4. Modeling the interactions

To talk about the various interactions and their grand unification, we should, first of all, a clear idea of what is at stake. And we must first find out why the consequences of the analysis of interactions. So we should change the question we ask nature. We must ask not only "How to interact?" But "Why did it happen?" We can not explain the action of the fundamental laws of Newton, Coulomb, Faraday and others. To understand their reasons, we must leave the system in the extra dimensions. We must be realized that the causes of interactions are at a deeper level of matter than we think. Many of the properties of the surrounding world of matter depend on the structure of the electromagnetic field, i.e., on the characteristics of traffic flows of gravitons.

4.1. Example of a model of the strong interaction

In 1935, the Japanese physicist Yukawa H. built the first quantitative theory of nucleon-nucleon interaction, which occurs through the exchange of new particles, which are now known as pi-mesons (or pions). Peonies were subsequently discovered experimentally in 1947.

In the pion-nucleon theory attraction or repulsion between two nucleons described as the emission of the pion one nucleon and its subsequent absorption of another nucleon (similar to the electromagnetic interaction, which is described as an exchange of virtual photons). This theory successfully describes a range of phenomena in nucleon-nucleon collisions and bound states as well as in the pion-nucleon collisions. Numerical coefficient that determines the "efficiency" of the pion emission, was very large (compared to the same ratio for the electromagnetic interaction), which determines the "strength" of the strong interaction.

However, the principle of binding the particles due to the exchange interaction does not fit into the concept of intuitive common sense. In fact, let the bodies 1 and 2 in Figure 4.1 are exchanged particle 3. The emission of a particle with momentum $\vec{p}$ body 1 recoil momentum $-\vec{p}$. In the absorption of a particle with momentum $\vec{p}$ body 2 gain momentum $\vec{p}$. The exchange of body particles disperse. The total momentum of the system of bodies remains the same.
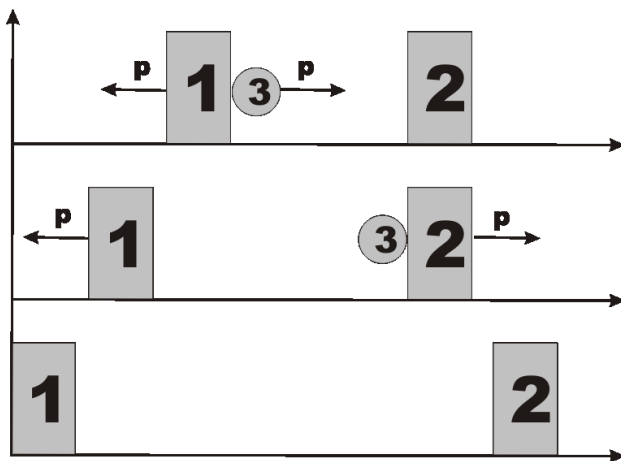

Figure 4.1. Repulsion of the particles of bodies in the exchange

How can I make the attraction of bodies? There should be a force propelling one body towards the other. Force is the change in momentum. The body of one should, for example, emit particles in the opposite direction to the body 2. A similar situation to the body 2. But this means that the idea of linking bodies due to the exchange interaction is not physically justified. Moreover, the emission of particles clearly indicates instability of the nucleon or quark. Their stability is confirmed by experience. Proton

contains two pions. Clearly, if the mind be allowed to one pion flew out, the properties of the proton immediately change. Accordingly change the properties of the system to which it belongs. The same applies to the exchange of gluons and any "virtual" particles. From the experience of working with radioactive substances, we know that the emission of particles is unambiguously associated with the destruction of the substance.

The reason for the interaction between particles is at a deeper level of matter, than the level of particles. "Carriers" of all kinds of interactions between the particles are the quanta of the electromagnetic field — gravitons. Attraction and repulsion between the vortex elements of composite particles and between vortex nucleon nuclei is due to the interaction between the vortices. The previous section described the vortex model of fundamental and metastable particles. But their interaction with the environment is only through the attached layer of gravitons. Explain once more the essence of the vortex interaction in Figure 4.2.
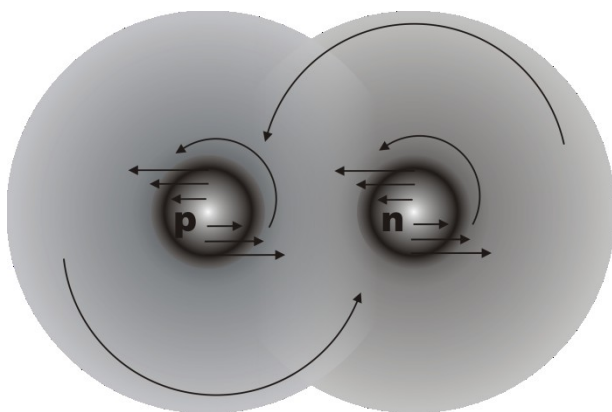

Figure 4.2. The scheme of the attraction between two vortices

The figure shows two vortices, for example, a proton (p) and neutrons (n), which have the same direction of rotation. They quickly rotate in a continuous medium of gravitons, dragging the rotation around their borders layer graviton fluid (gas). Attached to the vortex flow p graviton environment shifts the center of mass of the vortex n up in the velocity towards the left. Vortex n moves left towards the vortex p, while continuing to get involved in the attached eddy p.

The same thing happens with the proton p. Under the action of the rotating vortex flow n the center of mass of the neutron proton p goes down, in the range of velocities to the right, to the vortex n. At the same time he continues to get involved in the angular motion of the vortex n.

The interaction of two vortices in a continuous medium of gravitons is attracted to each other, and begins to rotate around a common center. A single rotating system — a new vortex — forms. Note that the mechanism of attraction does not depend on the charge of the particles or the type of fluid. This is pure hydrodynamics. It should also be noted that the initial displacement of the center of mass of the vortex by external forces and the subsequent resulting "self shifting" occur in mutually perpendicular directions. The work is not done.

Condition of attraction vortex particles is the same direction of rotation in the plane. At different rotational direction vortices will repel. Vortex attraction and repulsion be seen only at a distance effective action attached layer field. Usually this distance is only a few times the size of the particle.

We have said that in the nucleus of an atom on the neutrons are forces that prevent their collapse. Figure 4.3 shows a possible structure of α-particles. Free protons p1 and p2 and protons, related to neutrons n1 and n2, form a solid of four-power circuit. Neutron components — two electrons and two antineutrinos — enclosed within the circuit. They pulled together a chain of protons — it does not allow

them to transfer their energy to the environment, does not allow to increase their sizes. On the other nuclear shells neutrons oriented the same way.
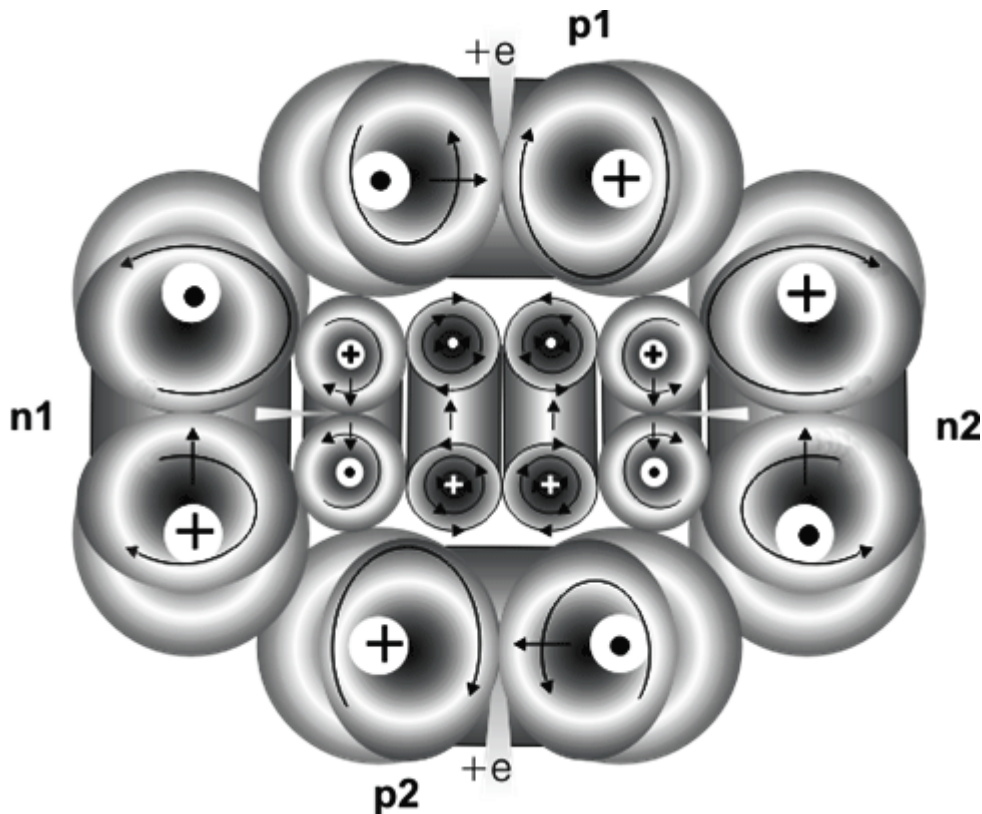

Figure 4.3. Scheme of α-particles

As an example, consider the strong interaction of the shell structure of the nuclei of atoms. Nucleons as electrons are particles with spin h/2. They obey Fermi-Dirac statistics and the principles of the prohibition, i.e. do not merge. We assume that the structure of the core is similar to the well-known structure of the electron shell of the atom.

In other words, inside the core there is a periodic system as outside of it. Nucleons in the nucleus are grouped into four sectors ball. They are presented in Figure 4.4. Top shows the location of the proton, and the side - α-particle neutron in its nucleus.
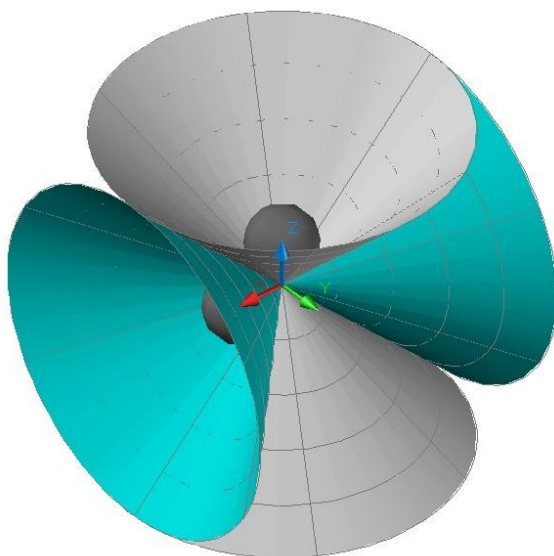

Figure 4.4. Ball sector for the nucleons in the nucleus of an atom

The values of the quantum numbers of the electron shells of atoms directly suggest and structure of nuclei. Distribution of protons in the nucleus and electrons in the atom must be symmetric, correspond to the same matrix. Protons are located in the core sectors of the two ball on one coordinate axis (OZ in Figure 4.4), the neutrons are collected in two sectors of the ball on the other axes (OX in Figure 4.4). The structure of the proton nucleus has cylindrical symmetry, which provides the observed values of the spins. The same can be said of the neutron part of the nucleus.

The basic principle of the nucleons in the nucleus of the ensemble (and subsequently electron atom) - minimization of the angular momentum of the ensemble. Let us form the core principle of the example of the upper spherical cone protons (Figure 4.5) on spherical surfaces (shells). Vortex model did away with the myth of the repulsion of protons in the nucleus under the influence of their own charge.
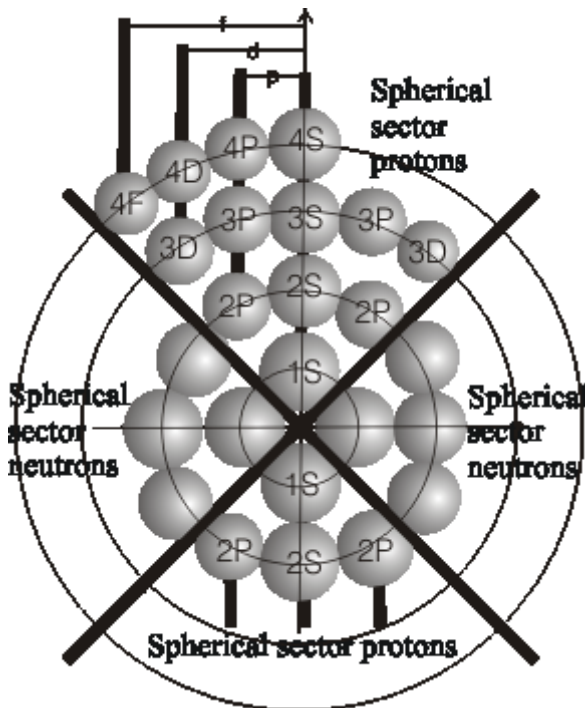

Figure 4.5. Formation of nucleons in a spherical sector

In the first shell only one proton 1S fits. In the second shell has room for four protons. One of them (2S) is located on the axis, and three protons (2l+1=2*1+1=3) took place on the same shell around it. Dimensions of nucleons are such that free space, for example, for the fourth 2P-proton is not.

Protons mounted symmetrically in the lower ball sector. The third shell can be established between the 3S-axial proton and sector boundaries ball two protons. The first consists of three circular chain 3P-protons, a second-round chain consists of five (2l +1 = 2 * 2 +1 = 5) 3D-protons. The fourth shell allows the optional seven 4F-protons in the third circular chain. Ball sector protons rotate around a vertical axis in different directions.

Packing nucleons in the nucleus, in general, should be thick enough to provide a strong interaction. Radiant Flux of electric field from the lower protons is extending through the overlying. At the exit of the kernel threads have the total intensity of all the charges of the gap.

Similarly, the neutrons are packing the right and left ball sectors. Ball sector neutrons rotate around a horizontal axis in different directions.

Figure 4.6 shows a model of the nucleus of an atom of oxygen. It can be seen that the oxygen nucleus is a system of nucleons in four sectors of the ball, connected α-particle.

Proton p1 is the basis for the upper spherical cone protons. Proton p2 is the reason for the lower sector of the protons. Their charge from the center of the tube is directed along the axis z. At the exit of protons p3 and p4 is double electrostatic field strength (charge 2e). Figure 5.2 The scheme is similar to the electronic configuration of the oxygen atom in the periodic table: $1s^2 2s^2 2p^4$.
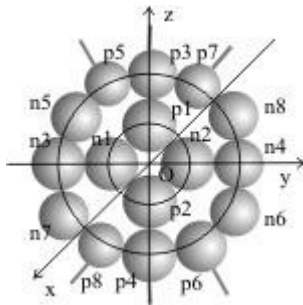

Figure4.6. Nucleus of an atom of oxygen

Ball sector protons p1, p3, p5 and p7 and with protons p2, p4, p6 and p8 rotate in opposite directions around the vertical axis of the proton OZ. The other two sectors with neutrons ball n1, n3, n5 and n7 and neutrons n2, n4, n6 and n8 also rotate in opposite directions around the horizontal axis neutron OY.

Nucleus as a whole has a spherical shape. The protons in the nucleus are located at opposite poles of the sphere. Neutrons are balanced just. The symmetry in the arrangement of the nucleons leads to the fact that the decay of the fragments has similar masses.

4.2. Examples of electromagnetic interaction

According to modern ideas electromagnetic interaction is one of the four fundamental interactions. It exists between the particles with an electrical charge. From the point of view of quantum field theory, the electromagnetic interaction is mediated by massless bosons — photons. This particle can be represented as a quantum excitation of the electromagnetic field. What does this mean, no one can not imagine. Photon itself does not have an electric charge and, therefore, can not directly interact with other photons. It only interacts with the charges. But what exactly a photon does with the charged particles of which it takes off and flies which in theory is not specified.

The electromagnetic interaction is different from the weak and strong interactions to its long-range character — the force between two charges decreases only the second degree of the distance (Coulomb's law).

In the vortex model the interaction between electric charges exists between the charges through the exchange of quanta of the electromagnetic field, i.e., gravitons. Isolated electron emits energy in the form of a rotating beam of gravitons. The range of the beam is electrostatic field. In the interaction an electron gets energy from a positive charge as a stream of gravitons.

The force of attraction between the charges created by the Bernoulli effect — reducing the static pressure in the connecting charges rotating flow of gravitons. Recall the classical Bernoulli experience to see the effect of the dynamic pressure on the horizontal plate in the fluid flow (Figure 4.7).

The total pressure p in the fluid stream is composed of static and dynamic p_st p_din pressures:

$$p = p_{ст} + p_{дин} = p_{ст} + \frac{\rho v^2}{2},$$

where ρ - density of the fluid, and v - flow velocity.

Bernoulli's experience shows that if the rate of flow is directed along the surface of the plate, then it is only the static pressure and the flow of pressure on it has not. We show by example that the attraction of the electron and positron is explained by Bernoulli.
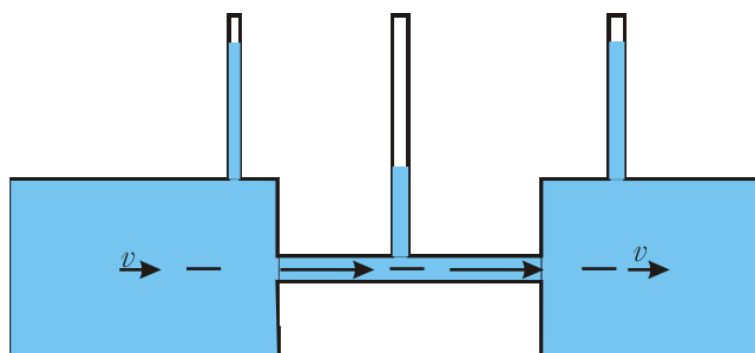

Figure 4.7. Experience Bernoulli

Electron in Figure 4.8 (left) and a positron (right) thrown towards each other flows of gravitons, twisted as shown in the figure. If the point of the center of mass of the electron E put the plate perpendicular to the flow 2, then left on the plate will apply full pressure environment gravitons. To the right of the plate pressure will be reduced by the amount of dynamic pressure, as the rotation speed of the flow is parallel to the surface of the plate. Consequently, at the point E will be a pressure gradient, i.e., the force that moves this point to the right, toward the positron.
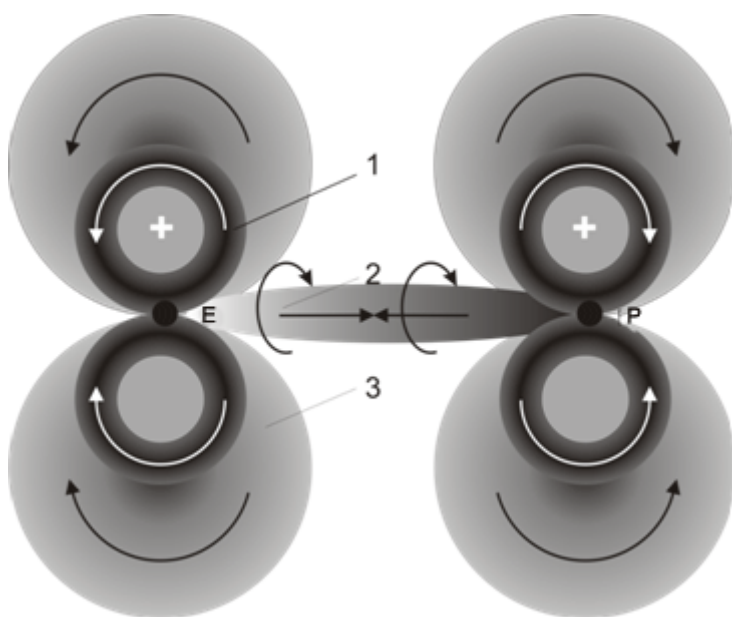

Figure 4.8. The mechanism of attraction of an electron to the positron

A similar analysis leads to the conclusion that at the point P will also monitor the pressure drop, which will create an attractive force for a positron to electron. Of course, the mechanism of interaction of charges can be attributed to the exchange mechanism. Charges share their flow of gravitons. Do positive charges emitted streams right screw. Negative charges emit left screw flows. Interaction flows leads to the fact that like charges repel and unlike - attract.

But the subtlety of modeling is that the interacting objects are exchanged not just particles and eddy fluxes of particles. A rotating flow creates interaction. The speed of neutrinos rotation around a common axis is closed to the speed of light. In other words, the dynamic pressure in the channel

between the points E and P is very high. That is what determines the strength of the electrostatic interaction.

Thus, the "carrier" of the electromagnetic interactions is gravitons — quanta of the electromagnetic field. Thanks to them, the world is supported by a huge variety of structures of matter. Here we look at just two examples.

Example 1

In the vortex model of the objects and their properties are based on a vector representation. The nucleus of an atom is not centrally symmetric electric field. Atoms are formed by closing charge vortex tubes of protons and electrons. Electrical connection is fully saturated.

The configuration of the electrons in the atom repeats the configuration of the nucleons in the nucleus. The electrons are generated by embedded into each other seven spherical shells. The total energy of electrons in the shells is constant. Electron rotates with the nucleus by the laws of motion of a solid body. Thus the question of the centripetal acceleration and radiation at the same time accelerating removed.

For the example in Figure 4.9 shows the block-diagram of an atom of oxygen. The nucleus is at the point, each electron is held from the nucleus with the charge of the vortex tube, like an astronaut is connected to the ship with a hose. Charge handset resembles not so much on an iron rod, and the rubber band. Vortex model did away with the myth of "planetary atom" with the idea of electrons flying around nucleus in stationary orbits.

Electrons e1 - e4 located on the axis OZ and are in s-state. They only rotate around its axis. Electrons e5 - e8 are in the p-state. They rotate around the axis OZ in orbits, shown by solid lines. The angular frequency of the orbital rotation is the same for all the electrons in this shell. On these orbits can be placed on one more electron (E9 and E10) to the shell was closed. The absence of electrons in the shell can be considered as a "hole", the state of which is determined by the same quantum numbers as the state of the missing electrons.
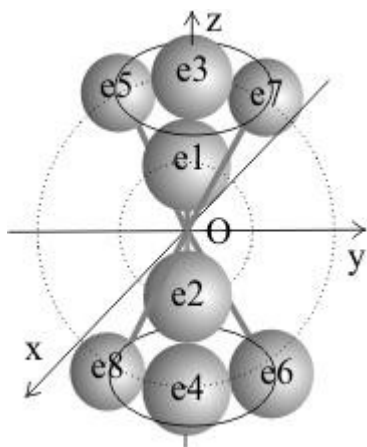

Figure 4.9. Electron shell of an atom of oxygen

Note that if all of the electrons in one "pole" of the atom rotate in one direction, they are attracted to each other with the fields on the mechanism of the strong interaction. Therefore the energy of the electrons increases as the filling of the shell. Electronic configuration of noble gases is particularly resistant. A chemical resistance related of structure of these elements.

The recombination of the charge after closing vortex tubes electron moves rapidly towards the nucleus, "falling" to him, like a stone to the ground. Annihilate the proton and electron can not, because when approaching they repel each other.

The angular momentum of a free electron is related to its kinetic energy $E=M\omega/2$. Neutrino rings is further promoting in accelerated motion to the nucleus. The kinetic energy of motion is converted into the internal rotational energy. After braking rotational energy stored of the electron neutrino rings partially or completely transmitted photons fly through them.

Example 2

Combination of atoms in the molecule occurs so that their spins cancel out. Therefore, should be a force that attract each other atoms with opposite spins and keep them in a new formation. These forces cause the outer electrons of the atom on the mechanism of the vortex interaction.

On figure 4.10 shows two electrons e1 and e2 of outer shell, for example, an oxygen atom, between which there is a gap. Electron spins pointing up (out of the nucleus). Let the hydrogen atom approaches. If the moment of the hydrogen atom is directed downward, the eddy fluxes of electrons e1 and e2 (shown by dashed arrows) attract respectively left and right electron ring of a hydrogen atom. As a result, hydrogen is focused and set in the gap between the electrons e1 and e2.
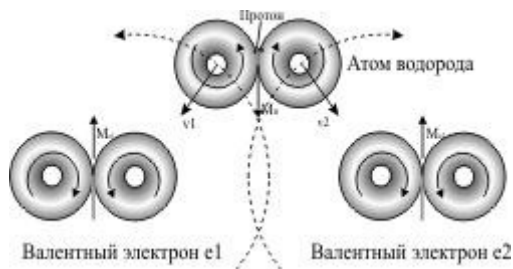

Figure 4.10. Incorporation of H atoms in the electron shell

If instead of a hydrogen atom to the electrons e1 and e2 another atom have approached, outer electron of the atom established in the gap between the electrons e1 and e2. Atom itself will be held near the oxygen charge vortex tube.

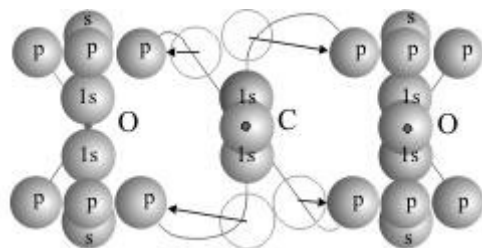For example in figure 4.11 shows the block-diagram of the molecule of carbon dioxide CO_2.

Figure 4.11. A molecule of CO_2

The electrons, gone to the acceptor atoms (atoms of oxygen O), remain suppressed by atomic nucleus by donor (carbon C) electrostatically with charge vortex tubes.

After the transfer of electrons from the donor to the acceptor configuration outer carbon shell is helium, and oxygen is neon. The binding energy carried away by photons. The distance between the molecules in the figure by the way is as they were before the redistribution of electrons to show the initial positions of the particles. Real atoms in the molecules are packed tightly enough.

Thus, the the atoms do not participate in the formation of molecules. Electrons do not spend the time in front of one nucleus, and the other part of the time — near the other nucleus. Electrons do not need

synchronization with the movements of many other particles — they do not fly in orbits. Electrical connections in neutral atoms are saturated. The formation of molecules is due to the transfer of valence electrons from atom to atom, the donor-acceptor interaction of the forces of the vortex. Stability of molecules is provided by the electrostatic connection between atoms by the charge vortex tubes.

4.3. Modeling the interaction of photons with atoms

The recombination the accelerated electron "falls" into a proton. In this case, the neutrino rings is spinning proportional to linear velocity. After stopping the electron neutrino rings still are spinning. This energy is manifested in the form of pressure of the electron on barrier. The energy of the excited state electron is transferred to the photons and is carried away by them in the form of radiation.

Let us consider the interaction of electrons with photons. Now generally claim that the emission of light a photon "born" by atom, and the absorption of light by atom a photon "disappears". Where in the atom is the photon before birth and places after absorption, is not specified. But photons do not die. When we say that the photon gave all its energy, it only means that the photon has only its own energy and is generally not in the excited state.

There are about 10^9 photons on each electron in the universe. Therefore, the electrons are surrounded on all sides by flying at the speed of light photons of various energies. Electrons for light photons are obstacles: the size of the particles are of the same order. Suppose, for example, an electron in a hydrogen atom approaches the photon, which is in the ground state. Photon moves at the speed of light, the electron neutrino catches and begins to put pressure on it (Figure 4.12). Then the ring in the electron neutrino expands by a force perpendicular to the plane of the ring.
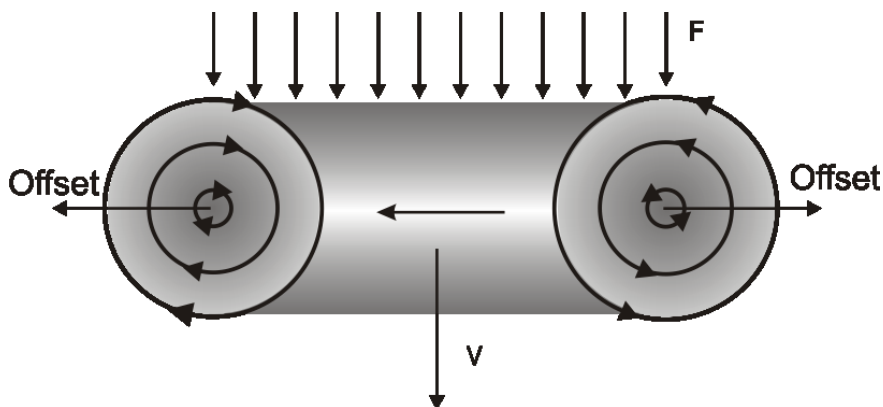

Figure 4.12. Expansion of the ring vortex in the electron neutrino

This force, as shown in the figure, makes toroid vortices in each cross-section to move in opposite directions in the plane of the ring. Photonic ring, on the contrary, under the influence of electron vortex flow one after the other to reduce the size. Then they pass through the inner hole of the neutrino ring (game vortex rings). The figure 4.13 at right shows left screw photons moving in pursuit of the electron.

Right screw photons will also be attracted to the electron by vortex interaction, as long as they are flying towards each other. Photon hits in neutrinos in rotating media — attached to the neutrino vortex field — rotating flow of gravitons. Field of the photon spin up in this whirlwind of a field of electron neutrinos on the principle "from hot to cold", i.e. while their velocities are not equal. Not transmitted impulse and

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angular moment, so that the photon only increases its transverse energy. The process of changing energy of the photon is not affected to the longitudinal movement.
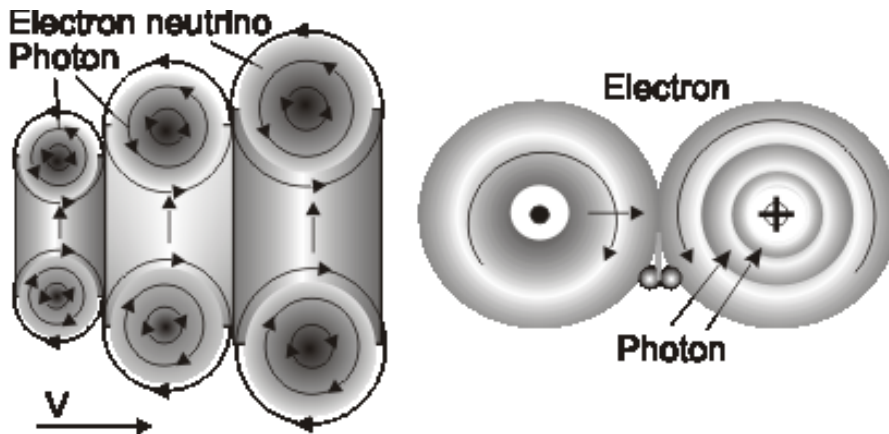

Figure 4.13. Momentum transfer from the photon electron

The remaining energy of the electron can be transferred to other series photons. Similarly the inverse process of the excitation of an electron energetic by photon is. Thus, the photon emission provides energy exchange between the particles of matter. Photons are the "carriers" of heat.

4.4. Modeling diffraction particle

In the analysis of the diffraction of light and particles, we have to assign them to the diffraction lattice quantum-particle properties, and after passing through the lattice — the wave properties. Vortex model allows us to stay at the same point of view. Every natural phenomenon in its mechanistic basis is based on the mechanical properties of physical objects. If the particles were infinitely small points then there was no diffraction. But the particles have a finite size. It's the reason why particles round obstacles (Figure 4.14). The particles that "fit" in the size of the hole pass over a hole in a straight line.
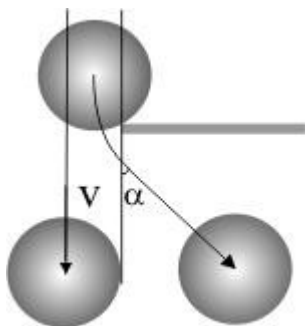
Figure 4.14. Rounding particles obstacles

Suppose the center of mass of the particles pass through the hole and the edge touches the barrier. The particle turns around and goes behind a hole at an angle α to the original direction. The deflection angle depends on the energy of the particles in the incident beam and the size of the hole. If the size of the hole is almost equal to the size of the particles, almost all of the particles will be rejected (the screen will be a "hemispherical wave"). In this case, the rotation angle α particles can reach up to 90 degrees.

Consider the incident photon flux (or electrons) in the hole (figure 4.15).

Figure 4.15. The mechanism of diffraction vortex particles

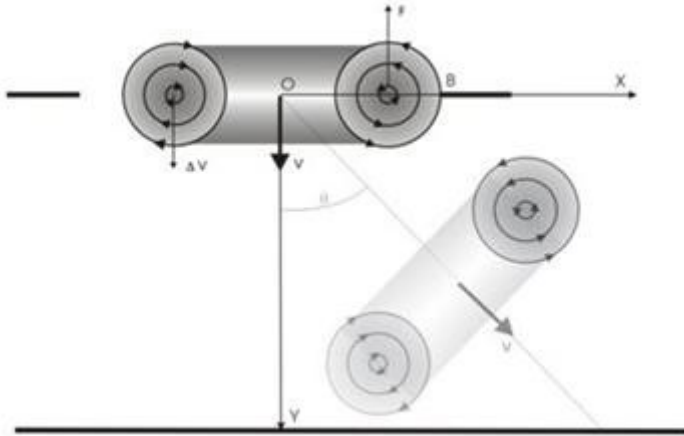The diffraction pattern arises from the interaction of a vortex photon with the edge barrier. As usual, the size of the opening set commensurate with the size of the particles and small compared to the distance from the obstacle to the screen (figure not drawn to scale).

The incident photon has directed momentum p_y. The collision with the edge of the obstacles under the elastic force F vortex rotates around the point B in changing the initial moment. The position of the vortex after passing holes is shown. The moment became a component along the x-axis and was equal to p. According to the law of conservation of angular momentum of the rate of change of the moment M is the moment of the forces:

$$\frac{\partial M}{\partial t} = N = [D \times F].$$

where D - diameter circular axis of the photon vortex. Rewrite the equation in the form

$$\Delta M = D \cdot F \cdot \Delta t = D \cdot \Delta p = D \cdot p_x.$$

Change in the moment due to the change in momentum of the particle. Momentum p_y we believe the same, and the momentum change is the addition of component p_x. But the moment of the photon vortex is quantized: $\Delta M = hm \quad (m = 1, 2, \dots)$ and p_x = p sinθ. Finally we write the condition of the maximum lateral

$$sin\theta = \frac{hm}{Dp},$$

where m = 1, 2, ...,   p — longitudinal momentum of the particle, D - diameter of the torus. This expression can be written in the form of a wave, given that λ = 2πh/p:

$$sin\theta = \frac{\lambda m}{2\pi D}.$$

Diffraction particle due to the quantization of their moment in contact with the edges of obstacles.

4.5. Modeling of the weak interaction

In the weak interaction involves all the fundamental fermions (leptons and quarks). This is the only interaction involving neutrinos. The weak interaction allows leptons, quarks and their antiparticles to exchange energy, mass, electric charge, and quantum numbers —i.e. to convert into each other.

For example, draw up short-lived neutral vortex (K ^ 0)⁻-meson model. Its decay is caused by the weak interaction. With a high probability (69%), it is divided into $\pi^{\pm}$-mesons. Lifetime is 10^{-10}s and the mass of

497.8 MeV (974,7 m_e). According to the quark model K^0-meson contains d-quark and s-antiquark. Consequently, the vortex model must contain two particles. Rather it should be a c-quark and c~-quark, as shown in Figure 4.16.
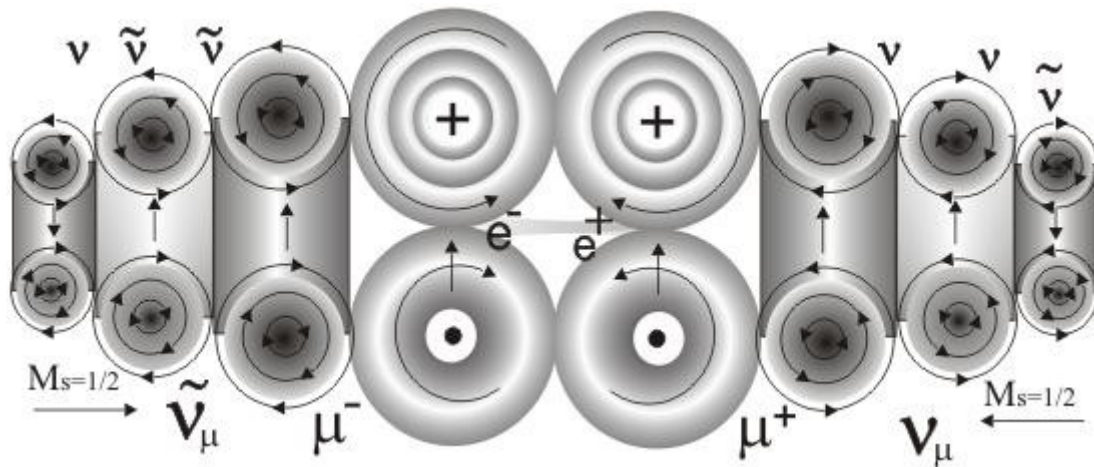

Figure 4.16. Neutral ‾ (K ^ 0) meson

Analysis of the decay scheme can provide a neutral K^0-meson in the form of bound electrostatically π^+-meson and π^-- meson (in Figure 4.16 on the right and left, respectively). On the binding energy of two pions in the ‾ (K ^ 0) meson have

E_{bin} = (2 · 279,14) -497,8 = 218,66 MeV.

The figure clearly shows nature of metastable particles. Toroid direction is opposite to the rotation of the muons. Vortices associated layers of gravitons muons repel each other (strong interaction). They are attracted to each other by the electromagnetic interaction (e⁻e⁺) and the counter-pressure of mesons at each other due to the forces of inertia. This is supported by the stability of $\overline{K^0}$ - meson. But the surrounding neutrinos and photons carry energy mesons by the mechanism described above. Pressure of the particles at each other weakens. Attraction becomes weaker than repulsion. Electrical power would be enough to keep the single electrons, but not for heavy pions. The binding energy shows a threshold energy mesons, below which comes their repulsion, decay $\overline{K^0}$ -meson.

To increase the lifetime of the metastable composite particles is possible in several ways. You can increase the initial energy, working, for example, by cosmic rays. Then the decay process will take longer dissipation. Particle can be compressed by the external mechanical forces that would exceed the force of repulsion. Since nature did with neutrons, putting them together with protons in the nuclei of atoms densely packed (see Figure 4.3).

Thus, in the vortex model for the weak interaction does not need specific "carriers" of the interaction. The physical nature of the weak interaction is the balance of forces of attraction and repulsion forces. As in all other cases the interaction between the particles, these phenomena provided for the flow of quanta of the electromagnetic field — gravitons.

4.6. Modeling of the gravitational interaction

Today there is no answer as to why bodies attract each other. There is no physical model of the gravitational field. Meanwhile, astronomical observations and practical calculation of the movement of the stars there are more than 2000 years from the time of the Egyptian pharaohs. But Ptolemy, Newton, and Einstein about the causes of gravity "hypotheses do not invent."

Ptolemaic system

"Quantization" and "curvature of space" was begun by Claudius Ptolemy (70-147 years) in his work "Almagest". Geocentric model of Ptolemy has a crystal eight celestial spheres surrounding the Earth (Figure 4.17).
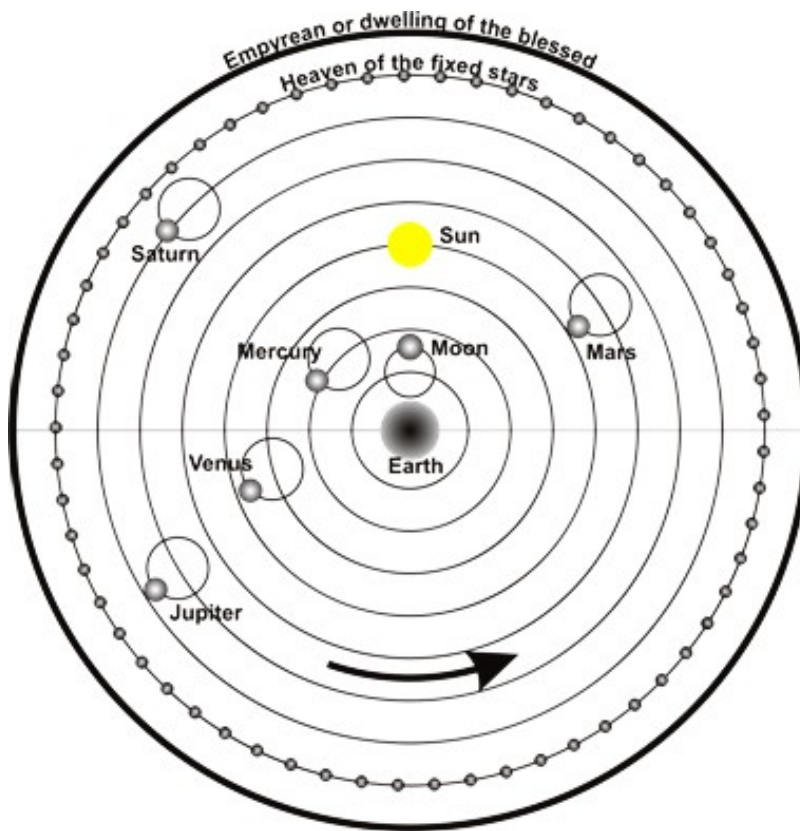

Figure 4.17. Deferent and epicycles Ptolemy

All planets move uniformly at large circles called epicycles. The center of each epicycle glides evenly around the circumference of another, much larger circle, called the deferent. Deferent is reversing epicycle around the Earth. Earth takes a few eccentric positions within the deferent. The planes of deferents pass through the center of the Earth. They inclined to each other at various angles, as well as plane epicycles to deferents. Behind the sky of the fixed stars medieval theologians placed Empyrean or "home of the blessed" — the seat of God, angels, and other."

The essence of the system of Ptolemy is the assumption that a circular orbit around the Earth is made not the planet itself, and the center of the epicycle in which the planet moves. Speaking of today's words, the quantized space Ptolemy (crystal spheres, deferent) revolves around the Earth. Planets masses in each deferent bend space near planet so that the geodesic lines are closed in epicycles. All planets move in a curved space along geodesic lines. The motion of the planets determined by the geometry of space. The geometry of space affects the planet, and the planet affects the geometry of space. The heavenly bodies, being perfect, moving in circular orbits because of their excellence, as a circle - this is the ideal geometric shape.

It is possible that Ptolemy did not accept epicycles for real-life communities, and ascribed to them only geometric value without regard to the question about their true nature. But in the Middle Ages, up to the XVI century Ptolemy opus was considered as a kind of gospel. His entire scheme was regarded as the authentic expression of the reality (Figure 4.18).

Tycho Brahe deservedly was proued of the fact that he was the first to "break the celestial sphere." Having established that the comet's orbit extends far beyond the orbit of the moon, and even Venus, thus he truly believed impossible to prove the existence of solid transparent spheres.

Figure 4.18. Heavenly spheres of Ptolemy

Discard epicycles dared even Copernicus, as he failed to reject the principle of uniform circular motion for celestial bodies. In essence, the Copernican system was the theory of epicycles, processed on a new heliocentric basis., Johannes Kepler formulated in 1609 its own laws. It was the final end the system of Ptolemy.

The classical theory of gravitation Newton

Apples were falling to the ground by the force of gravity when Ptolemy. But it was believed that the earth's gravity is acting on imperfect earth and heaven gravity is acting on a perfect heaven. Neither Ptolemy nor his successors could not answer many questions. What makes the planets on epicycles to rotate around completely empty center? In addition, every planet within days should, together with all the stars rotate around the Earth. In 1687, Isaac Newton combined these two types of gravity. From this point on the artificial division of the Earth and the rest of the universe ceased to exist.

Newton formulated his laws to objectively existing absolute space and constant flow of time. He wrote: "Absolute space, in its own nature independent of any reference to external objects, remains unchanged and motionless." Space seemed to him as a kind of endless "scene," which played the "event" does not affect this "scene". A sense of time Newton considered obvious: "Absolute, true, and mathematical time, taken by itself, without regard to any body, flows uniformly, respectively, of its own nature."

Newton's law of gravity states that the force of gravitational attraction between two mass points of mass m_1 and m_2, separated by a distance r, is proportional to both the masses and inversely proportional to the square of the distance between them:

$$F = G \frac{m_1 m_2}{r^2},$$

Here G - gravitational constant, equal to 6,67 • 10^{-11} m ³ / (kg ²).

In Newton's theory, every massive body generates a potential gravitational field of attraction to this body. The gravitational potential for a material point of mass m is given by:

$$\varphi\left(r\right) = -G\frac{M}{r}.$$

In the general case, when the density of matter ρ is distributed randomly, $\varphi\left(r\right)$ satisfies the Poisson equation:

$$\Delta\varphi = -4\pi G\rho.$$

This equation can be written as:

$$\varphi = -G\int\frac{\rho dV}{r} + C, \tag{a}$$

where r - the distance between the volume element dV and the point at which the potential is determined φ, C - an arbitrary constant.

Attractive force acting in a gravitational field on a material point of mass m, related to the capacity formula:

$$F\left(r\right) = -m\nabla\varphi\left(r\right). \tag{b}$$

Essentially Newtonian gravity model is mathematically, without any physical content. Newton does not even pose the question of why gravity bodies. But the main difficulty of the Newtonian theory is the inexplicable action at a distance. it is unclear how the force of gravity is transferred infinitely fast through a completely empty space. In addition, if the universe is infinite and Euclidean, then the non-zero average density of matter in it there is the gravitational paradox.

The essence of the paradox is as follows. If r → ∞, ρ decreases faster than r^{-2}, then the integral (a) converges and the potential can be determined. If the distance increases the density ρ decreases slower than r^{-2} (for example, for a uniform distribution of matter ρ = const), the integral (a) diverges. Gravitational acceleration generated by gravity substance found from (b): $a = -\nabla\varphi\left(r\right)$ can take any, including endless meanings depending on the method of integration. If r → ∞ the density ρ decreases slower than r^{-1}, then the acceleration is uncertain.

Paradox is a demonstration of the limits of applicability of the Newtonian theory of gravitation. This theory is not applicable to strong gravitational fields and, in particular, the allocation of an infinite amount of matter in an infinite space. In these cases, you must use a relativistic theory of gravity — the general theory of relativity, free of paradoxes.

But the question of the stability of an infinite universe with a uniform density of matter, Einstein solved in general relativity only an introduction of the cosmological constant. Translated into the language of the vortex model, this means the introduction of the principles of dynamic equilibrium. Substance (in general terms - matter) pulls the universe into a ball, and formatter stretches it. So the size of galaxies supported unchanged, and the intervals between them increase.

General theory of relativity

Most people are convinced that, in the general theory of relativity (GR), Einstein studied the gravitational field. However, this is not the case. Einstein in 1915, adopted as the postulate of an analogy between the gravitational fields and non-inertial frames of reference (principle of equivalence). Einstein said that the most successful idea in his life was the idea that "the person, flying from the roof, is not experiencing any of the forces!".

Based on the principle of equivalence of inertial mass and passive gravitational mass, Einstein speculated that in a curved space-time any particles move along geodesic lines. This corresponds to motion with constant velocity along a straight path of three-dimensional, i.e. inertial motion.

Einstein's second assumption was that the space-time has a certain elasticity, and embedded in the space of the body tend to distort it. In the complete absence of matter in the present and in the past there is a flat (pseudo-euclidean) space-time of special relativity. Since the density of matter is associated a certain combination of variables characterizing the curvature of space-time. In general relativity, the gravitational field is a source of energy-momentum tensor, which contains ten different components that connect the field curvature with the properties of matter.

In the theory of relativity, a new element of the invariant four-dimensional space-time is the interval. In a non-inertial reference frame interval square is a quadratic form of the general form of the differentials of the coordinates:

$$-ds^2 = g_{ik}dx_i dx_k,$$

where g_{ik} - some functions of spatial coordinates x_1, x_2, x_3 and temporal coordinates x_0, defining the space-time metric. In general, this metric tensor has ten different values g_{ik} and completely determined by the local gravitational field. So they are talking about the curvature of space-time, as if giving of the physical space the status of the object. Then the physical nature of gravity is expressed in the change of the geometrical properties, the curvature of the non-Euclidean 4-dimensional space-time near massive bodies, creating a gravitational field. Components of the metric tensor must satisfy the equations of the gravitational field:

$$R_{ik} - \frac{1}{2}g_{ik}R = (8\pi G \ c^4)T_{ik},$$

where R_{ik} - curvature tensor, $R = g^{ik} R_{ik}$, but a source of curvature is T_{ik} - energy-momentum tensor.

The solution of this equation out a centrally symmetric body of mass m is the expression:

$$ds^2 = \ c^2 - \frac{2Gm}{r} \ dt^2 - r^2(sin^2\vartheta d\varphi^2 + d\vartheta^2 - \frac{dr^2}{1-2Gm \ c^2 r}),$$

where r, ϑ, φ - spherical coordinates.

This metric is not very different from the Galilean at $r \gg r_0 = 2Gm \ c^2$, i.e. at distances much greater than the gravitational radius of a massive body.

When taking into account the expanding formatter in the field equations, enter the cosmological constant Λ:

$$R_{ik} - \frac{1}{2}g_{ik}R + \Lambda g_{ik} = (8\pi G \ c^4)T_{ik}.$$

General relativity is a theory of space-time geometry. The gravitational field is identified with the metric. It is essential that the space in general relativity is classical, continuous. But is there a description of the mechanism by which the active gravitational mass curves the space around it? And how can we measure the curvature of space?

Four-dimensional space-time is just a property of material objects moving in a certain direction and change at a certain speed. Space and time are not realities existing in themselves, and the phenomena arising from the existence of other realities. "The space is relative and is thought of as the relationship between material objects as the order of placement of bodies" (Leibniz). Space is not a physical object, it can not be bent or quantized, the material world is quantized — Leibniz's monads in the form of vortices of Descartes. While timing a constant rate compares to others.

In the special theory of relativity (STR), Einstein abandoned the ether as a general frame of reference, because the events that followed in the same inertial frame of reference were compared only with events in another inertial frame of reference. But in the general theory of relativity (GR) events in a gravitational field is equivalent to the events in a non-inertial reference frame. The illustration on the

left shows the elevator, standing at the North Pole in the gravitational field of the Earth. Movement of bodies in it is equivalent to movements in the elevator, shown on the right, when the Earth is no more. This elevator is moving with acceleration g up. But in relation to what it is moving? And Albert Einstein once again introduce the rejected his earlier broadcast. He said: "If you had thought that if the extract from the universe matter - space and time remain, but now with the advent of the theory of relativity, believe that no matter the time and no space." For some reason, this opinion is ignored almost 100 years.
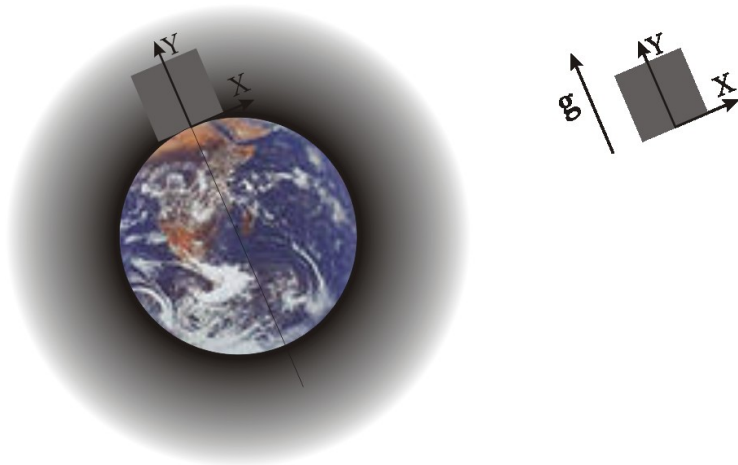
Thus, the matter of filling the entire space of the universe in a vortex model does not contradict either the special or general relativity. From the analysis of the structure implies the existence of black holes at their cores in the form of unstructured Supercompressed formatter. This substance is a continuum fills the entire space of the universe. In phase transitions in the deposition of the vortex structure, which we perceive as a particle. So solving the problem of continuity of matter in the observed discontinuous (quantized) fields.

The geometry of space indicates matter what properties it should have, and the matter indicates the space-time, as it should be curved. While we say that the source of the gravitational field is the energy-momentum tensor and an appropriate metric tensor, so good. But when we are interested in the cause of attraction of bodies, general relativity do not answer on this question. Let us try to find an answer in quantum gravity.

Quantum Gravity

Today, theoretical physics tries to answer the following questions:

− Is it possible to quantum mechanics and general relativity included in a self-consistent theory?
− Whether the space-time is fundamentally continuous or discrete?
− Will the self-consistent theory to use a hypothetical graviton or it will be completely the product of the discrete structure of space-time (as in loop quantum gravity)?

Under the identification of gravity with the metric of space-time arise fundamental difficulties with the quantization of this metric. Theory of quantum gravity would unite general relativity with quantum electrodynamics, i.e. "Large" to "Small." But the inconsistency of these theories in 1936 said in his doctoral thesis, M.P. Bronstein:

"The fundamental difference between quantum electrodynamics and quantum theory of the gravitational field is that in the formal quantum electrodynamics, which ignores the structure of the elementary charge, there is no fundamental reason limiting the increase in the density ρ. At a

sufficiently high charge density measurement accuracy components of the electric field can be arbitrary. In nature, there are probably some fundamental limitations of the electric charge density (not more than one elementary charge on the amount of the linear dimensions of the order of the classical electron radius). However, these restrictions are not considered formal quantum electrodynamics. As a result, it can be considered without prejudice measuring electromagnetic quantities as "predictable."

Not that — in the quantum theory of the gravitational field. It should be the restrictions resulting from the fact that the gravitational radius of the test body ... can not exceed its actual size ... so

$\Delta[00,1] > h^{2/3}G^{2/3}/cTV^{4/9}$,

where T - time, V - volume of the measurement field.

The quantity on the right side of this inequality, which is the absolute minimum of the uncertainty in the measurement component of the force of gravity, which can not be exceeded by introducing appropriate measuring device selected ... similar result to continue in a more exact theory, as it does not in itself imply the principle of superposition . It corresponds only to the fact that in general relativity can not be arbitrarily large body mass in a given volume. In electrodynamics, there is no analogy to this fact (and this is due to the fact that it obeys the principle of superposition). That's why quantum electrodynamics can be free of internal contradictions.

In the theory of gravitational waves is the internal conflict can not be avoided. We can assume that the measurement of the gravitational field "predictable" only in the event that limit ourselves large volumes and time intervals.

Eliminating the associated logical contradictions requires a radical restructuring of the theory and, in particular, non-Riemannian geometry dealing, as we see here, is fundamentally unobservable variables - and, perhaps, and the rejection of traditional notions of space and time and replace them with what- it is much deeper and lacking clarity concepts. "Wer's nicht glaubt, bezahlt einen Thaler".

Vortex model

Failure of quantum gravity is due, above all, the lack of a physical model of the phenomenon. In the vortex model of quantum electrodynamics, quantum electrodynamics and quantum gravity - it's the same field theory with quantum gravitons as vector interactions. Combine these disciplines unified mechanism of action of gravitons attached layer provides all kinds of interactions between objects of matter, including gravity. Vortex model fills matter abstract space Einstein's General Relativity and rejects the method of analogy. Indeed, based on the principle of equivalence of general relativity, in which the gravitational field can not be distinguished from the constant acceleration with which the observer is moving.

At first let us explain the origin of the radial force acting on the body mass, thrown vertically upwards at a speed v_0. When moving up the body interacts with the gravitational field of Earth. The body performs negative work against the force mg, reducing its kinetic energy to $\frac{mv_0^2}{2} = mgh$. The field does positive work, acting force $(-mg)$ moves up in the body. The field increases its potential energy at mgh. Thus, the gravitational field gets from the body energy, ability to return the body during freefall initial kinetic energy $\frac{mv_0^2}{2}$. Accumulation of field energy is produced by the tension of elastic elements. Warping of these elements provides the body.

We assume that the earth is surrounded by a spherical layer of gravitons stationary incompressible fluid with constant density ρ. This layer is made a closed on Earth flow of gravitons and extends far beyond the orbit of the Moon. We have considered that the constituent particles (protons, Figure 2.18) pass of the graviton flows of all components — the excess of the value of its own — outside the compound fragment, forming a "layer attached gravitons." This layer provides strong, electromagnetic, and gravitational interactions of matter.

In the subsurface layer of the Earth's paths of graviton flows strongly curved (shown schematically in Figure 4.19). The intensity of the flow decreases with distance, so there is a vertical gradient.
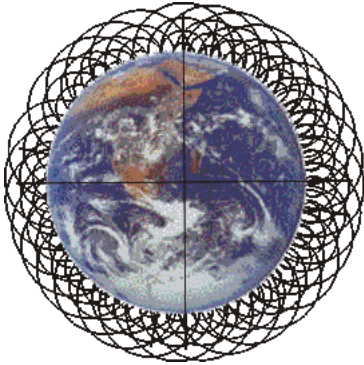

Figure 4.19. Trajectories of graviton flows at the surface of the Earth

Smooth trajectory of each thread can be replaced by a U-shaped without significant loss to understand the merits. Then the surface will be only vertical and horizontal flows of gravitons. The Earth itself is immersed in the graviton environment in which gravitons are moving in all directions at the speed of light, creating a background pressure.

In Figure 4.20 shows in light the change in conditional pressure altitude for the Earth and the Moon. In fact, their fields overlap, extending over long distances.
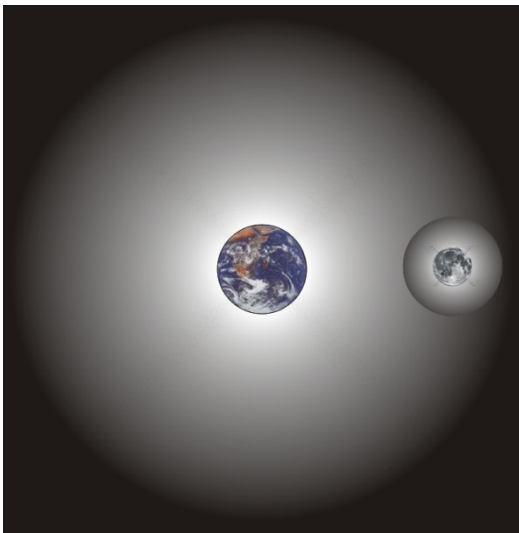

Figure 4.20. The gravitational field of the Earth and the Moon

Earth and Moon are immersed in the relativistic gravitons, moving in all directions at the speed of light. The pressure in the undisturbed environment gravitons is the same in all directions. Around the Earth and the Moon, as well as around each massive body, is a flow of their own gravitons. The horizontal component of the flow creates a dynamic pressure, whereby the static pressure near the bodies decreases. Thus, the source of gravity is the pressure of interplanetary graviton environment

(electromagnetic field or "dark matter"). "The force of gravity" is a radial pressure gradient environment.

In connection with the analysis, we see that the frequent assertion that "the bodies are attracted to each other" essentially has no basis. It would be truer to say that every massive body creates around itself a gravitational field. Further, the gravitational field must understand the range of a significant reduction of the normal pressure of the surrounding environment graviton. This under pressure is created by the tangential flow of its own gravitons.

A fundamental difference between gravitational and electric interactions is in the amendment. Electric interaction is between the charges. The gravitational interaction is carried out with the medium. Therefore, part of the comparison of the electrostatic repulsive force and the gravitational force of attraction between two electrons is incorrect.

"Vortex" gravity to some extent resembles the mechanism of "Shadow of gravity", proposed in 1690 Fatio and in 1756 Lesage. In the vortex model the bodies is also not attracted but "pressed down" to each other external to it graviton pressure interplanetary medium.

Return to the beginning of this section. Against what forces do work a body thrown vertically upward? The answer is simple: the forces of the graviton pressure interplanetary medium. What causes the body to fall back to Earth? The body is acted the force (pressure gradient) by the graviton interplanetary medium.

If you draw a picture is correct, then gravity can describe the known mathematical methods. Restrict the representation of physical models of the mechanism of gravity in the non-relativistic steady state at constant density continuum.

We write the equation of motion of the Navier-Stokes equations for a unit volume of a continuum of the surface layer of the field [6]:

$$\rho \frac{dv}{dt} = \rho \left(\frac{\partial v}{\partial t} + (v \cdot \nabla) v \right) = -\nabla p + \eta \Delta v + f. \qquad (4.1)$$

Right recorded density of forces acting on a unit volume: the gradient of static pressure, shear forces of viscosity and external forces.

Since we consider averaged over all micro movements stationary liquid, the viscosity can be neglected. If external forces do not, then immediately obtain the force on unit mass:

$$-\frac{\nabla p}{\rho} = \frac{1}{2} \nabla v^2. \qquad (4.2)$$

Rewrite (5.2) in the form

$$\frac{1}{\rho} \nabla (p + \frac{\rho v^2}{2}) = 0. \qquad (4.3)$$

The sum of static pressure p and kinetic energy density of the liquid layer of particles (gravitons) is in parentheses. Integrating (4.3), we obtain an expression for the static pressure:

$$p = p_0 - \frac{\rho v^2}{2}, \qquad (4.4)$$

where p_0 — total pressure. It consists of static and dynamic pressures. Pressure p_0 is equal to the static pressure in the "undisturbed" liquid.

Figure 4.21 shows the curvature dependence of surface static pressure $p(r)$ because of the introduction of the Moon in the field of the Earth. The gravitational attraction is due to the gradient of static pressure, rather than its absolute value. Therefore, the test body is attracted to only one center of force.

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The strength of gravity on both sides of the moon is the same. Superposition principle is unfair for gravitational fields.
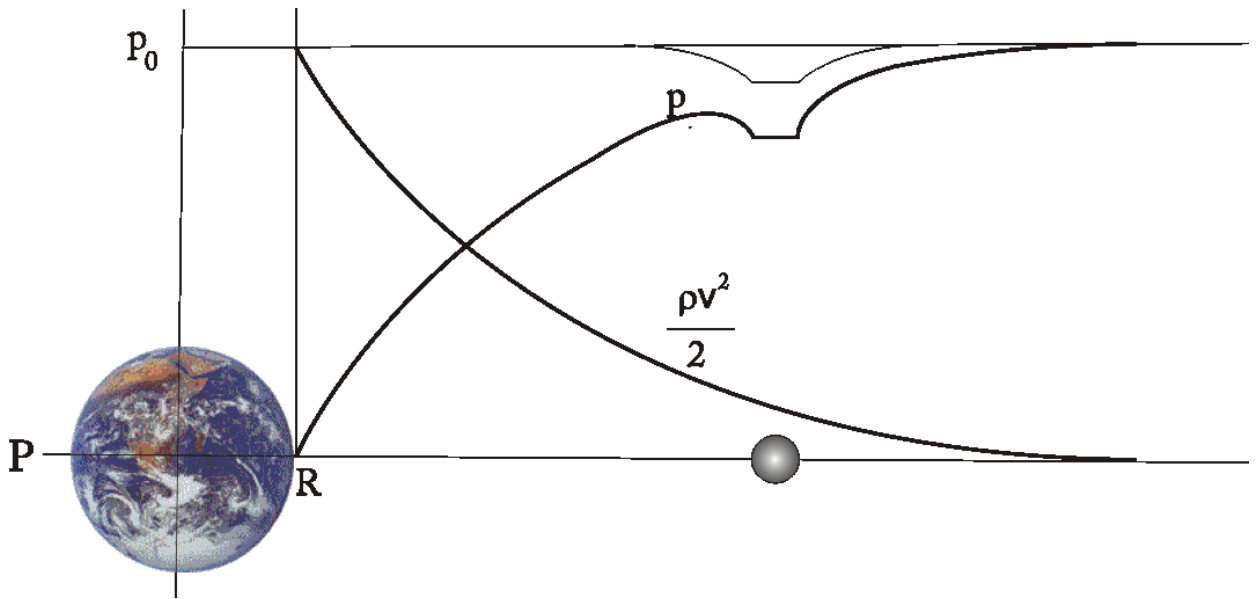

Figure 4.21. The pressure of gravitons in the surface layer

This situation we were discussed in Section 4.2. In Figure 4.7 shows the experimental setup Bernoulli corresponding discussed conditions near the Earth. Static pressure consists of the total pressure "interplanetary" graviton environment p_0 and dynamic pressure of the flow of gravitons $(\rho v^2)/2$. On horizontally disposed plate horizontal flow does not affect. The right figure is placed second body (e.g. the Moon). If the moon were isolated from other bodies, the pressure in the neighborhood depicted of a graph above the figure. Overlay fields of Earth and the Moon leads to a "pit" in the resulting curve p. Force is the pressure gradient. It can be seen that the force of gravity on both sides of the moon is the same and does not depend on whether or not it is a satellite of the Earth.

It can be seen that the elastic element of the gravitational field is not a "space-time" in itself, and the static pressure graviton gas that filling the space. Gas tends to straighten the "curvature" — fill a hole formed by the body — and the body moves in the direction of lower pressure.

Electromagnetic and gravitational forces are due to the gradients of the energy density of gravitons in the location of bodies. In the interaction of the electron and the proton gradient of the energy density is created by applying a rotating flow of gravitons in charge tubes with light speed. Radial gradient of static gravitons pressure near the Earth is created by the azimuth (horizontal) threads of gravitons. They create a "dynamic" pressure, which is not transmitted in the radial direction.

The figure shows that the elastic element of the gravitational field is not "space-time itself" and the static pressure of gravitons gas filling the space. Gas tends to straighten the "distortion". Gravitons gas tends to fill the hole formed by the body — and shifts the body toward the lower pressure.

The radial dependence of the energy density is expressed as follows:

$$\frac{\rho v^2}{2} = \frac{\rho V^2}{2} \frac{R}{r}, \tag{4.5}$$

where V — boundary velocity of gravitons, and R — Radius of the Earth.

Then from (5.2) once we obtain the force acting on unit volume in the layer. It is proportional to the radius of the Earth R and the energy density in the boundary layer:

$$-\nabla p = \frac{\partial}{\partial r}\frac{\rho v^2}{2} = -\frac{\rho V^2}{2}\frac{R}{r^2} \tag{4.6}$$

Per unit mass of the layer to a force:

$$-\frac{\nabla p}{\rho} = \frac{1}{2}\frac{\partial v^2}{\partial r} = -V^2 R\frac{1}{2r^2}. \tag{4.7}$$

Minus sign indicates that the direction of the force opposite to the direction of the radius. Expression does not contain the mass, — the movement of all bodies is alike.

The force of attraction to the Earth mass m:

$$F = -\frac{mV^2}{2}\frac{R}{r^2}. \tag{4.8}$$

When r = R is equal to the force of attraction mg. Here you can find the value V:

$$V = \sqrt{2Rg} = \sqrt{2 \cdot 6{,}4 \cdot 10^6 \cdot 9{,}81} = 11.2 \text{ m/s.}$$

This value coincides with the rate of release (escape velocity).

The expression for the energy density in (4.3) plays the role of the Newtonian potential. His solution is found from the Poisson equation:

$$\Phi = -G\frac{m}{r}.$$

Value $V^2R/2$ is proportional to the mass of the source of gravity. Now we can write (4.8) in the usual form, as in Newton:

$$F = G\frac{Mm}{r^3}r.$$

We have reviewed the graviton field of fixed outer body. Note that if the layer is rotating around the Earth, it is recorded by us as a magnetic field. Moon and Venus does not rotate and the magnetic field they do not. We will show the details of another effect due to rotation: the desire of all the planets of the solar system to stay in the equatorial plane of the Sun.

Consider a model of the sun, rotating in an infinite medium fields (figure 4.22). The linear velocity of points on the surface is $v_o\sin\theta$.
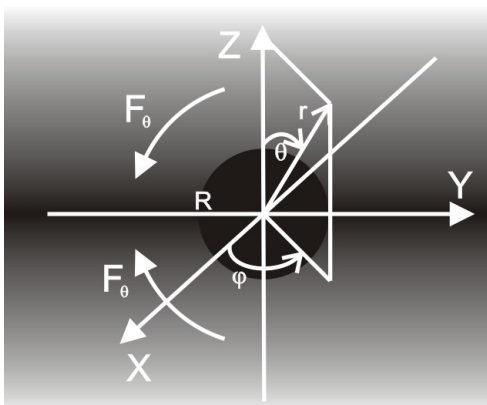
Ris.4.22. Rotating the ball in an unbounded fluid

In a coordinate system associated with the Sun, the flow rotates in a circle around the ball. Circulation when crawling around the axis of rotation of the ball is not zero, but rot**v** in the liquid is zero. For a circular path with the center coinciding with the center of the ball, the line integral of velocity is equal

$$\int v \cdot ds = 2\pi r\sin\theta \cdot v.$$

For irrotational flow the integral should not depend on r. Denote it by a constant C_θ obtain

$$v = \frac{C(\theta)}{2\pi r \sin\theta}.$$

In particular, the surface of the body

$$V\sin\theta = \frac{C(\theta)}{2\pi R\sin\theta}, \qquad C_\theta = 2\pi RV\sin^2\theta.$$

The final expression for velocity in spherical coordinates:

$$v = V\sin\theta \frac{R}{r},$$

where V — linear velocity of the rotating flow at the equator.

We now rewrite again the Navier-Stokes equations for the force acting on unit volume of a spherical surface of radius r:

$$\left(-\frac{\nabla p}{\rho}\right)_\theta = \frac{1}{2}(\nabla v^2)_\theta = \frac{1}{2r}\frac{\partial(v^2)}{\partial\theta} = \frac{V^2 R^2}{2}\frac{\sin 2\theta}{r^3}.$$

It is the force per unit mass. It is directed to the equatorial plane. On a planet of mass m will force acting in m times greater.

4.7. Modeling of Space Objects

In the previous sections of the paper discussed the details and mechanisms of formation and functioning of the electromagnetic field and matter. It is shown that the field is the template for the structure of matter and the interactions among its objects. Universe sealed universal vortex interaction. Divide the types of fundamental forces (nuclear, electromagnetic, weak and gravitational) no reason. In this case, at its core mechanisms of the fundamental interactions are reduced to the mechanics of flow of gravitons. Power is defined as the pressure environment gradient.

The next stage after the formation of matter is the formation from matter the cosmic objects, including planets, stars and galaxies. This process is symmetric states for the form process of substance, as shown in the table.

The level of the structure of matter	Field	Substance	Space	Universe
Single vortices	Neutralino	Neutrino	Stars	Galaxies
Fermions	Gravitons	Electrons	Double Star	
Bosons	Fotino	Photons	Black Holes	Mega Black Holes
Composite objects		Atoms	Planetary Systems	Clusters of galaxies

The level of cosmic objects is closely related to levels of field and matter. Universe - a complete system of interacting vortex sites for all states of matter. The table shows that nature is economical and not looking for ways to target every time. At each level are ready tools and templates, known from previous levels.

Neutralino as a toroid vortex in the field are the result of "boiling" formatter, and became the basis of field matter. Neutrinos in a toroid vortex formed by the "boiling" graviton fluid and became the basis of

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the substance. Particles and fragments of matter formed by the contraction in clumps neutrinos. Stars in the form of spherical vortices formed by the contraction of fragmentary molecular clouds and collapse of the central part. They became the basis of the level of the cosmos. The galaxy in the form of vortices of stars and interstellar matter with nuclei in the form of black holes formed by the contraction in clumps of stars and the collapse of their central parts. Galaxies formed the basis of the level of the universe. In the main elements of the levels are presented as right screw and left screw vortices.

Nonrelativistic objects of each level are formed by connecting the vortex attraction of two or more basic elements. To level the field is gravitons forming "dark matter." For this matter, electrons and positrons (two elements) and quarks (three items). It should again be emphasized that all "anti-matter" is contained within a "matter." At the level of the cosmos half stars are born as double or triple. Even in the solar system Jupiter could become the second star. Today in astronomy accepted that double or triple star system began to form only in the third generation of stars. At the level of individual galaxies of the universe gather in clusters.

Relativistic objects field are photinos. They are formed by two or more toroid neutralinos aligned facing each other. This structure is repeated relativistic objects of matter - photons. They are composed of two coaxial standing neutrinos or antineutrinos. Here also equally represented as "matter" and "antimatter". At the level of the cosmos to the relativistic objects include black holes. They are characterized by the escape velocity equal to the speed of light. At the level of the universe clusters of galaxies will form Mega black holes— the beginning of the process of the collapse of the universe. Black hole is a composite object. In the nuclei of black holes realized super pressed substance — formatter of white holes. Periodic cycle of matter on which is ended to happen again.

Vortex nature of the structure of matter is preserved at all levels. In Figure 4.23 shows a photograph of the vortex galaxy. In the center there is a dense core around which the attached layer with decreasing density is placed.

Figure 4.23. The Whirlpool Galaxy (NGC 5194, M51) in the constellation of type Sc Hunting Dogs

In the discussion of the processes in the early Universe they are often wondering: what had happened and antimatter? Now extended this view. With the explosion occurred the same amount of matter and antimatter. But then these substances are quickly annihilated and turned into photons. However by accident (freak of nature?) there was a small excess of matter over antimatter, through which we exist. For such a point of view there is no reason. Most processes in nature and most of the objects of nature are based on the dynamic equilibrium of opposing factors: particle — antiparticle, the positive charge —

a negative charge, the black hole — white hole. Antiparticles, in particular, needed to compensate for the momentum of the particles in the composite object.

The processes of formation of stars at all stages well studied. Therefore we only observe that dark matter controls the formation of stars — dense clouds of gas and dust material formed at the site of massive fragments of dark matter. The same applies to the formation of galaxies. Often dark matter halo is detected around the galaxy. The rotation of stars and galaxies is due to rotation of the "substrate" of dark matter. The mass of the dark matter is almost 6 times larger the mass of stars and galaxies.

Star formation occurs constantly in our time. The initial process of star formation is seen in Figure 4.24 due to the collapse of the central part of the dense dust cloud.

 Figure 4.24. Start of star formation

In Figure 4.25 shows the final stage of star formation. From the peripheral part of the cloud planets are formed.

Figure 4.25. The final stage of star formation

The energy sources of the life cycle of stars are thermonuclear reactions. It is supposed that they start on heating protostar due to compression to 10 million degrees. This temperature is continuously maintained in the center of the star. Energy is transferred to the outside through the inner radiation and

convection. The question arises why the star does not explode like a hydrogen bomb? What prevents the synthesis reaction spread to the entire volume of the stars? How does this ideal controlled reactor, for hundreds of millions of years, slowly generating the stored fuel?

In the study of nuclear reaction is tacitly assumed that the protons are something like balls "substance" covered, as the Christmas tinsel, "charge". And to overcome the Coulomb repulsion it is nessesary to press firmly balls to one another. You can warm them up high temperature that they were "bumped" into each other.

However, in this paper we show that the particles axisymmetric vortex formations. They automatically tend to merge, if they move close to a stream. Look at our Sun. In Figure 4.26 shows a photograph of the sun with a crown.
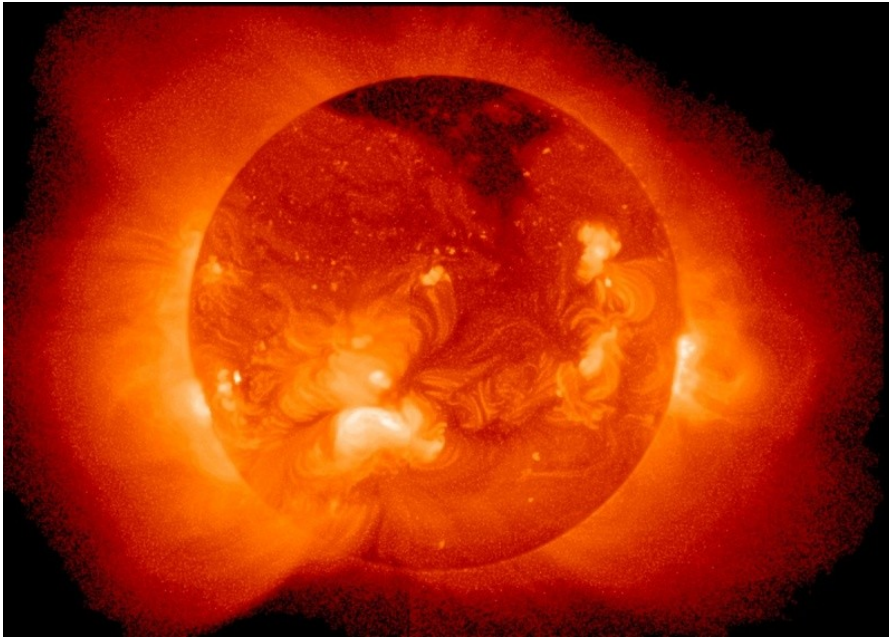

Figure 4.26. Sun with a crown

Why solar corona (the atmospheric layer of the Sun) is much hotter than the surface of the Sun? Temperature of the corona is millions of degrees and on the surface of the sun only about 5800 K. Now they postulated that the corona is heating of plasma waves produced by convection flows in the outer layers of the Sun. However, this mechanism seems unconvincing. The energy density of the sun is quite low, and the temperature inside the sun is less than 6 million degrees.

In the radio-meter waves at all the solar radiation coming from the solar corona. In the short-wave part of the optical spectrum of the entire radiation $\lambda \leq 200$ Å, coming from the Sun, also owned by the solar corona. This suggests that in the crown are intensely active processes. The land is located in the solar corona. It blows the "solar wind" - the flow of coronal gas. Its speed of the surface of the Sun is a few km /s, and near the Earth speed increases to 300 km/s. The solar wind consists of neutral and charged particles: electrons, protons, helium nuclei. The electron density near the Earth is several tens to 1 cm^3.

Now compare Figure 4.26 with a photo flame fire, shown in Figure 4.27.

Hottest part of the fire is the flame. That is where the process of combustion, i.e. compound of carbon and oxygen. This releases the binding energy in the form of photon radiation and kinetic energy of the combustion products: CO_2, H_2O, and smoke. The burning of wood is reduced to within the pyrolysis, i.e., degradation of cellulose into simple components that differ from the embers in the form of a "tree of

wind." Pyrolysis also leads to a relatively small release of binding energy, so embers heated, though not lit.

Figure 4.27. Flames of fire

After burning wood in the main fuel "Wood Wind" dies down, and the oxidation proceeds to do smut — they turn into hot coals (Figure 4.28) and destroyed.

Figure 4.28. After-burning fire: hot in the coals and broken

It is possible that the same mechanism of "burning" is supported in the stars. The following table provides a complete hydrogen pp cycle, responsible for the release of energy Star:

The reaction	Releases energy, MeV	Average response time
$p + p \Rightarrow D + e^+ + \nu$	2.0,164 + (2.0,257)	$1,4.10^{10}$ years
$e^+ + e^- \Rightarrow 2\gamma$	2.1,02	—
$p + D \Rightarrow He^3 + \gamma$	2.5,49	5,7 s
$He^3 + He^3 \Rightarrow He^4 + 2p$	12,85	10^6 years
Total: $4p \Rightarrow He^4 + 2e^+$	26,21 + (0,514) MeV	

The first three reactions are in the cycle twice. These reactions "pyrolysis" training components for the process of "burning" completely disappear inside the star. These reactions are very slow and give off little heat. However, the latter reaction is carried out mainly in the stellar atmosphere, the "fire" solar fire. In the outgoing plasma flow from the star He^3 ions have the same direction and are attracted to

each other, turning in α-particle. Aimed to create such concentrated flows inside the star is impossible. The released binding energy is realized, especially in the high kinetic energy of the reaction products. Hence it is clear reason for the sharp increase of the flow temperature of ~ 6000 K to ~ 10^6 K.

On the example of our star should review the main provisions of the program on controlled thermonuclear fusion. Should abandon the old concepts of "Coulomb repulsion" from super faced decision of complex problems of nature. It should be at a high concentration for a sufficient length of the path to create a flow of ions for the reaction:

$T + D \Rightarrow He^4 + n$
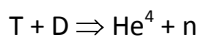
Synthesis must be "cold." Very high plasma temperatures will this reaction reversible. Of course, there stand in the way of technical and technological problems. In particular, to improve efficiency, ensure pinching (compression) of the ion flux.

When the star will burn much of the hydrogen, the pressure in the plasma flow from the star weakened. Thermonuclear reaction closer to the surface of the star and its surface will warm up areas. Then explosively reaction starts in the heated outdoor areas (overheat and start burning coals of smut!). The star becomes a spherical hydrogen bomb. The central part of the star will be strongly squeezed explosive shell. Depending on the size and mass of the star supernova process ends with one of four outcomes:

- scattering without reserve;
- becoming a white dwarf;
- conversion of a neutron star;
- transformation into a black hole.

For the considered subject matter cycle of greatest interest is the transformation of stars into black holes. Many phenomena in these objects have not been studied. For example, the emission of relativistic jets of black holes, active galactic nuclei was observed (Figure 4.29).
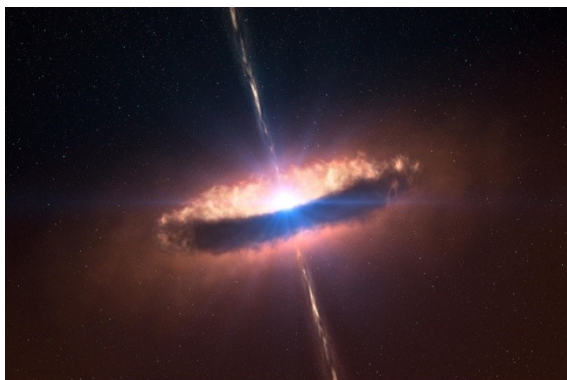

Figure 4.29. Relativistic jets of active objects

Photos have powerful jets, emitted by the accretion disk along the polar axis, which extend far (thousands of light years) off-site. The presence of relativistic jets is a clear proof of the existence formatter — the ground state of the universe.