described more efficiently by the indexes D_2^i, where i is the inertia vector, 2 is the deformation of the field inside the trial mass. In this case, the trial mass is subjected to the effect of the accelerating inertia force $\mathbf{F}_i$, regardless of the fact that the surrounding quantised space-time is not deformed.

Inside the trial mass m_2 (Fig. 1.14) the quantum density of the medium increases from ρ_2^{i1} to ρ_2^{i2}, forming inside the solid the gradient of the quantum density of the medium which determines the direction and magnitude of the deformation vector D_2^i and the effect of the accelerating force $\mathbf{F}_i$:

$$\mathbf{D}_2^i = \text{grad}\,(\rho_2^i) \tag{1.38}$$

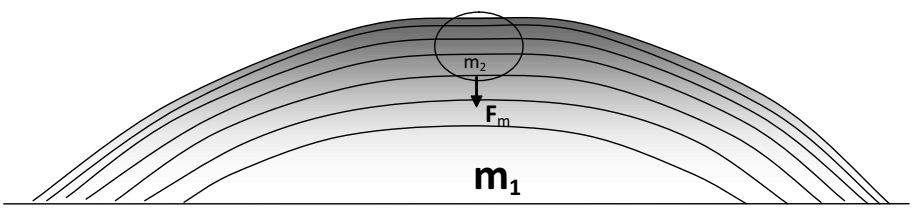

Fig. 1.12. Gravity force $\mathbf{F}_m$, acting on the mass m_2 in the field of the perturbing mass m_1.

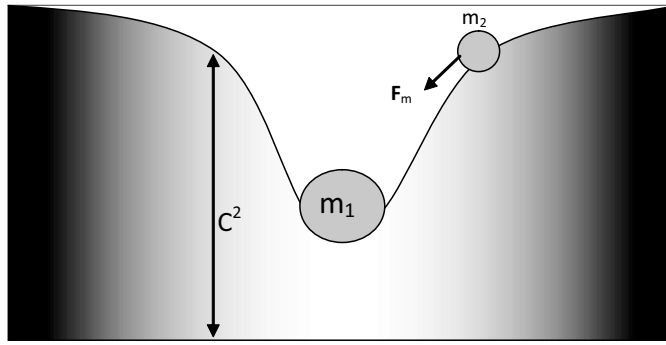

Fig. 1.13. Presence of a gravitation well in the quantised space-time around the perturbing mass m_1 two explains the effect of the gravity force $\mathbf{F}_m$ on trial mass m_2.

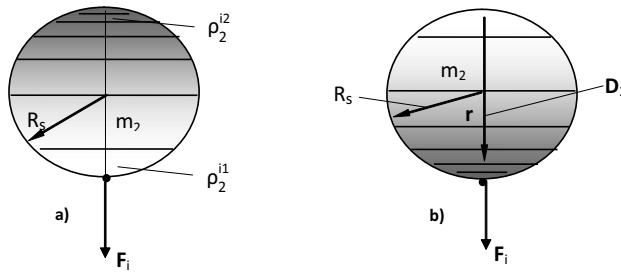

Fig. 1.14. Redistribution of the quantum density of the medium (or gravitation potentials) (a) and the formation of deformation vector $\mathbf{D}_2^i$ (b) inside trial mass m_2 as a result of the effect of the accelerating force F_i.

$$\mathbf{F}_m = m_2\mathbf{a} = m_2 \frac{C_0^2}{\rho_0}\mathbf{D}_2^i \tag{1.39}$$

$$\mathbf{a} = \frac{C_0^2}{\rho_0}\mathbf{D}_2^i \tag{1.40}$$

The equivalence of gravity and inertia is de termined by the capacity of the quantised space-time for deformation in the presence of which the unbalanced gravity force or inertia forms. The difference between gravity and inertia is that the deformation of the field inside the trial mass under the effect of gravity is caused by the external perturbing field, and in the case of inertia – by the effect of the perturbing force.

For the limiting case of the gravity force, the parameters of the gravitation object can be examined conveniently in the black hole state. The theory of

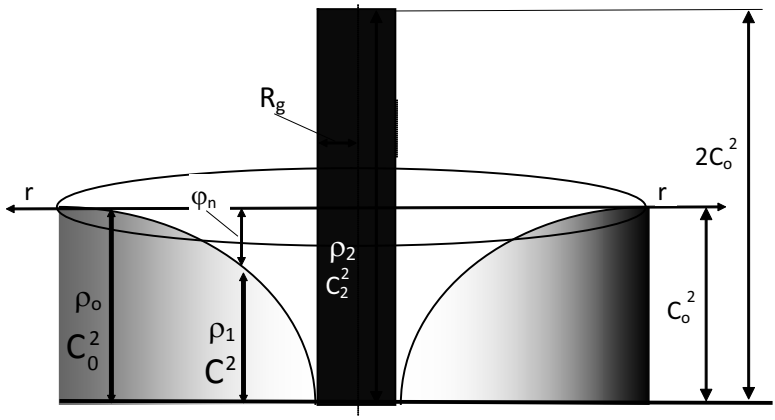

Fig. 1.15. Gravitation diagram of a black hole.

Superunification has its own method of calculating the parameters of black holes. Taking this into account, we can write the parameters of a static black hole on the surface from (1.10) for $r = R_g$ (1.5) and $\gamma_n = 1$

$$\text{At } r = R_g, \quad \varphi_1 = 0; \quad \varphi_2 = 2C_0^2 \tag{1.41}$$

Figure 1.15 shows the gravitation diagram of a black hole. The compression region is dark, the tension region is light. At the interface of the regions, there is a break in the luminiferous medium. For this reason, the light cannot penetrate into the black hole or escape from it. $C = 0$ on the surface of the black hole also results from the equation (1.32).

The theory of Superunification removes the fundamental errors relating to the theory of black holes. It is assumed that the strong gravitational field of the black hole captures the light and prevents it from escaping. In fact, the strong gravitational field results in breaks of the luminiferous medium, i.e., quantised space-time.

For a dynamic black hole, the collapse of matter takes place when the speed of the object is increased. At $C^2 = 0$ from equation (1.11) we obtain the condition of formation of the dynamic black hole:

$$\varphi_n \gamma_n = C_0^2 \tag{1.42}$$

At $r = R_g$ (on the surface of the black hole) we determine the mass of the black hole which determines the limiting mass of the particle (1.7). Evidently, when the speed of light is reached, the elementary particle transfers to the state of the dynamic black hole or, more accurately, a microhole. Equation (1.8) gives the limiting force $F_{T\max}$ of surface tension of the quantised space-time for the black hole:

$$F_{T\max} = \frac{C_0^4}{G} = 1.2 \cdot 10^{44} \text{ N} \tag{1.43}$$

The magnitude of the force (1.43) is the maximum force attainable by gravitation in quantised space-time.

1.3.6. Anti-gravitation. Minus mass. White holes

Anti-gravitation is gravitational repulsion. There is an erroneous view according to which anti-gravitation is the hypothetical conjecture of theoreticians and does not exist in nature. In fact, the effect of anti-gravitation in nature is manifested as widely as gravity. Only its effect is found in the area of cosmology and also in the area of elementary particles at a distance is smaller than the conventional radius of the electron.

In the area of cosmology, anti-gravitation repulsion from the centre of the universe explains the accelerated recession of galaxies and the nature of these forces is also described in the theory of Superunification.

These zones of anti-gravitational repulsion at distances smaller than the conventional electron radius have been found in the elementary particles: the electron, positron, proton and neutron. This excludes the collapse of atomic nuclei, balancing the nuclear forces as the forces of electrical attraction of nucleon shells. Evidently, the electronic neutrino, as a dipole structure, has the minus mass showing repulsion forces at short distances and, at the same time, having a small interaction cross-section.

Since this study is concerned with cosmology, the minus mass as the source of gravitation, can be described by the two-component solution (1.8) of the Poisson equation and by the balance of the gravitation potentials (1.11), replacing the minus sign (–) by the plus sign (+):

$$C^2 = C_0^2 + \varphi_n \gamma_n \tag{1.44}$$

$$\begin{cases} \varphi_1 = C^2 = C_0^2 \left(1 + \dfrac{R_g \gamma_n}{r} \right) \\ \varphi_2 = C_2^2 = C_0^2 \left(1 - \dfrac{R_g \gamma_n}{R_s} \right) \end{cases} \tag{1.45}$$

Figure 1.16 shows the gravitation diagram of the minus mass in accordance with (1.44) and (1.45). In contrast to the plus mass (Fig. 1.7 and 1.13), the minus mass forms a hillock and not a well in the quantised space-time (Fig. 1.13) Formally, this explains the rolling of the trial mass from the hillock as the representation of repulsion forces. In fact, the direction of the deformation vector **D** of the quantised medium changes and the gradient

forces of repulsion act from the centre of the minus mass. In any case, the gradient forces act in the direction of the region of the decrease of the quantum density of the medium and gravitation potential of the quantised space-time (Fig. 1.13 and 1.16). The heterogeneity of the quantised space-time determines the effect of the gradient forces in the quantised space-time.

It should be mentioned that the positron, having the plus mass, relates to antiparticles. This means that the presence of the minus mass does not indicate that this mass is antimatter.

The minus mass can be in the state of a white hole (Fig. 1.17) on the condition:

$$\text{At } r = R_g, \quad \varphi_1 = 2C_0^2; \quad \varphi_2 = 0 \tag{1.46}$$

Evidently, our universe may be in the state of the white hole because only this state is characterised by the effect of the gradient forces from the centre of the universe on the galaxies starting acceleration of the latter.

Figure 1.18 shows the possible scheme of our quantised universe in the state of the white hole and the minus mass. This means that our universe has the form of a sphere expanding as a result of inflation and the centre of the sphere contains a white hole (the absence of the quantised medium). This allows the possibility of a big bang preceding inflation releasing the quantons and bonded and free electrical quarks. It is likely that the inflationary theory will provide the answer to the process of expansion of our universe and individual stages of this expansion.

It is possible that the gradient of the quantum density of the medium directed from the centre of the universe to the periphery which determines the direction of the deformation vector and the accelerated recession of the galaxies, could be referred to as a gigantic gravitational wave which periodically changes the direction of the gradient of the quantum density of

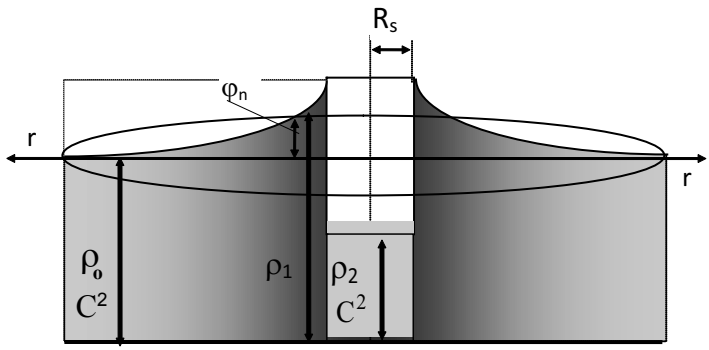

Fig. 1.16. The gravitation diagram of the minus mass. The compression region is dark , tension region light.

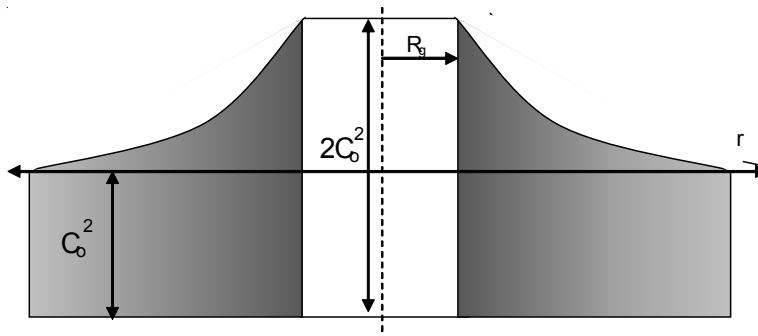

Fig. 1.17. The minus mass in the white hole state.

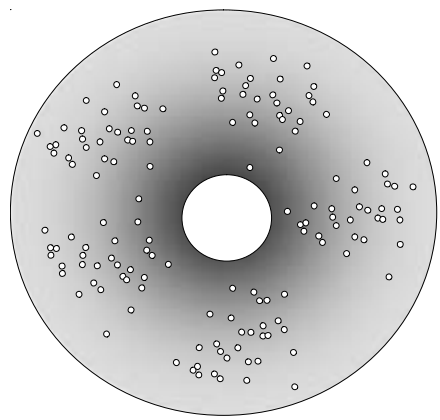

Fig. 1.18. Our post-inflationary quantised universe in the white hole state and the minus mass.

the medium. The recession of the galaxies is replaced by their movement in the direction to the centre of the universe.

The state of our universe may be described by the Poisson equation and its two-component solution for the minus mass (1.45) under the condition (1.46):

$$\begin{cases} \varphi_1 = C^2 = C_0^2\left(1+\dfrac{R_g}{r}\right) \\ \varphi_2 = C_2^2 = 0 \end{cases} \tag{1.47}$$

Unfortunately, the gravitation radius R_g of our universe as the minus mass is not yet known. The visible horizon of the universe is determined by the dimension 10^{26} m. However, this does not mean that we can see the actual image of the world. As indicated by Fig. 1.17, our universe is not flat and

the quantised space-time is deformed from the centre to the periphery. The universe is distorted. In this deformed distorted luminiferous medium, the light beam is bent and does not travel along a straight line. The same galaxy can be seen from different sides as different objects. If a light beam from our Sun travels travel around a galaxy and returns to us, we would see our past. This is the real basis for a time machine to be used not for travel to the future but for observing the past.

The quantised space-time has gaps between quantons, i.e., the same wormholes and tunnels whose role should be investigated. The possible application of tunnels as channels ensuring the circulation of energy in the universe has been investigated as an example.

1.3.7. Problem of time. Chronal fields

The theory of quantum gravitation cannot be investigated separately from time whose carrier is the quanton, specifying the lapse of time with a period of $2.5 \cdot 10^{-34}$ s inside the quantised space-time (Fig. 1.5). In this respect, the quantin is an unique and universal particle uniting electromagnetism and gravitation, space and time. The problem of time is far more complicated than thought previously. The theory of Superunification presents for the first time a material carrier of time, a real 'electronic clock', defining the rate of time at every point of quantised space-time. The concentration of the time carriers in the volume of space is determined by the quantum density of the medium ρ_0 for the quantised space-time unperturbed by gravitation:

$$\rho_0 = \frac{k_3}{L_{q0}^3} = 3.55 \cdot 10^{75} \frac{\text{quantons}}{\text{m}^3} \tag{1.48}$$

where $L_{qo} = 0.74 \cdot 10^{-25}$ m is the calculated diameter of the quanton, $k_f = 1.44$ is the filling coefficient.

The period T_0 of the electromagnetic oscillation of the quanton is determined by the speed of travel of the electromagnetic wave C_0. Separating L_{q0} from equation (1.48), we obtain:

$$T_0 = \frac{L_{q0}}{C_0} = \frac{1}{C_0}\left(\frac{k_3}{\rho_0}\right)^{\frac{1}{3}} \approx 2.5 \cdot 10^{-34} \text{ s} \tag{1.49}$$

In the case of gravitation perturbation of the quantised space-time, the lapse of time T_1 and T_2 is determined by the changed quantum density of the medium ρ_1 and ρ_2 for the two-component solution (1.4):

$$T_1 = \frac{1}{C}\left(\frac{k_3}{\rho_1}\right)^{\frac{1}{3}} \tag{1.50}$$

$$T_2 = \frac{1}{C_2}\left(\frac{k_3}{\rho_2}\right)^{\frac{1}{3}} \tag{1.51}$$

The equations (1.50) and (1.51) determine the lapse of time in the external region from the gravitational boundary and inside the region in the presence of the perturbing gravitation mass in quantised space-time. Substituting the speed of light C and the quantum density of the medium ρ_1 into the equations (1.50) and (1.51), taking into account the normalised relativistic factor γ_n, we obtain the lapse of time in the external and internal regions of the gravitational diagram (Fig. 1.8) for the perturbing mass in the entire speed range from 0 to C_0:

$$T_1 = T_0\left(1 - \frac{\gamma_n R_g}{r}\right)^{-\frac{5}{6}} \tag{1.52}$$

$$T_2 = T_0\left(1 + \frac{\gamma_n R_g}{r}\right)^{-\frac{5}{6}} \tag{1.53}$$

Analysis of (1.52) shows that with the increase of gravity and the speed of movement of the perturbing mass, the period T_1 (1.52) in the vicinity of the mass increases. This is equivalent to reducing the rate of lapse of time. However, inside the gravitation boundary of the rate of lapse of time (1.6) increases. Naturally, the lapse of time is given by the elastic properties of space-time quantum (quanton) as a volume resonator playing the role of specific 'electronic' clock. With the increase of the speed of the body and the decrease of the quantum density of the medium on the surface of the body, the elastic properties of the medium decrease and, correspondingly, the rate of lapse of time in the vicinity of the body decreases.

Finally, it is interesting to investigate the course of the biological clock of cosmonauts flying in a spaceship at the speed close to the speed of light. According to Einstein, this problem was treated as the twins paradox where the deceleration of time at high speeds causes that one of the twins who returned from cosmic travel finds his brother to be an old man whereas he remains young. In fact, this problem is not so simple, and the twins paradox is only the Einstein's original concept in order to attract the attention of society to the theory of relativity during its popularisation.

Taking into account the behaviour of matter in the quantised medium at high speeds close to the speed of light, it may be predicted that the cosmonaut inside a spaceship will be simply crushed by the gravity force of his own body and even his matter can transfer to the state of a dynamic black microhole. However, even at lower speeds, the time is accelerated inside the shell of the elementary particles forming the body of the cosmonaut because the quantum and density of the medium increases. In the external region behind the shell (gravitational boundary) of the particles, i.e., inside the cosmonaut body, the time slows down. If it is imagined that the cosmonaut is not crushed by gravity, then it is difficult to estimate at the moment the effect of space travel on the ageing of the organism. However, even if the spaceship travels at a speed of 50% of the speed of light, which is a very high speed of the order of 150 000 km/s, the increase of gravity and the variation of the lapse of time will be small so the cosmonaut will not notice them. For the cosmonaut it is more difficult to withstand overloading and weightlessness. However, in travel with constant acceleration equal to the freefall acceleration on the Earth surface, the problem of weightlessness can be solved.

Equation (1.52) shows that the lapse of time in the quantised medium perturbed by gravitation is distributed nonuniformly and represents a scalar field which can be referred to as a chronal field. In fact, the chronal field is described by the Poisson equation for the lapse of time whose solution is represented by the equations (1.52) and (1.53).

When discussing the quanton as the carrier of the chronal field, the quanton only the gives the rate of time but is not an integrator as the clock. The quanton specifies only the rate of electromagnetic processes to which all known physical processes are reduced. When discussing the clock, we are discussing the summation of time sections. Being a part of the quantised space-time, we constantly move in it as a result of the wave transfer of mass and take part in the colossal number of energy exchange processes with a large number of quantons. Therefore, all the physical processes can be regarded as irreversible. It is not possible to enter the same river twice. The arrow of time is directed only into the future.

1.3.8. Who lights up stars?

Working on the theory of Superunification, I did not found any convincing reasons for supporting the thermonuclear hypothesis of the source of luminosity of the stars. This is not caused by the solar neutrino and stability of the solar radiation over the period of billions of years from the moment of birth of biological life. It is not due even to the results of investigations

carried out using the Hubble telescope which shows the birth of new stars. The entire point is the temperature concept of thermonuclear synthesis which still has no theoretical substantiation.

At the present time, the contradictions of the quantum theory lay between the temperature and recoil of the atom during emission (adsorption) of the photon. It would appear that as the energy of the emitted photon increases, the intensity of the recoil of the atom and by the photon should also increase and the temperature vibrations of the atoms (molecules) should become greater. However, in practice the situation is completely reversed, the most intensive recoil is shown by the low-energy infrared photon (thermal photon). It must be proved mathematically that the thermal recoil of the atom (molecule) is inversely proportional to the energy of the emitted photon. This problem has been solved successfully in the theory of Superunification.

We have been accustomed to think that the recoil of a gun is proportional to the momentum of the emitted projectile. However, the reverse must now be proven. These are the paradoxes of the quantum theory. For more than 40 years we have been led to believe that the future of power engineering is controlled thermonuclear synthesis (CTS) thus closing other investigation directions. It was promised that CTS would solve all energy problems of the mankind already by the year 2000, and huge sums of money have been spent on this project. The time has passed, the energy problems have not been solved and on the contrary, the situation is quite critical. The inoperative CTS systems of the Tokamak type have been replaced by the new international project ITER.

I say openly that the ITER project is the grandiose scientific adventure and clear waste money of taxpayers for the antiscientific and futile investigations, as already was the case with the Tokamak. The CTS is based on the false temperature concept of synthesis. Initially, it was assumed that it is sufficient to heat hydrogen-forming plasma in a magnetic trap to a temperature of 15 000 000° and the CTS of helium would start with the generation of energy as a result of a mass defect of the nuclei. The temperature in the plasma has already reached 70 000 000° but no CTS has taken place. It is evident that the temperature concept of synthesis of nuclei does not work.

When the nature of nuclear forces in the theory of Superunification became known, it appeared that there are no methods for including the temperature factor in the concept of CTS as the factor of overcoming the electrostatic repulsion of protons (hydrogen nuclei). The temperature concept of CTS was based on the positive experience of exploding hydrogen bombs in which the detonator was represented by a preliminary atomic explosion, accompanied by the generation of a colossal amount of energy. However,

in this case, temperature is one of the energy generation factors. Other factors include high pressure and acceleration which 'push' the proton nuclei into each other to distances of the action of nuclear forces (electrical forces of alternating shells of the nucleons), overcoming the electrostatic repulsion of the nuclei.

Generation of colossal pressures and acceleration of particles under the effect of nuclear explosion inside a thermonuclear reactor in the laboratory conditions is not possible because of purely technical reasons. Heating of the plasma in the magnetic trap of the Tokamak is of no use here. Knowing the values of the nuclear forces and the cross-section of the effect of these forces, it is easy to calculate the pressures and forces which must be overcome to bring the nucleons together despite their electrostatic repulsion. For this purpose, the proton nuclei of light elements must be compressed by the accelerated fragments of the atomic nuclei of heavy elements (uranium, plutonium, etc), giving the fragments the force momentum, as is the case in the thermonuclear bomb. The fragments of the heavy nuclei are accelerated as a result of their stronger electrostatic repulsion in splitting at the moment of atomic explosion. The conditions for natural acceleration of nucleus fragments are generated.

Consequently, we obtain a nuclear press in which the light nuclei are compressed between the accelerated fragments of the heavy nuclei and quantised space-time representing the elastic quantised medium (EQM) which plays the role of a wall (anvil). The strength of this anvil increases with the increase of the strength of the effect of acceleration and momentum on the anvil. This is the factor of the quantised medium having the properties of super hardness under the effect of colossal acceleration and forces from the side of the second compulsory factor - accelerated fragments of the heavy nuclei which have not as yet been investigated in the theory of nuclear synthesis. Without these two factors playing the fundamental role in the explosion of the thermonuclear bomb, it is not possible to start controlled thermonuclear synthesis.

On the other hand, I wanted to verify by calculations the extent to which the temperature concept of thermonuclear synthesis is related with the synthesis of nuclei. I could not find in the literature sources any calculations linking nuclear forces with temperature. It is highly likely that they do not exist. In order to calculate these forces, it is necessary to have clear information on the temperature not as the parameter on the scale of the thermometer or the energy of the photon but as the thermal energetics parameter. However, here as already mentioned, the currently available quantum theory fails. It appears that as the photon energy increases the intensity of the recoil of the atom by the photon decreases; the most intensive

recoil is characteristic of the low-energy infrared photon (thermal photon) which is not capable of ensuring a recoil momentum of the atomic nucleus for overcoming the electrostatic barrier between the elements of the light nuclei.

I paid special attention to this energy paradox because temperature is connected with the temperature oscillations of the atoms and molecules as a result of a recoil during radiation (reemission) of the photon. In its time, the development of quantum theory also started from the energy paradox when the discrete nature of radiation of the atoms and the dependence of the photon energy on its frequency (and not on the intensity of radiation) was discovered. This contradicted classic electrodynamics. At present, these contradictions of quantum theory are found between the temperature and the recoil of the atom at emission (absorption) of the photon when it is not possible to overcome the forces of electrostatic repulsion of the atomic nuclei when attempting their synthesis. The temperature concept of the CTS is anti-scientific in its nature and has no prospects for development in energetics. Other concepts must be found.

Thus, the solution of the given task is not only of the purely theoretical interest but is also of the colossal applied value in the processes of production of thermal energy in new energy cycles of quantum energetics. Here we are discussing a number of the experimental effects with the generation of excess heat, including the Usherenko effect (the effect of superdeep penetration of microparticles into hard targets). If the effect of positive generation of heat is still being attempted in the CTS, in the Usherenko effect this energy generation is 10^2–10^4 times higher than the kinetic energy of accelerated particles – strikers. However, this is only one of the many facts confirming by experiments the prospects for the development of quantum energetics as the basis of energetics of the 21st century. In fact, quantum energetics is a more general concept which also includes nuclear reactions which, in the final analysis, are only one of the methods of extracting the energy of superstrong electromagnetic interaction (SEI).

It has been established that the only source of energy in the universe is the superstrong electromagnetic interaction. This is the source of luminosity of stars. It is necessary to find new power cycles which would replace the thermonuclear concept of thermonuclear synthesis. The temperature on the Sun surface does not exceed 6000°C and the temperature inside the Sun has not been measured. It is necessary to develop new approaches to the energy of stars. The energy cycles in the electron–positron plasma appear to be more suitable for this purpose. It is completely justified to assume that these new energy cycles have been experimentally established in the Usherenko effect. Through the electron–positron plasma we can

arrive to the birth of protons and neutrons and subsequently hydrogen and helium.

The principle of spatial transformation of energy provides a scientific substantiation for the release of the energy of superstrong electromagnetic interaction in new energy cycles in which the energy capacity may reach 10^{17} J/kg. This is three orders of magnitude greater than the energy capacity of nuclear and thermonuclear reactions. The new energy cycles are based on the reactions of cold synthesis of elementary particles and their antiparticles with subsequent annihilation. This is considerably simpler and safer than work with the synthesis of atomic nuclei.

Nobody has confirmed that the heavy elements form in the nuclei of stars. In all likelihood, the process of formation of heavy elements takes place outside the stars in the quantised space-time in which there are suitable conditions for the natural acceleration of light elements. The accelerated nuclei in collisions in the opposite directions, overcoming electrostatic repulsion, merge into heavier nuclei. Cosmos is the acceleration laboratory for the production of new elements, starting with the synthesis of elementary particles and their antiparticles in quantised space-time.

Figure 1.19 shows shell models of nucleons which contain electrical quarks of different polarity in their alternating shell. Such a shell is characterised by the tightening effect, compressing the quantised space-time inside the shell and expanding it on the external side. The effect of the alternating shell with respect to the spherical deformation of the quantised medium is considerably stronger in comparison with the effect of the central quark in the generation of the electron (positron). Therefore, the mass of the nucleons is considerably greater than the mass of the electron (proton). On the other hand, the alternating shell of the nucleons is characterised by the transmission capacity for the quantons, ensuring the wave transfer of nucleons in the quantised space-time.

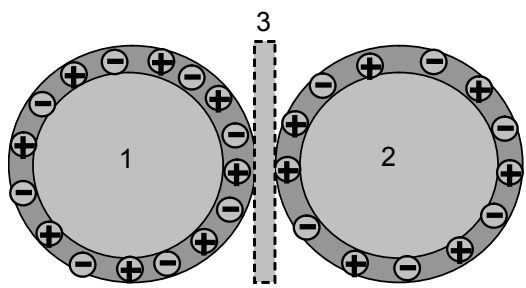

Fig. 1.19. Electrical interaction of alternating shells of nucleons. 1) neutron, 2) proton, 3) the region of the effect of nuclear forces.

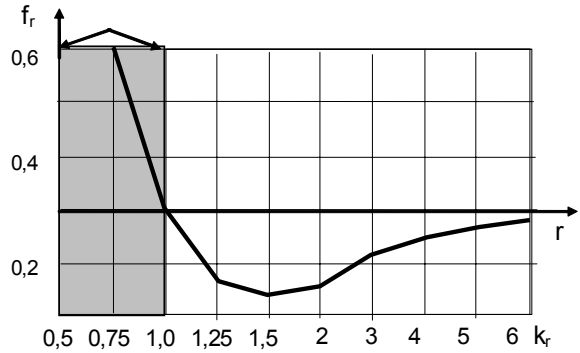

Fig. 1.20. Variation of electrical forces of repulsion and attraction in interaction of the shells of the nucleons as a function of f_r (k_r).

The difference between the proton and the neutron is the presence of the unbalanced electrical charge (quark) with positive polarity in the proton shell. In the neutron, the alternating shell contains the same amount of the charge with the opposite sign, showing its electrical neutrality. However, at shorter distances, the alternating shells of the nucleons attract each other and this results in the formation of nuclear forces as the forces of electrical attraction of quarks of different type (Fig. 1.20). At distances shorter than the classic electron radius zones of anti-gravitation repulsion were detected at the quarks inside the nucleon shell. These zones balance the forces of electrical attraction of the shells, ensuring the stability of the atomic nuclei at the main elements. The instability of the nuclei of the heavy elements is caused by the increase in the depth of the gravitation well and by the corresponding weakening of the electrical forces of attraction of the nucleon shells. The decay of heavy atoms is caused by the fluctuations ('boiling') of the quantised space-time.

The quark model of the nucleons has been included to the shell model without any objections.

1.3.9. Superstrings

The theory of Superunification has found a suitable applied position in many studies of theoreticians whose concepts were ahead of time. This refers to the space-time quantum, the Dirac magnetic monopole, quarks, fundamental length determined by the quanton diameter, anti-gravitation, the fifth force and the theory of superstrings.

The theory of the superstrings, as the quantum theory, assumes that gravity is determined by the exchange of locked strings which replace

hypothetical gravitons. The theory of the superstrings also contradicts the Einstein gravitation theory, rejecting the role of the four-dimensional continuum in the nature of gravity. Unfortunately, none of the theoretical physicists, working in the area of string theory, can proposed methods for experimental verification of the theory.

At the same time, studies of the theory of Superunification, as a continuation of the unified field by Einstein, revealed the presence of real superstrings determining the tension of the quantised space-time.

Figure 1.21 shows that in the quantised space-time we can separate alternating superstrings from quantons. The tension of such an electromagnetic superstring is determined by the mutual attraction of the charges with opposite signs (quarks) inside the quantum and can be easily calculated. The tension force $\mathbf{F}_z$ of the string is calculated as the total effect of electrical F_e and magnetic F_g forces in the superstring ($\mathbf{1}_z$ is the unit vector along the superstring):

$$\mathbf{F}_z = \pm\mathbf{1}_z(F_e + F_g)\cos\alpha_z = \pm\mathbf{1}_z \frac{\pi}{12L_{q0}^2}\left(\frac{e^2}{\varepsilon_0} + \mu_0 g^2\right) = \pm 2\cdot 10^{23}\ \text{N} \qquad (1.54)$$

The tension $\pm\mathbf{T}_z$ of the electromagnetic superstring is determined as the force $\mathbf{F}_z$ acting in the cross-section S_q of the quanton:

$$\pm \mathrm{T}_z = \frac{\pm \mathrm{F}_z}{S_q} = 4\frac{\pm \mathrm{F}_z}{\pi L_{qo}^2} = \frac{\pm 1_z}{3L_{q0}^4}\left(\frac{e^2}{\varepsilon_0} + \mu_0 g^2\right) = \pm 4.65\cdot 10^{73}\frac{H}{\mathrm{m}^2} \qquad (1.55)$$

As indicated by (1.54) and (1.55), the quantised space-time is characterised by colossal tension (and elasticity) which determines the high rate of the wave processes in it (the speed of light $3\cdot 10^8$ m/s).

In Fig. 1.22, the electromagnetic superstring (Fig. 1.21) is interpreted in a slightly different form in which the tension between the quantons is determined by short locked strings. In this respect, the string theory has a real physical basis.

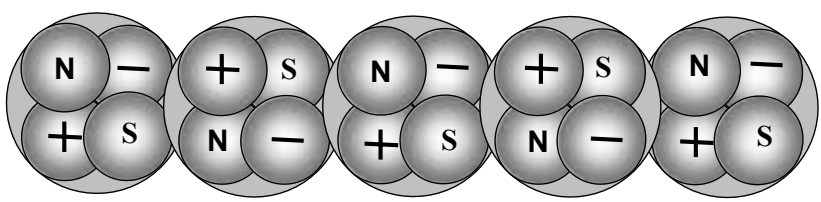

Fig. 1.21. Separation of the alternating electromagnetic superstring from the quantons inside quantised space-time.

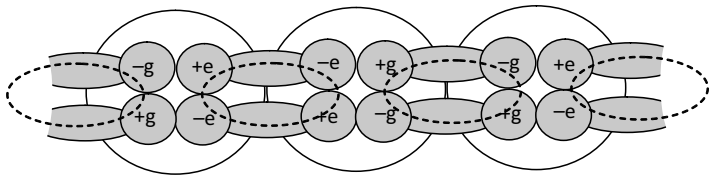

Fig. 1.22. Section of the electromagnetic superstring from quantons connected together by short strings. For better understanding electric and magnetic dipoles of the quantons are rotated in the plane of the figure whereas in reality their axes are mutually perpendicular (Fig. 1.5).

1.3.10 Main problems of modern physics

In the last ten years, since the discovery in 1996 of the quantum of space-time (quanton) and the superstrong electromagnetic interaction, I have completed the theory of Superunification of fundamental interactions which unites gravitation, electromagnetism, nuclear and electrical weak forces. The integrating factor is the superstrong electromagnetic interaction (SEI), i.e., the fifth force which is so far unknown to science. The SEI is the unified field whose realias were proposed by the genius Einstein who spent 30 years of his life to find within the framework of the general theory of relativity (see the section Einstein's posthmuous phrase).

The theory of Superunification is the main theory of contemporary physics. The main assumptions of the theory of Superunification have been published in open press and summing this up, I would like to mention that two volumes of studies have been collected, with the total volume of more than 1000 pages and several thousands of new equations. The period of active popularisation of new concepts is about to begin. There is no better approach to the popularisation of new fundamental discoveries and the theory of Superunification than the polemics between Ginzburg and Leonov

To understand the principal error made by Ginzburg, is it necessary to present his ideological viewpoint regarding matter taking the results of his studies into account? I hope that I am not too far away from the truth when assuming that in his concept, the basis of the material world is represented by the ponderable matter, i.e., the matter, and these are elementary particles having the mass and all other physical bodies, including stars and black holes. There are also photons with some small rest mass (?) and another electromagnetic matter, which however appears to be secondary and not main. The principal method of investigations ponderable matter is the decomposition method in which the matter is divided into smaller particles. We arrive here at the elementary particles which, it would appear, are not so elementary but their structure cannot be determined. Smaller particles

have been invented, i.e., quarks, but no reliable experimental facts have been presented. In the area of the theory of elementary particles, special attention is given to the probability phenomenology of quantum theory, without understanding the reasons controlling the microworld, assuming that the end of certainty in physics has arrived. The space-time is the purely geometrical category with the minimum energy level, governed by the relativity principle. This is the basis of advanced theoretical physics which is somewhere accurate and somewhere erroneous. In particular, in some cases I did not touch this basis and in some cases I corrected it, but in the main I removed it completely in order to link physics by a single concept in the theory of Superunification. However, this will be discussed later.

Ginzburg clearly understood that the problem of Superunification lies in the fifth force but made the serious error in its formulation: '*Physicists know that the micro- and macroworld are controlled by four forces. The attempts to find the fifth force have been unsuccessful for more than 50 years. The physicists realise that they are looking for something incredibly weak that has been eluding detection so far (Vestnik RAN, vol. 69, No. 3, 1999, p. 200).* In fact, in order to combine the four fundamental interactions (forces): gravitation, electromagnetism, nuclear and electroweak forces, the fifth force is essential. However, dear Vitalii Lazarevich, to combine these forces, they must be governed by the fifth force: any schoolboy knows that: in '*in order to subordinate a force*, *an even greater force is required*'. This is the golden rule of physics. In order to subordinate nuclear (strong) interactions, it is necessary to have a force which is greater than the nuclear force. So what is the force you are referring to, saying that 'it is something incredibly weak?'. There is for example the electroweak force, i.e., we are discussing the fifth force as the superweak force. However, this force is not capable of combining all other forces. For this reason, you have not been able to create the theory of Superunification because no accurate concept of unification has been developed.

Superunification requires the Superforce. The well-known English theoretical physicist and science populariser Paul Davis devoted his popular book 'Superforce' in this problem, claiming: 'Entire nature, in the final analysis, is governed by the effect of some Superforce, manifested in different 'hypostases'. This force is sufficiently powerful to create our universe and provide it with light, energy, matter and the structure. However, the Superforce is something greater than simply something creating the beginning. In the Superforce, matter, space-time and interaction are combined into the indivisible harmonic whole generating such unity of the universe which previously no one assumed'. [Davies P., Superforce. The

search for a grand unified theory of nature, New York, 1985].

It can be seen that not all the physicists in the world shared Ginzburg's views. I find it surprising why Davies, who correctly formulated the concept of the Superforce more than 10 years prior to the discovery of the quanton – the particle of the carrier of Superforce – did not do this instead of me. This could have been done by Einstein who accurately formulated the concept of the unified field whose carrier is also the quanton. The unified Einstein field cannot be separated from the Superforce. This is now clear and understood when it is presented in the theory of Superunification but this could not be done so simply until my research.

The Lord gave me the power to see what others cannot see. My brain enables me to penetrate into the secrets of the ultra-macroworld of quantised space-time. I simply see what takes place there. I then draw the observed physical models and calculate them. I have no rough copies. I have now reached a highly perfected state and all calculations are carried out immediately, accurately, with only a small number of errors. However, this required many years of training. I have never studied mathematics, I have only several books and the Encyclopaedia of Mathematics to which I refer only very seldom. I assume that it is much simpler to start everything from the beginning instead of studying conclusions made by others. Therefore, I do not experience any serious problems with the mathematical description of the processes which I observed in the ultra-microworld of the quantons. I explain this by the fact that the observed physical models are accurate in their basis and they contain the correct mathematical origins. There is one fine detail. I must have a problem long before without knowing how to solve it. It is evident that subconsciousness operates in this case and when the solution is ready, I only write it down. This was the procedure which I used for solving the most difficult problems of theoretical physics which had been regarded as insolvable. When I turned to mathematicians, nobody could help me. As the theoretical physicist, I have no secrets in the work of my laboratory. Evidently, this purely individual phenomenon explains the reasons for my successes in the development of the theory of Superunification. I work with real physical models and with phenomenological models.

It is now possible to formulate the main problem of contemporary physics: 'what was the first, the matter as ponderable matter or weightless electromagnetic matter? Many mistakes have been made in this question and it is difficult to solve the situation. To explain this problem, we return to the concepts of the open quantum-mechanics system (OQS) and the closed quantum-mechanics system (CQS). For the latter, the base of the matter is the matter represented by ponderable bodies and particles. In this case, the

particle (body) is treated as an object isolated in the void. However, this is not in agreement with the experimental results according to which the particle (body) shows both corpuscular and wave properties. How can the isolated particle (body) be both a wave and a corpuscule? The current quantum theory does not provide the answer to this question and postulates the principle of corpuscular–wave dualism as the fundamental physical category.

In order to solve this problem, it would be necessary to examine the structure of the quantised space-time as the carrier of the fifth force - Superforce. In the theory of Superunification, the ambitious term Superforce is replaced by the purely scientific term – superstrong electromagnetic interaction (SEI) whose carrier is the quantised space-time. I shall not discuss the problem of quantisation of space-time which has been explained in other studies. I should only mention that the problem of quantisation of the space is equivalent to the process of filling its volume with quantons - the elementary quanta of space-time, forming in this case the elastic quantised medium (EQM) with the gravitation potential equal to C^2 and not zero, as assumed previously. Here C is the speed of light, equal to the square root of the gravitation potential of the quantised medium which is used as the luminiferous medium. The waves cannot exist without a medium. The quanton itself unites electricity and magnetism, including in itself the electrical and magnetic elementary dipoles whose axes are orthogonal to each other.

In order to understand the reasons for corpuscular–wave dualism, we discuss the formation in quantised space-time of an elementary particle – electron which is the carrier of the electrical charge and mass. If an elementary electrical charge with negative polarity and no mass is thrown into the elastic quantised medium, then under the effect of ponderomotive forces the quantons start to move in the direction of the central charge, as pieces of paper travelling to an electrified comb. The quantised space-time around the central electrical charge is spherically deformed or, according to Einstein, distorted. Consequently, the electrical charge acquire mass and generates the electron as the carrier of charge and mass.

Therefore, the movement of the electron in the elastic quantised medium can be regarded as the wave process of spherical deformation of the medium, i.e., the wave transfer of mass, and the corpuscular transfer of the elementary charge. This is in complete agreement with the principle of corpuscular–wave dualism according to which the particle shows simultaneously its wave and corpuscular properties. The mass of the electron is the equivalent of the energy of elastic deformation of the quantised medium whose basis is electromagnetic. This explains the equivalence of

the mass and electromagnetic energy of the particle, established by Einstein, where the energy mC^2 is determined by the work with the transfer of mass m into the region of the quantised medium with the potential C^2.

The principle of corpuscular–wave dualism concerns not only the elementary particles having mass, but also all physical bodies because they consist in the final analysis of elementary particles, being the integral part of quantised space-time. It can be seen that objects isolated from the quantised space-time do not exist in nature and also in closed quantum-mechanics systems. All the elementary particles and physical bodies are open quantum-mechanics systems, and the theory of Superunification has been developed for describing these systems.

The theory of Superunification shows that primary matter in nature is the quantised space-time, with the superstrong electromagnetic interaction (SEI) being its carrier. We live in the electromagnetic universe. In this respect, the energy is unique, and all known types of energy in the final analysis are reduced to extraction or transformation of the energy of the SEI. The theory of Superunification changes the philosophical approach to understanding the mass not as the basis of matter but as the secondary manifestation of the energy of the SEI as a result of spherical deformation of the quantised space-time. It appears that the mass as such does not exist in nature in the concept which we were presented. Mass is secondary.

Paradoxically, the development of fundamental science takes place along the path of its combination with the religious views. Religion always taught that the soul is primary and the body secondary. In the theory of Superunification this main assumption of religious teaching is completely confirmed. If the soul is regarded as the weightless (non-body) electron charge, the physics of the elementary particles leads to the scientific justification of the field form of energy-information interactions. The field form is the weightless (non-body) form of matter, with the information bit being the carrier of the latter. A classic example of the formation of an elementary information bit inside the quantised space-time is the reaction of annihilation of the positron and the electron. The positron differs from the electron only by the sign of the central electrical charge, in the positron the charge is of positive polarity.

When the electron and the positron come together to some specific critical distance their spherical fields break up. The electromagnetic energy of elastic deformation of the medium, released during this phenomenon, changes to wave photon radiation. This is similar to shooting from a catapult in which the elastic energy of tension in the rubber is released, ejecting the stone. However, what takes place with the weightless (non-body) charges of the electron and the positron? Their charges with positive and negative

polarity form a weightless electrical dipole, some information bit in space on the existence of the pair of the particles: electron and positron. This determines the laws of conservation: energy, mass, charge, and information. It has been proven that the law of conservation of information is the fundamental law of nature. In order to produce an electron and a positron from vacuum it is necessary to split the information bit (weightless electrical dipole) into two charges which spherically deform the quantised medium, forming a mass at the charges and transforming them into elementary particles: electron and positron.

The concentration of the field (weightless) form of information inside the quantised space-time is extremely high and has the controlling importance for the formation of life and intelligence in the universe. A more suitable example confirming this assumption is the non-correspondence between the information detected in the double helix of the DNA and the information required for describing the man as a self-organising and self-reproducing social system. The number of the chemical links of the DNA determines $10^{20}...10^{21}$ bits of information. This information is on the cell level. It is easy to calculate that for the complete description of the man we require 10^{40}–10^{42} bits of information. Where to obtain 20 orders of missing information?

The annihilation of the electron and the positron takes place at distances of the order of 10^{-15} m. Calculation showed that the elementary information bit in the form of an electrical dipole has the size smaller than 10^{-15} m. It can easily be calculated that the information capacity of a single m^3 of quantised space-time may equal 10^{45} information bits. This is the level of information comparable with the level of information required for describing the man. Of course, missing information on the man is hidden on the field level inside quantised space-time. This weightless information is linked with the structure of DNA determining only the inheritance features but on the whole the man as a complicated energy-information system.

Physical investigations show that as we penetrate deeper into the matter, we need to deal with the higher and higher concentration of energy and information. The theory of Superunification shows that the man is an open quantum-mechanical and energy-information system, being the compound and inseparable part of quantised space-time. The man is the cosmos. It is believed that we live the most powerful computer which controls our life activity and also regulates us giving us some freedom of selection. Taking into account that the quantised space-time resembles a solid state structure with impurities, resembling a microprocessor in the local region, the analogy with the computer is fully acceptable. It appears to me that when I work on a computer, I enter the state unity with the information

field obtaining new information. I am convinced that we are to face an interesting period, the complete description of the still unknown mysteries of the nature and ourselves.

The theory of Superunification is the most powerful apparatus of investigation of matter. We do not have to go very far for confirmation. For this purpose, we compare the 'Ginzburg list' and the 'Leonov' list, presented previously in the introduction by the author to volume 1.

1.3.11. Problems of inflationary theory

Inflationary theory does not take into account the presence of primary matter, i.e. quantised space-time. How to describe the process of quantisation of the universe? Why is the entire universe electrically asymmetric? Who filled the universe initially with photons?

These problems preceded the appearance of ponderable matter whose fraction is negligibly small in comparison with the primary matter that fills everything.

Will the inflationary theory be capable of answering these and other questions? The development of the theory of Superunification probably facilitated the solution or probably increased the complexity of the problems of inflationary theory. It is pleasing that the inflationary theory, the Big Bang hypothesis has been filled by new initial assumptions which must be clarified.

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1.4. The Einstein posthumous phrase

'*However, at the moment nobody knows how to find the basis of this theory*' is the final phase in the final scientific study of the greatest physicist of the 20th century Albert Einstein published at the year of his death (he died April 18, 1955). The article 'Relativistic theory of the asymmetric field' is barely cited by the physicistd because in it Einstein practically rejected all the scientific knowledge to which he devoted his life and proposes to start everything anew.

Much has been written about Einstein and the theory of relativity but his posthumous will to his successors has not been analysed. The point is that the theory of relativity was not completed by Einstein and after his death many investigators could not add anything significant to the theory. The history of science shows that science develops in jumps from genius to genius. Geniuses appear when a crisis arises in science and they eliminate the crisis by providing new knowledge. In gaps between the jumps new knowledge is required by the scientific community and the knowledge becomes the property of many. This takes many decades. However, nobody knows what to do next. This is the moment of appearance of another scientific crisis and it is necessary to await the arrival of the next genius in order to obtain new information for future generations

The scientific community exploits the knowledge of geniuses, thus living from them. This is the rule of life because scientists also need means. The theory of relativity has been mastered by many physicists who added something or changed something in Einstein equations, published scientific proceedings and books, defending thesis and obtaining academic titles and departments. In particular, for this wide scientific community, the Einstein claim that it is necessary to abandon everything that he di, and it is necessary to start anew, but he does not know how to do it, is unacceptable because it already affects their reputation. In order to have the undisputed scientific

reputation, it is necessary to do more than Einstein. However, if it is not possible to do more, it is better to not say anything about the Einstein's posthumous phase. Yes, he was a genius, a strange man, he could afford any trick, even show his tongoue, this was how many perceived him.

It is natural that the majority of scientists do not possess the courage and adherence to principles of Einstein when scientific truth is more expensive than scientific reputation and career. No one forced Einstein to write such a frank scientific testament, he could have been silent. I attempted to analyze not only the reasons which forced Einstein to forego his scientific heritage, but also to trace the motion of his thoughts, to establish where he was right and where he was overcome by serious doubts.

The historians of science, yes even specialists, regards Einstein as the creator of the theory of relativity, at first the special theory of relativity (STR), and then the general theory of relativity (GTR). And only sometimes and that casually, they mention his work on the unified field theory, or more precisely the unified field theory. Einstein assumed that there exists, thus far inaccessible for the researcher, some united field which is also a carrier of gravity and electromagnetism. They are altogether only different manifestations of the unified field. If it is possible to penetrate into the essence of the unified field and to describe it mathematically, then it will be possible to combine gravity and electromagnetism. This was supported by the field theory in which gravity and electrostatics were described by a single differential Poisson equation. Moreover, the laws of the attraction of two masses and two electric charges had identical nature and it seemed that this is the manifestation of some forces, only in different measurements.

For a period of 30 years Einstein fanatically worked on the unified field theory, periodically publishing articles in which he noted that the result would soon be achieved. But time went by and there was no end to the work in sight. Friends and associates repeatedly attempted to dissuade Einstein from this hopeless occupation and they recommended to study quantum theory, especially because he was awarded the Nobel Prize for studies in this region. Young Landau (22 years) specially visited Einstein in 1930 in order to put him on the right track. But the effect was reverse, Einstein to the end of his life did not accept the statistical nature of quantum theory and continued his studies to the last day in order to finally forego its scientific heritage at the end.

Today, when reproaches come from all side to the address of the great physicist that it was his fault that physics came to a sequential crisis, and it is necessary to return to the concept of the universal aether which was allegedly buried by Einstein, I should come out in defense of the outstanding physicist. Several years ago I myself held the same opinion and personally

participated in several scientific conferences, including international, dedicated to the criticism of the theory of relativity and wrote four articles on this subject which I now reject and do not refer to them.

The reason for this is the following. After my discovery in 1996 of the quantum of space-time (quanton) and superstrong electromagnetic interaction (SEI), it was necessary to consider the quantised space-time as an absolute substance and I erroneously assumed that the concept of the absolute is incompatible with the concept of relativity. To this contributed publications of a number of the contemporary physicists who categorically asserted that the physical reality is the essence of the geometry of empty space-time and nothing more. In this case they referred on the authority of Einstein and the principle of relativity which allegedly was valid only for the empty space. My studies of the structure of the quantised space-time gave opposite results – there cannot be voids in nature. I was confident that I was right, but the idea of the relativity as the property of empty space interfered with my reasoning. It meant that it was necessary to subvert the theory of relativity which in addition did not work as the theory of the unification of gravity and electromagnetism.

But as I continued my calculations I became convinced that the principle of relativity is indeed the fundamental property of quantised space-time and that Einstein is right. I finally understood that I am on the right track. I cannot find a better teacher than Einstein since the last 30 years of his life he spent on this problem also helped me to complete my work on the unification of fundamental interactions. The crux of the matter is not in personalities. He in fact worked alone for future generations so that the theory of Superunification could be created, uniting within the framework the Einstein's unified field: gravity, electromagnetism, nuclear and electroweak forces.

And now, returning to the last article by Einstein, I felt how stressed was his mind, already an old and very lonely person. He was confident that the united field does exist but that the derived equations are difficult to understand and are unconvincing for physics. He already abandoned the concept of the constancy of the speed of light and the concepts of the inertial and non-inertial systems which he used in the special theory of relativity. The general theory of relativity (GTR) with a constant tensor curvature in the equations of four-dimensional space-time, some complicated analogues of the Poisson equations was his last hope. He did not have any other mathematical apparatus. But the curvature of space-time characterizes only gravity and does not give in any transformation the output to electromagnetism. The field theory does not '*make it possible to understand the atomistic and quantum structure of reality*'. His

consciousness could not agree with this. The mind goes round??? 'quantisation", 'quantum phenomena', 'quantum numbers'…

Now, when the quantisation of Einstein space-time has been carried out in the theory of the elastic quantised medium (EQM) and the 'quantum structure of reality' has been understood, when it is established that the principle of relativity is the fundamental property of quantised space-time, reproaches to Einstein's address regarding the suggestion that the theory of relativity led contemporary physics to a crisis state are unfounded. As it was noted, the present crisis has not been caused by Einstein but by contemporary physicists incapable of raising the bar of knowledge above the level established by Einstein. Only the discovery of the quanton and SEI, as the carrier of the unified field, has guided physics out of the crisis state. The time interval between 'jumps' in the development of fundamental science was 91 years (1905–1996). This was the period of the accumulation of new scientific facts for the next 'jump' of knowledge.

Then, at the beginning of the century in 1905 Einstein saved physics from a crisis, postulating the constancy of the speed of light and the independence of inertial systems on the speed of motion when only relative motion, characterized by relative intervals of length and time, determines the reality of motion of matter in the local region of space. Let us say that the constancy of the speed of light is characteristic for the local region of space during movement in it. This is the basis of STR named by Einstein the partial theory of relativity. The concept of gas-like aether dominant in physics up to that time did not allow this. However, in the experiments by Michaelson and Morley the speed of light was registered as constant in the direction and across the motion of the Earth. This contradicted the concept of gas-like aether and corresponded to Einstein's claims. At that time the simple postulation of the constancy of the speed of light was sufficient in order to remove the emerging contradictions and thus forever exclude from physics the concept of gas-like aether as not having experimental confirmation.

But already in 1904 Poincaré formulated the principle of relativity, assuming that inside a closed camera moving in a straight line as regards inertia it is not possible to measure by physical instruments the speed of the camera relative to the absolute space (this refers to the measurement instruments available at the beginning of 20th century). His conclusions were categorical: if we cannot measure the absolute speed, then absolute space and time in nature do not exist in nature. For him the space was synonymous with the void. Reality can be represented only by relative intervals of time and length in the void. Poincaré was a mathematician and as a mathematician he became accustomed to operating with small

speculative intervals, disregarding physics. Absolute space and time were introduced by Newton, but he was initially a physicist and only later a mathematician.

As the physicist, Newton allowed the presence of aether, a carrier of luminiferous medium which must be characterised by colossal elasticity. In a letter to Boyle, Newton suggests that gravity is also the reason for the pressure of the universal aether – some smallest invisible particles which fill entire space and penetrate solids. Since this could not be verified by experiments, then remaining the supporter of physics as an experimental science ('I do not invent hypotheses'), Newton did not carry out any serious studies in this direction and concentrated on the laws of motion in absolute space and time.

The tragedy of physics of the 20th century is that it did not consider the third version, when absolute space and time possess the unique properties of relativity. Poincaré and also independently mathematician Minkowski introduced, purely mathematically, the fourth time coordinate t, adding it to three spatial coordinates x, y, z on the basis of the Pythagoras quadratic formula. This was quite relevant although not accurate. Einstein attempted to find the physical sense of this mathematics, especially because this approach was in agreement with his studies. He reached the physical understanding of the unity of space-time as a continuous continuum capable of functional changes. In fact, Einstein performed the physical unification of space and time into a single substance. This was the first stage on the way to Superunification.

Einstein could not combine gravity and electromagnetism, but the first stage of the physical unification of space and time was realised by him. Mathematicians Poincaré and Minkowski did not give any physical value to the fourth coordinate introduced by them and examined only the geometric parameters of coordinates. Einstein, possessing colossal physical intuition, understood already at the very beginning when he formulated the concept of the unified field, that the united four-dimensional space-time contains colossal physical sense and is the carrier of gravity and electromagnetism. Therefore he could not for 30 years study any another problem and regarded this problem as the most important. And as time showed, Einstein was right.

But then in order to give mathematical meaning to the concept of the unified field, and Einstein was not a mathematician, he rejected the formulas derived by mathematicians Poincaré and Minkowski, characterising the metric properties of space-time by the four-dimensional interval. However, the functional possibilities of the four-dimensional interval for the analysis of the state of space-time are limited. This Einstein understood. He

required a universal function, and by varying this function, from the properties of space-time one can transfer to gravity and then to electromagnetism.

Einstein's scientific intuition again surpassed the possibilities of mathematical apparatus. It is believed that he saw the curvature of cosmic space-time as a result of the disruption of its uniformity by many moving cosmological objects. At present, it is not possible to mathematically describe the visible picture of curvature. However, it can be seen on the surface of the sphere if we take two very close apparently parallel meridial lines on the equator, and they will inevitably cross far beyond the horizon on the pole. Einstein used this approach to the non-Euclidean geometry of Lobachevsky and Riemann, to the tensors, continuously complicating and complicating mathematical apparatus, but without reaching the necessary result of the unification of gravity and electromagnetism. Geometry made it possible to connect the distortion of space-time only with gravity.

I intentionally omitted reasonings about the transformations of the Lorentz coordinates and the relativism as integral parts of the theory of relativity, since all this can be found in books. Together with Einstein, founders of relativity are Poincaré and Lorentz. To me it is important to concentrate attention on the contradictions between the categories of absolute and relative in physics as the categories of unity and of fighting the opposite. Specifically, the prevailing contradictions between the categories of the absolute and the relative influenced the fate of physics in the 20th century.

Poincaré was categorical and connected relativity only with the empty space, completely denying the Newtonian concepts of absolute space and time. Lorentz originally supported the concept of the stationary absolute aether and did not determine its structure (gas-like or electromagnetic?), and after the publication of Einstein's studies, he agreed only with his mathematical computations, attempting to resuscitate the aether concept by the effect of reductions of linear dimensions in the direction of motion. Einstein categorically disagreed with him, but was very careful in his statements with respect to the aether during his entire life: '*According to the general theory of relativity space is unthinkable without aether*'; '*To deny aether – this, in the final analysis, it means to assume that the empty space has no physical properties*' (1920) and so forth.

As is evident, the basic problems of physics of 20th century concern the nature of the four-dimensional space-time. Even classics of science had the opposite opinions: from the complete negation of the structure in space (Poincaré) to the nonacceptance of empty space-time (Einstein). Einstein replaced the gas-like aether with the concept of four-dimensional space-time, completely denying the existence of empty space, and by aether he understood the medium which does not possess the properties of weighty

matter regarded as the carrier of gravity and electromagnetism. The problem was that Einstein did not visualize the weightless structure of space-time.

If space-time is the carrier of light and gravity, and light as an electromagnetic wave moves with the colossal speed, then they understood everything that the structure of space-time must possess colossal elasticity. Taking into account that the electromagnetic wave is transverse waves, the space-time must resemble a solid body since the transverse waves can be transffered only in the solid body. Thus, the structure of space-time must resemble a superhard body and possess colossal elasticity. However, this appears to contradict the common sense, since other solid bodies are not capable of movement inside the superhard body and other bodies which can be only 'frozen in' the superhard structure. I had to face this paradox of contemporary physics when I accepted the relay which led me down to the discovery of the quantum of space-time (quanton). A new stage of the quantum theory, which was full of paradoxes, started.

Discussing the above reasons which prevented Einstein from discovering the quanton, I understood that these reasons were purely methodological. Einstein conducted the first stage on the way to Superunification after combining space and time into the united substance. Then he started the unification of gravity and electromagnetism, being confident that he goes in the right direction, but nothing was obtained. The methodology of science provides for step by step motion, and if something is not obtained, then a very important stage of studies is possibly passed. So what it was that Einstein did not foresee? Today it is clear to me that the stage of the unification of electricity and magnetism into electromagnetism was passed.

It would seem that everything is clear as regards electromagnetism, except one thing – the carrier of the magnetic field has not been determined. Carriers were found for the electric charge of negative and positive polarity – elementary particles: electron, positron, proton. The carrier was not determined for the magnetic charge. It turned out that magnetism originates from the space-time through its incomprehensible topology as a result of the motion of electric charges. This was some magic. No electric charges were generally found in the electromagnetic wave of electric charges but electrical and magnetic fields were present, moreover simultaneously.

Today I regard as very naive the explanation of the reasons for propagation of the electromagnetic wave in vacuum which is erroneously connected with the laws of electromagnetic induction. It is considered that an electrical rotor forms a magnetic rotor which gives birth to a new electrical rotor in the direction of propagation of the wave, and so on. However, in experiments the formation of the electrical component in the electromagnetic wave occurs simultaneously with the appearance of the

magnetic component. This means that these components cannot consecutively produce each other since they exist simultaneously.

Analysis of the nature of the electromagnetic wave was of interest to me already in the school as a wireless enthusiast and, after all, it led me to realise the presence of the electrical and magnetic monopoles concealed in vacuum which do not possess mass and represent electrical and magnetic elementary charges. Mass-free monopoles were regarded as weightless matter, as indicated by Einstein. However, if the electric charge has its own a carrier-particle, then magnetic monopoles were not discovered experimentally. In spite of this, electrical and magnetic monopoles played the basic role during the quantisation of space-time and the unification of electricity and magnetism into a single substance – electromagnetism the carrier of which is quantised space-time.

In order to isolate the elementary quantum of space as some volume, it is necessary to proceed from the rationality of nature which manages with minimum means. If it is necessary to fix a coordinate then a single point is sufficient. If it is necessary to isolate a line or a trajectory, then it is sufficient to have two points, and for the surface three points. The figure which separates the elementary volume is a tetrahedron with four points 1, 2, 3, 4 on the apices. In order to pass from the geometry to physics geometric points 1, 2, 3, 4 must be replaced with weightless particles which are planned by nature itself in the form of four monopole charges: two electrical (e^+ and e^-) and two magnetic (g^+ and g^-).

Figure 1.4 shows an electromagnetic quadrupole, not known earlier to science, which is the first stage of the unification of electrical and magnetic mater into electromagnetism.

Figure 1.5 shows how the quadrupole forms a quanton – spherical particle – the elementary space-time quantum - under the action of the forces of superstrong electromagnetic interaction (SEI). The quanton is the weightless field form of primary matter. In the quanton, the electrical and magnetic charges are connected into dipoles which cannot be split. Therefore, free magnetic charges have not been discovered experimentally. Magnetism belongs only to quantised space-time. The surplus of free electrical charges in nature is determined by the electrical asymmetry of the universe, but the presence of this asymmetry determines the presence of real matter.

Since the quanton is an elastic element, it also determines the rate of all physical processes at each point of space-time. The quanton is a real carrier and a time-setting device (electromagnetic clock) in nature (for more details see my studies of the EQM theory).

The electromagnetic quantization of space-time is the process of filling the volume with quantons.

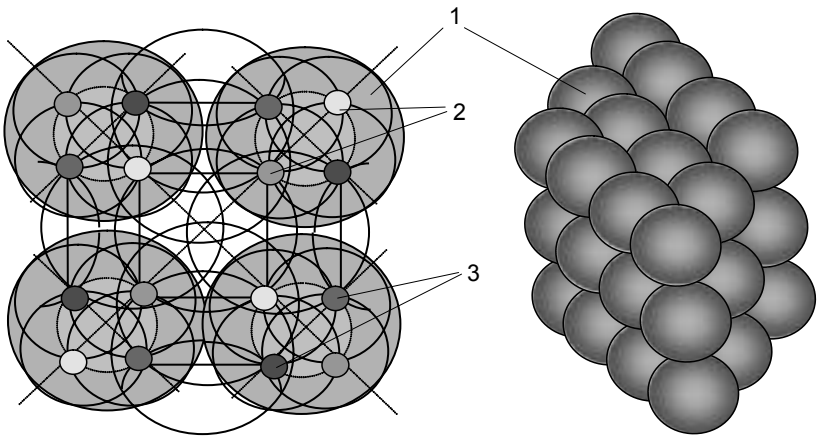

Fig. 1.23. Grid model of the quantised space-time in projection in the form of lines of force. 1) quantons; 2) electrical charges; 3) magnetic charges.

Fig. 1.24. (right) Solid-state model of quantised space-time.

Figure 1.23 shows the projection the simplified model of the local section of the quantised space-time of four quantons with the deposited grid of the lines of force of electrical and magnetic fields between the charges inside quantons and between them. This makes it possible to consider the quantised space-time as a discrete grid thrown on the entire universe which connects together all objects. The diameter of the quantons is of the order of 10^{-25} m, and their concentration is 10^{75} quantons in m^3, the density of accumulated energy is 10^{73} J/m^3. If we activate one cubic meter of vacuum, this is equivalent to the birth of another universe as a result of a Big Bang. The quantised space-time is the carrier of superstrong electromagnetic interaction (SEI) – Einstein's unified field.

In Fig. 1.24 (Fig. 1.3) the quantised space-time is represented in an even simpler form as a discrete close-packed structure of quantons in the form of spheres. This structure resembles the solid-state structure (charges inside quantons are not shown on the solid-state model).

The grid and solid-state elastic models of the quantised space-time are equivalent to each other. The grid model is convenient for studying electromagnetic wave processes, and the solid-state model for studying gravity. In the equilibrium state the charges with the opposite sign inside the quanton opposite are symmetrically balanced, presenting the quantised medium as neutral. I have omitted the moments of disruption of the electromagnetic equilibrium of the quantised space-time which are described in my works.

Let us examine the fundamentals of gravity which start with the

phenomenon of formation of mass in elementary particles. Mass is a gravitational charge. It is gratifying that the nature of gravity completely coincides with Einstein's concept of distorted space-time. For the sake of clarity, the solid-state model in Fig. 1.24 is regarded as a cube of elastic sponge which consists of very small elastic quantons. I have already mentioned that the three-dimensional distortion of space-time is difficult to imagine. But this model makes this possible. Inside the elastic sponge we hypothetically separate a small spherical region and start to compress it evenly on all sides together with the quantons inside the sphere. It is obvious that with compression inside, on the outer side of the sphere the sponge will be stretched and the nearer to the sphere the stronger this extension is.

From the geometrical viewpoint, we can discuss a change in the topology of the space whose description is represented by many Lobachevsky's spheres with different curvature, placed as a Russian doll (matrioshka) inside each other. This approach leads to the serious complication of mathematical apparatus and to departure from the physics of the phenomenon. I acted as a physicist, abandoned the geometry of distorted space-time, and introduced a new unit of measurement – the quantum density of the medium which characterizes the concentration of the quantons per unit volume of space-time. This is the basis of the new quantum theory of gravity, whose mathematical description has become possible within the framework of the classic field theory.

I would like to mention that Einstein did not accept the statistical nature of the wave function – the basis of mathematical description in quantum theory. The introduction of the quantum density of the medium has returned the deterministic nature to the quantum theory. The spherical deformation of sponge, examined above, in transfer to the quantised space-time, causes that the quantum density inside the compressed sphere increases due to its decrease on the outer side. In the field theory, this process is called as the divergence of the gradient of the quantum density of the medium and is described by Poisson's equation which describes gravity. The two-component solution of Poisson's equation was thus obtained for the first time when the tension of medium (its distortion according to Einstein) is balanced by its compression.

It turns out that gravity is manifested as a result of the spherical deformation of the quantised space-time, and the sphere of final compression is the gravitational boundary which divides the regions of compression and tension of the quantised medium and which balance each other. For the elementary particle the process of the spherical deformation of the quantised space-time leads to the formation of mass in the particle, which is equivalent to the energy of elastic deformation of medium, only it is expressed in other

measurement units. The release of the energy of elastic deformation of medium in wave photon emission is determined as the mass defect of elementary particles.

In order to form a gravitational boundary, it is necessary to have a certain surplus of free electrical monopoles not connected in quantons. This is determined by the electrical asymmetry of the universe. In nucleons, the gravitational boundary is formed in the form of an alternating shell, collected from several tens of electrical monopoles with the alternation of the polarity of the positive and negative charges which ensure the effect of compression of shell and the medium in formation of the nucleon mass. At the same time, this enables the alternating shells of nucleons inside the atomic nucleus to be mutually attracted by the electrical attraction forces of monopoles, regardless of the presence of the unbalanced charge of positive polarity in the protons. Thus, nuclear forces in the theory of Superunification are reduced to the forces of the electrical attraction of the alternating shells of nucleons. The electron does not have a clearly expressed gravitational boundary, since the weak effect of the spherical deformation of the quantised medium is produced by a single central electrical monopole charge. Therefore, the mass of the electron is considerably smaller, almost ~1800 times, than the mass of the nucleon. Thus, a study of the structure of elementary particles inside the quantised space-time made it possible to combine gravity and electromagnetism, considering gravity as a secondary formation.

Once Einstein described mass as the measure of inertness and gravity by the curvature of space-time. Now it is possible to refine the concept of mass as a measure of the elastic spherical deformation of the quantised space-time. In a popular publication I intentionally did not present any equations, despite the fact that the described complex processes can be described relatively simply in the field theory. It was important for me to show the physical essence of the generation of mass as the basis of gravity. When these unique scientific results were obtained, I was in a state of shock since the mass, as I was taught, does not exist in nature. It turns out that mass is the cluster of energy of the spherical deformation of the quantised space-time and not more. Therefore, an increase in the speed of a particle increases the energy of elastic deformation of the quantised medium and respectively the particle mass. Real matter is the integral and indissoluble part of the quantised space-time.

However, precisely this phenomenon of mass could explain the motion of one solid body inside the super-solid body as wave energy transfer. It turns out that the elementary particle, for example a nucleon, moves in space as a single wave, as some soliton, via the transfer of the spherical

deformation of the medium (i.e., the nucleon mass) and monopole (mass-free) charges in the alternating shell of the nucleon. Only this explains the corpuscular-wave duality of elementary particles in quantum theory when the particle simultaneously shows wave and corpuscular properties.

However, most importantly, it was possible to establish that during movement of the particle in the entire speed range, including light, its gravitational field and form remain spherical. This made it possible to formulate the principle of spherical invariance, extending it to other bodies which consist, in the final analysis, of a set of elementary particles. In accordance with the principle of spherical invariance, the speed of light on the Earth's surface in the local region of space remains identical with respect to directions in the entire speed range. This was experimentally observed in the experiments of Michaelson and Morley. It was established that the principle of relativity is the fundamental property of the quantised space-time. This made it possible to formulate a new fundamental principle of the relative-absolute dualism.

The properties of the quantised space-time as weightless matter do not have any analogues with the known material media: solid, liquid, gaseous. Possessing superhard and superelastic properties, the quantised space-time is characterized by superpermeability, freely making possible for real matter to penetrate without friction through the quantised medium. Light, as the wave motion of photons, also freely propagates in the quantised medium. Outwardly this enables us to perceive the quantised space-time as a void. The quantised space-time reacts by force only on the acceleration of the particle and the body. This fact was established already by Newton. Now this fact has theoretical explanation. No real medium possesses such unique properties.

To complete the analysis of the posthumous Einstein's article, I have come to a conclusion that he in vain, probably due to desperation and fatigue, forewent his scientific heritage, since his ideas work wonderfully inside the quantised space-time. Simply, one human life was not sufficient to solve such a global issue. Nevertheless, he had time to indicate the direction towards the quantisation of space-time on the way to the unification of quantum theory and the theory of relativity. Einstein accepted only the deterministic nature of quantum theory, and he was confident that the problems of quantum theory lie inside the space-time.

1.5. Conclusion to chapter 1

In the popular form it is shown that the basis of the theory of Superunification are the fundamental discoveries of the quantum of space-time (quanton)

and superstrong electromagnetic interaction (SEI) the carrier of which is the quantised space-time.

The quanton is the real carrier of space-time and it is the uniting particle, uniting at first electricity and magnetism into electromagnetism and then electromagnetism and gravity.

The electromagnetic quantisation of space is the process of the filling of space with quantons, forming the quantised space-time where every particle has its own ticking clock. The quanton as an elastic electromagnetic resonator is the real carrier of time and determines the lapse of time and the rate of electromagnetic processes.

The quantised space-time possesses the maximum energy level and, as shown later, it is the only energy carrier in the universe and all the remaining forms of energy are only the methods of the extraction of energy of superstrong electromagnetic interaction (SEI).

The theory of Superunification covers the study of processes both in the ultra-microworld of quantons and as a whole of the entire Universe.