3. Estimation parameters of particles

3.1. Longitudinal and transverse masses of electron

At Figure 3.1 shows a schematic model of the electron:

1 - toroidal vortex of neutrinos;
2 - electric vortex tube;
3- attached layer of gravitons.

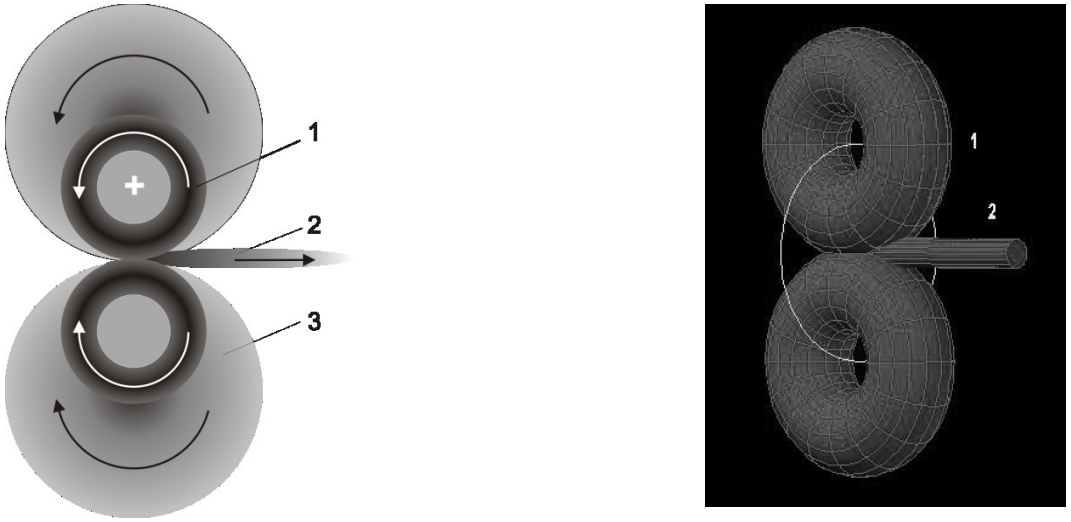

Fig.4.1. Structure of the electron

The basic relations of the special theory of relativity for freely moving point particle (particle system) are the relationships between energy E, impulse $\vec{p}$ and mass m [5]:

$$E^2 - p^2c^2 = m^2c^4 \qquad \vec{p} = \frac{\vec{v}E}{c^2}. \tag{3.1}$$

Note that here the impulse is the energy flow, rather than mass. Value (3.1) reflects the law of conservation of energy, while the expression mc^2 describes the potential energy. Based on these formulas we can write the expression for E and p:

$$E = \frac{mc^2}{\sqrt{1-\frac{v^2}{c^2}}}; \quad \vec{p} = \frac{m\vec{v}}{\sqrt{1-\frac{v^2}{c^2}}}. \tag{3.2}$$

Energy E and impulse p are components of four-dimensional vector, like the four-dimensional coordinates t and r. Therefore, equation (3.1) holds for each coordinate. Mass m and speed v is the same values with which we deal in Newtonian mechanics.

Equations (3.1) describe the motion of point particles in the entire range of speeds. On the one hand, if $v = c$, $pc = E$. Substituting this in the first equation (3.1), we conclude that if the particle moves with velocity c, then its mass is equal to zero. On the other hand, the energy of the body does not vanish when the body is at rest $v = 0$, $p = 0$. Then the rest energy $E_0 = mc^2$ or $m = E_0/c^2$. Finding the rest energy, we can calculate the mass of the particle.

Kinetic energy is defined as the difference between the total energy E and the rest energy E_0:

$$E_{kin} = E - E_0 = mc^2 \left(\frac{1}{\sqrt{1-\frac{v^2}{c^2}}} - 1 \right). \qquad (3.3)$$

By definition, mass is measured at zero impulse. But the electron can not be in absolute peace. From quantum mechanics we know that there is a minimum (eigenenergy or "zero") energy, which can not take [6]. Tabulated particle parameters (mass, charge, magnetic moment) are defined in its self (zero) energy. These are the eigen values of particles.

The increase of the electron energy is reduced to increase the angular velocity of rotation of the ring constituent neutrinos. The angular momentum of the neutrino $[r \cdot p]$ remains at h / 2, so that the size of the neutrino in particle decreases in inverse proportion to its momentum:

$$r = \frac{h}{2p} = \frac{h}{2} \frac{\sqrt{1-\frac{v^2}{c^2}}}{mv} = \frac{h}{2} \frac{c^2}{vE}.$$

The formula shows that the most powerful size reduction occurs for relativistic particles. In this case, the electron itself can not move, but to be in a bound state (e.g. to be in neutrons).

In the proposed model, the particles are not point objects, and axial symmetric vortices. Their movement should be considered in a cylindrical coordinate system, as in the ring vortices are carried out independent of motion along the axis and on the corner. Full additive energy is the sum of the energy of translational motion and rotational energy. Therefore, we rewrite the equation (4.1) for independent translational and rotational motions:

$$(E_z)^2 - p_z^2 c^2 = {m_z}^2 c^4, \quad \overrightarrow{p_z} = \overrightarrow{v_z} E_z / c^2; \qquad (3.4)$$

$$(E_\varphi)^2 - p_\varphi^2 c^2 = {m_\varphi}^2 c^4, \quad \overrightarrow{p_\varphi} = \overrightarrow{v_\varphi} E_\varphi / c^2. \qquad (3.5)$$

The notation m_z for longitudinal mass and m_φ for transverse mass are entered in the equations. Longitudinal mass is the observed inertial mass, which for the electron will continue again denoted as m.

We now apply equation (3.4) for the electron motion along the axis OZ. Please refer to Figure 3.1. Let the impulse p_z along the axis is zero. But the ring of neutrinos will continue to rotate around the axis with the light speed. The energy of these flows is the rest energy of the electron. Consequently, the longitudinal electron mass is determined by the energy of the toroidal rotation of gravitons.

In equation (3.4) the mass appears as potential energy. But when considering the wider system, it is the kinetic energy fluxes of gravitons.

Applying equation (3.5) for the transverse (or rather, angular) motion of the electron. In the plane perpendicular to the axis, neutrino revolve around the axis with a linear velocity equal to the speed of light ($v_\varphi = c$), therefore $m_\varphi = 0$. The transverse mass of the electron is zero.

Thus, the question "Where does the mass?" within the vortex model is completely eliminated. Mass is the self-energy particle, measured at zero impulse in a given direction.

Mass determined by the kinetic energy of the internal closed currents gravitons

Electrons have inertia in the progressive movement, as has the longitudinal mass. But in the transverse direction it is not inertia, because its transverse mass is equal to zero. When passing through a magnetic field the electron deflected by magnetic field in the transverse direction without making the work.

The property inertia is fully due to the rotational of the structure of the particles. Vortices do not feel a resistance when moving in the medium along the axis. The lateral application of force is turning axis of the vortex ring (Figure 1.18), i.e. its resistance in the direction of force.

In theory, the relationship between force $\vec{F} = \frac{d\vec{p}}{dt}$ and acceleration $\vec{a} = \frac{d\vec{v}}{dt}$ determined by the formula [7]:

$$\vec{F} - (\vec{F}\vec{\beta})\vec{\beta} = m\gamma\vec{a}, \quad \vec{\beta} = \vec{v}/c, \quad \gamma = 1/\sqrt{1-\beta^2}. \qquad (3.6)$$

The acceleration $a = \frac{dv}{dt}$ in the relativistic case is not intended to force $F = \frac{dp}{dt}$, but also has a component of the velocity. If the inertia mass was defined as the ratio of the current force to the acceleration, then it would depend on the mutual direction of the force and velocity. When $\vec{F} \perp \vec{v}$ equation of motion (4.6) will look like

$$\vec{F}_{\perp} = m\gamma\vec{a}, \qquad \text{and when} \qquad \vec{F} \parallel \vec{v} \qquad \vec{F}_{\parallel} = m\gamma^3\vec{a}.$$

Dependence of the parameters of the relativistic motion of the mutual direction of the force and velocity confirms, in particular, two-dimensional vortex model of the electron and justice of introducing the concepts the longitudinal and transverse mass.

3.2. Electron charge

Since there is nothing but matter in motion, then the property of the charge due to the mechanical movement of flows of gravitons in the attached to the particle layer. Forward flow of the graviton particles we take the electric field. Rotational motion attached to the particle layer gravitons appears to us the magnetic field. The magnetic field is not "created by moving charges." It is an inherent property of both the electron and the proton.

Consideration of electron model requires the redefinition of the basic electrical parameters in terms of flow in the MKS-system (meter, kilogram, second). To elucidate the physical nature of the basic concepts of electrostatics we write the expression for the energy density of the electrostatic field:

$$u = \frac{\varepsilon\varepsilon_0}{2}E^2, \qquad (3.7)$$

where $\varepsilon_0 = 8{,}85.10^{-12}$ F/m — electric constant;
ε— relative dielectric constant of the medium;
E V/m — electric field.
On the other hand, the energy density for unit volume of continuous medium flow inside the charge of an electron tube is written as

$$u = \frac{\rho}{2}v^2, \qquad (3.8)$$

where ρ kg/m^3 - flux density of gravitons in a selected volume;

$\mathbf{v}$ m/s - speed of the selected volume of the medium.

Comparing formulas (4.6) and (4.7), we obtain the relations:

$\varepsilon\varepsilon_o$ [F/m] = ρ [kg/m^3]

E [V/m] = $\mathbf{v}$ [m/s]

Absolute dielectric constant, expressed in V/m, is the flux density of gravitons in the charge tube, expressed in kg/m^3. The electric field expressed in V/m, a flow rate of gravitons in the charge tube, expressed in m/sec.

According to Coulomb's law electric field is inversely proportional to the square of the distance from the charge:

$$E = \frac{e}{4\pi\varepsilon\varepsilon_0 R^2}, \qquad (3.9)$$

where e is electron charge.

From formula (3.9) implies that the charge e in terms of flow has the dimension [kg/s]. We rewrite (4.9) in terms of flow:

$$e = 4\pi R^2 \rho v. \qquad (3.10)$$

Charge is the flux of the density of graviton through the sphere of radius R with an electron inside. Figure 3.1 schematically shown as part of the attached layer 1 gravitons trapped between the neutrinos rings and the emitted in the charge pipe.

The electric charge of an electron, expressed in C, is mass of gravitons emitted in the charge tube in one second, expressed in kg/s, with the self frequency of circular rotation ω_0

The equation of motion of charge in a relativistic form is written as:

$$\vec{F} = d\vec{p}/dt = \frac{d}{dt}\left(\frac{m\vec{v}}{\sqrt{1-v^2/c^2}}\right) = e\left(\vec{E} + \vec{v} \times \vec{B}\right). \qquad (3.11)$$

Generalized forces at the four-dimensional space will be the value f_μ:

$$f_\mu = \left(\frac{\vec{F}\cdot\vec{v}}{\sqrt{1-v^2/c^2}}, \frac{\vec{F}}{\sqrt{1-v^2/c^2}}\right) = \left(\frac{e\cdot\vec{v}\cdot\vec{E}}{\sqrt{1-v^2/c^2}}, \frac{e\cdot(\vec{E}+\vec{v}\times\vec{B})}{\sqrt{1-v^2/c^2}}\right), \qquad (3.12)$$

which is called “4-force”. The first time component of 4-vector equal power, i.e. rate of change of energy or flow of the force $\vec{F}\vec{v}$. Spatial components are the values $\vec{F}/\sqrt{1-v^2/c^2}$. Note that in (4.12) appears an expression $e\gamma$—a similar expression $m\gamma$in formula (4.6).

Recall that in the description of the electron, it referred only to the vortex core. In their motion in the environment gravitons arises vortex boundary layer perturbed environment: the body "carries" for a graviton gas. A very thin layer of gas "sticks" to the surface of the electron. Due to the viscosity of the moving gas layers partially carries with it the neighboring layers. Viscosity of gravitons vortex medium is manifested in a wave of precession. Particles of the layer at the same time participate in the toroidal and ring rotation. This rotation is converted the electron into electromagnetic complex with its own electric and magnetic fields.

The electrostatic field is formed by the rotation of the ring of the neutrino. Gravitons of attached layer trapped rotating neutrino. Then they emitted in the form of a narrow beam directed along the axis of a rotating flow of electron.

The magnetic field generated by the rotation of the attached layer of gravitons around the axis of the electron. Approximation we can assume that the mass of the attached layer with a negative velocity gradient equal to the mass of core (see Figure 2.3). You can also take that one revolution ring rotation in the charge pipe up the entire mass of attached layer m is ejected, and for one second — mass e.

The specific (unit) charge of the electron $\frac{e}{m} = \nu_o$= 1,76 • 10^{11} (s^{-1}) defines a Eigen Speed of rotation of the ring in a second. The Eigen Energy ring rotation $E_{ro} = 2\pi h\nu_o$ =1,161 • 10^{-22} J = 7,253 • 10^{-4} eV.

For comparison, the intrinsic energy of the toroidal rotation is E_o = mc ^ 2 = 8,187 • 10-14Dzh = 5,117 • 105eV.

In the ground state at zero translational velocity of the electron produces a magnetic field, which corresponds to own (spin) magnetic moment μ_s. The value is practically the same as the Bohr magneton μ_B — the product of spin h / 2 on the specific charge e/m:

$\mu_B = \frac{h}{2}\frac{e}{m}$= 9,274·$10^{-24}$ (J/T).

The spin of the electrons, is h/2, takes into account the energy of rotation of the two neutrinos around its axis in only one turnover. Electron spin is the angular momentum, moment of the mass flow: h/2 = m • c • r_o = 0,53 • 10^{-34} (J • s). Hence the radius of the electron neutrino in r_o = 1,932 • 10^{-13} m, radius of the electron in the ground state twice r_e = 3,863 • 10^{-13} m.

Magnetic moment is the rotational energy of the attached layer per second ([J = kg • m^2 • s^{-2}]), this is the moment of charge flux of the layer relative to the mean radius of the attached layer r_1:

$$\mu_s = e \cdot c \cdot r_1 = m \cdot \frac{e}{m} \cdot c \cdot r_o \cdot \frac{r_1}{r_0} = \frac{h}{2} \cdot \frac{e}{m} \cdot \frac{r_1}{r_o} = \mu_B \cdot \frac{r_1}{r_o}.$$

Hence the known value $\mu_s = 9{,}285 \cdot 10^{-24}$ J/T we find r_1 ≈ 1,934 10^{-13} m. Deviation values of the magnetic moment of the electron from the value of the Bohr magneton due to mismatch of the centers of mass of neutrinos and the associated layer (see Figure 3.1).

Scheme gravitons flows around the core of the vortex electron e shown in Figure 3.2. The flow passes through the cross-sectional area of the vortex core (magnetic moment is taken into account). Outside the electron part of the gravitons emitted along the axis of a narrow rotating beam sustained vortex tube. We fix this up as an electrostatic field E.

Another part of the vortex flow through the core of the vortex is locked outside the nucleus (considered as the flow of the vector potential $\vec{A}$). This flow is directed opposite to the movement of the electron. It also rotates around the axis at a speed close to light. The rotation of the attached layer we perceive as the magnetic field of the particle $\vec{B} = \mathrm{rot}\vec{A}$.

In the normal conductor, electrons are not focused, and the average magnetic field is zero. In the flow of the magnetic field of the electrons are added and their electric field directed along the axis of flow. In the transverse direction of the flow basis for the mutual repulsion of the electrons are not available. Pinching the arc in vacuum confirms these findings.

We note again that what we perceive as the potential energy of the electrostatic field and the magnetic field in the broader system is the kinetic energy of the translational and rotational flow of gravitons.

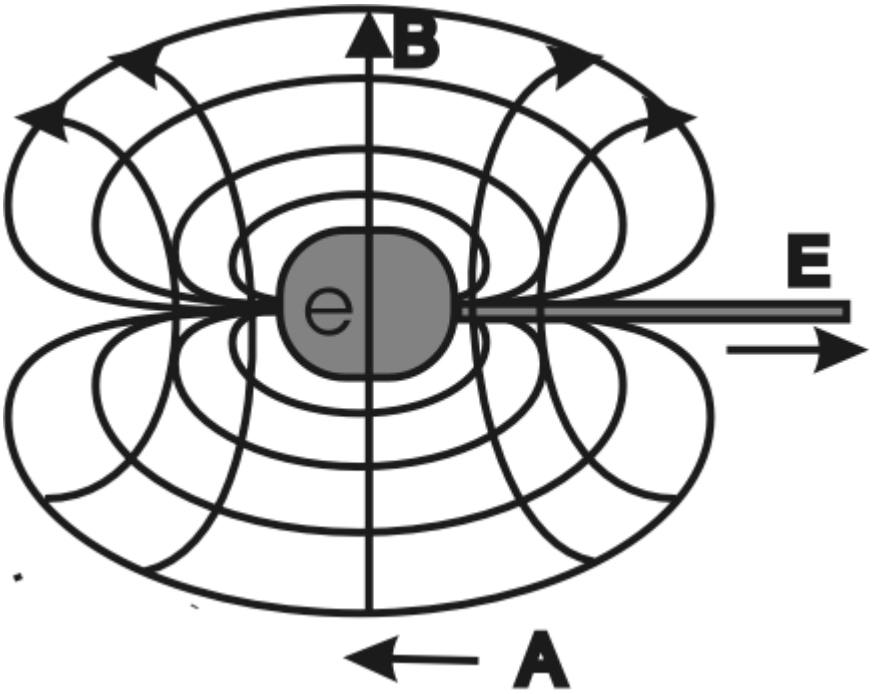

Figure 3.2. Scheme of flow field around the vortex core electron

The electric field is formed by rotating the electron beam flux of gravitons and has a directional character. Charge of an electron e is the intensity of the radiation flux measured at the natural frequency of circular rotation of the neutrino. The presence of angular momentum in the electrostatic field is detected in the effect of Hertz - Quincke – Sumoto. Dielectric sphere is rotating in a liquid placed between the plates of the capacitor. This effect was discovered by Hertz in 1881.

3.3. Characteristics of the electron wave

Centers of mass of the neutrinos in electron simultaneously with forward movement rotate around the axis of the electron, i.e. around the direction of movement. If we imagine an electron in a two point neutrino masses m_n, these masses will move in a spiral. The projections of the helical trajectories of neutrinos on a plane passing through the axis are shown in Figure 3.3. The trajectories differ in phase by 180 degrees.

The center of mass of neutrinos in a spiral reflects the wave picture of the electron. In this view are the following wave characteristics:

- λ_n - a wavelength equal to step spiral;
- v_e-electron velocity along the axis;
- R_n - amplitude, equal to the radius of the neutrino;
- ω_n - frequency of revolution around the axis of the helix neutrino OY;
- neutrino phase at a given time;
- polarization, i.e. direction of rotation around the axis OY.

The illustration on the left shows the projection of the helix on the plane XZ. Spin h/2 along the Y-axis is created by the uniform rotation of the two neutrino masses m_n circle of radius R_n with speed ≈ c. If you take the classical formulas, to estimate can be put

$$\frac{h}{2} = 2m_n \mathrm{R_n c}.$$

Hence, we obtain an expression for the radius of the neutrino, assuming $2m_n$ =m:

$$\mathrm{R_n} = \frac{\mathrm{h}}{2\mathrm{mc}} = \frac{1{,}06*10^{-34}}{2*9{,}1*10^{-31}*3*10^{8}} = 1{,}94 * 10^{-13} m$$

Radius of the electron is, respectively, 3.88 * 10^{-13} m

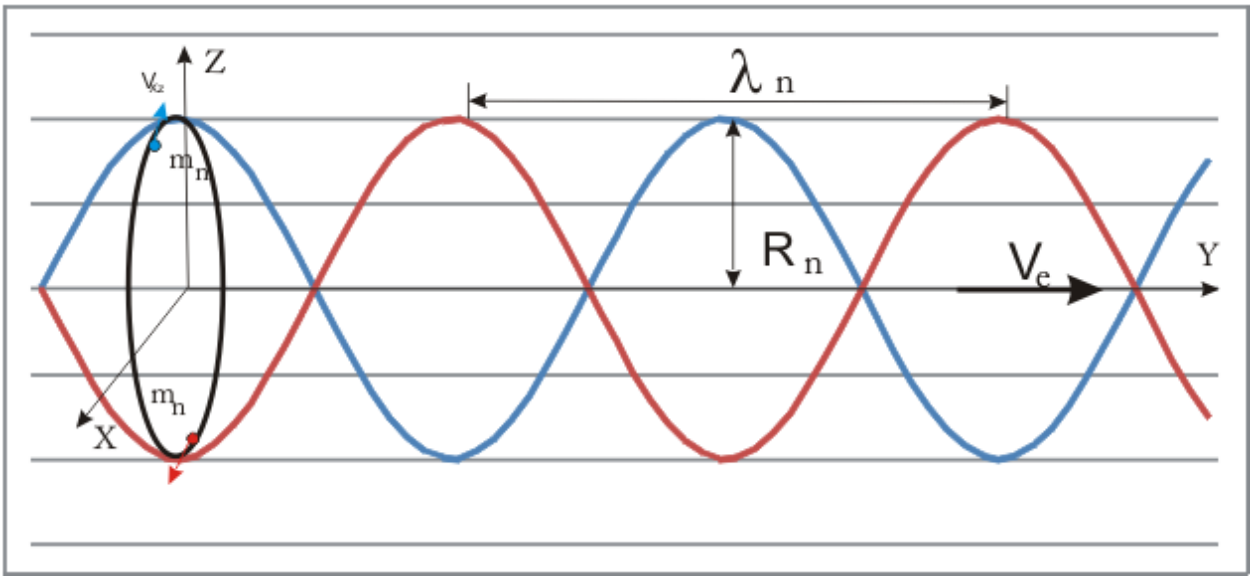

Figure 3.3. Projection on the plane spiral trajectories of neutrinos

The translational velocity of the electron v_e is given frequency ω_n of circular rotation around its axis neutrinos. And both neutrinos move along the axis of electron in a sinusoidal, representing the local wave. Wave characteristics are related

$$\lambda_n = \frac{2\pi}{\omega_n} v_e.$$

The connection between the corpuscular and wave representations through the expression for the energy of the particle. For low velocities the kinetic energy of a free electron is given by

$$E = (m v_e^2)/2.$$

The energy of a quantum with momentum h/2 is given by Planck $\mathrm{E_\omega} = (\mathrm{h}/2)\,\omega_n$.

From these formulas we obtain expressions for the wavelength: $\lambda_n = \frac{2\pi h}{m v_e}$, which coincides with the de Broglie wavelength. Wave-particle duality of the electron is a periodic change in the parameters of the internal motion of the components of the neutrino.

3.4. Mass of the photon

The assertion that the photons are quanta of the electromagnetic field is not justified. Neither in the electric or magnetic fields photons were not detected. The same applies to the recognition of light as electromagnetic wave. Photoelectric effect, Compton Effect, Raman scattering of photons speak clearly of the corpuscular structure of photons. Straightness of light flux due to the presence of photons in the transverse mass.

In the theory of relativity the mass of the system is not equal to the mass of bodies constituting the system. Consider two photons flying in opposite directions with equal energies E. The total impulse of such a system is zero, and the total energy (the same as the rest energy of two photons) is 2E, i.e. mass of this system is $2E/c^2$. But whether you then assume that the mass of each photon is E/c^2? It is not true, since the mass does not have the additive property. But then what is the physical meaning of mass system of two photons?

If the photons move in one direction then the mass of this system is equal to zero. Each of the photons, therefore, will also have zero mass. Such a formal review of the concept of mass requires further detailed consideration.

The mass of the photon is zero from (3.4). But what will happen in the collision of a photon with matter? Experiments P.N. Lebedev and the photoelectric effect Einstein's theory of more than one hundred years ago, confirmed that light exerts pressure, photons transfer energy. Consequently, the photons have the energy and momentum. But what about the mass? Could there be a power without mass? It should not take the word "massless" as analog of the word "virtual" or "intangible".

Schematic sketch of the photon is shown in Fig. 4.3. It is easy to see that the photon and electron are different, generally speaking, not composition, but only the structure, the orientation of the spins of neutrinos relative to each other. In the electron both neutrinos lie in one plane and their spins are directed in opposite directions. In the photon spins of both neutrinos are aimed at one and the same direction. Therefore we can say that the photon is an inverse electron.

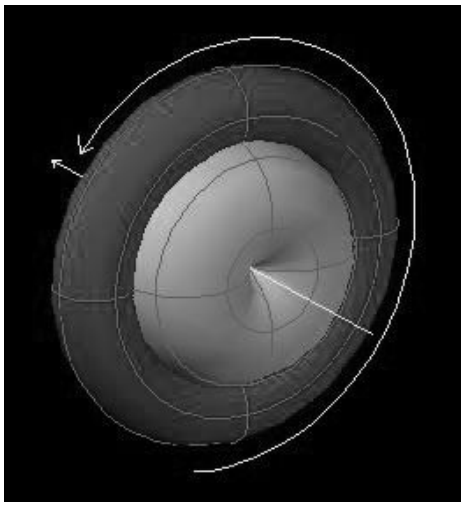

Figure 3.4. Neutrinos in a photon

Applying for the translational motion along the axis of the photon equation (3.4), we find that the longitudinal momentum of the photon $\overrightarrow{p_z} = \vec{c}\, E_z/c^2$ and the longitudinal inertial mass of a photon m_z zero.

Turn to the circular rotation of the photon. Again, we assume that the transverse motion regardless of the longitudinal. Apply the formula (3.5). A photon will have a transverse mass when $p_\varphi = 0$. Mass m_φ determined by the energy of a photon in the absence of motion in the transverse direction. This is the energy of the toroidal rotation of gravitons in the two rings of neutrinos. But it is expressed to the rest energy of an electron. Consequently, the transverse photon mass is equal to the longitudinal electron mass m.

Photons are not inertial only in the longitudinal direction: the longitudinal inertial mass is equal to zero. A beam of light is a symbol of linearity: to reject photons in the transverse direction it is necessary to overcome the inertia of the transverse mass. Deflecting force must do work. That is why the magnetic field has no effect on the flux.

Known, however, the light rays passing close to the Sun are attracted by the gravitational field. From the general theory of relativity implies that the force $\vec{F}$ of the body with a large mass M acting on a light particle with energy E moving at speeds $\vec{v}$ is determined by energy-impulse tensor and is equal to [7]:

$$\vec{F} = -G\frac{ME}{c^2 r^3}\left[(1+\beta^2)\vec{r} - (\vec{r}\vec{\beta})\vec{\beta}\right], \quad \vec{\beta} = \vec{v}/c. \qquad (3.13)$$

The theory says that the value of playing the role of "passive gravitational mass", depends not only on the energy of a particle, but also on the direction of the vectors $\vec{r}$ and $\vec{v}$. If the photon flies vertically ($\vec{v} \parallel \vec{r}$) then its "gravitational mass" is equal E/c^2. If the photon is flying horizontally ($\vec{v} \perp \vec{r}$) then its "gravitational mass" twice and is equal $2E/c^2$.

In the first case inertia is not in the longitudinal direction. The interaction of the gravitational field occurs only with the transverse energy. In the second case, besides the transverse energy, appeared inertia mass associated with the longitudinal energy of the photon.

A similar review of the structure of neutrino compels us to consider whether they have the non-observed transverse mass. In particular, for electron neutrinos and antineutrinos is equal to the transverse mass ~ $m/2$.