GRAVITY AS A GRAND UNIFICATION OF FORCES

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Any of all possible types of charges corresponds in nature to a kind of the inertial mass. Such a mass - charge duality of matter explains the coexistence of grand united rest mass and charge for the same neutrino equal respectively to its all the gravitational mass and charge which consist of the gravitoelectric, gravitoweak, gravitostrong and a range of others, innate components. From their point of view, a new grand unification theory has been created at the discussion of a question about unification of forces of a different nature. In this theory, the gravitational field must be naturally united gauge field of the unified system of the most diverse combinations of electromagnetic photons, weak bosons and strong gluons where the four pairs of forces of the micro world fundamental interactions are united. Some consequences and laboratory confirmations of the suggested theory have been listed which allow also to define the structure of the graviton as a grand united boson. Thereby it gives the possibility to directly look at the nature of the gravitational matter elucidating the interratio of intraneutrino forces and the problem of elementary particles chiral and mirror symmetries.

Owing to a mass - charge duality [1] of matter, any micro world interaction has the gravitational behavior. At the same time a question about the structure of gravity remains thus far not finally investigated. It is usually assumed that the gravitational force cannot appear at the micro world level due to its weakness.

However, in spite of this, one can with confidence state that there exists a real possibility of observation not only of massive neutrinos [2] or photons [3] but also of the gravitomagnetic force of the Earth [4]. Therefore, to a measurement of rest mass of the neutrino [5] or the photon [6] one must apply as to one of the available laboratory data [7] confirming the existence of microgravity and saying that nobody is in force to define the structure of elementary particles fundamental interactions regardless of gravity.

The nature is created so that each type charge in it be have the possibility to exist only in the presence of a kind of the inertial mass. Therefore, any of existing types of masses testifies in favor of the availability of a kind of charge. Such a mass - charge duality of matter implies the coexistence of the united rest mass m_ν^U and charge e_ν^U for the same neutrino [1] equal respectively to its all the mass and charge including the electric (E), weak (W), strong (S) and some others, innate contributions:

$$m_\nu^U = m_\nu^E + m_\nu^W + m_\nu^S + ..., \tag{1}$$

$$e_\nu^U = e_\nu^E + e_\nu^W + e_\nu^S + ... \tag{2}$$

Of course, the united mass can contain the part that corresponds to the gravitational charge [8]. Their existence as the structural parts of the united rest mass and charge implies the availability of the fifth force [8, 9] of interaction between the particles. It come forwards in the system as a harmony of the four remaining forces. But its regularity has not yet been discovered in measurements [10].

Another possibility is that regardless of whether or not the fifth force exists, all the mass of a particle is strictly the gravitational. However, in the form as was developed, the standard electroweak theory [11, 12, 13] is not in state to elucidate whether a particle gravitational rest mass and charge coincide with its all the mass and charge, if yes, what neutrino united mass and charge say about unification of forces of a different nature.

Here we investigate this question studying the ideas of each of all possible

types of charges and masses of the neutrino which may serve as the source of naturally united gauge field.

According to a mass - charge duality of matter, Newton's force of gravitation $F_{N_{\nu\nu}}$ between the two neutrinos and Coulomb's force $F_{C_{\nu\nu}}$ among them [14] must be defined from point of view of any of existing types of actions. In other words, each of all possible types of forces includes both a kind of the Newton and a kind of the Coulomb contributions [9]. In this, the gravitational structure is said of any force of the micro world interaction.

In conformity with these implications of the neutrino mass and charge, we not only conclude that

$$m_\nu^{GU} = m_\nu^G = m_\nu^U = m_\nu^{GE} + m_\nu^{GW} + m_\nu^{GS} + ..., \tag{3}$$

$$e_\nu^{GU} = e_\nu^G = e_\nu^U = e_\nu^{GE} + e_\nu^{GW} + e_\nu^{GS} + ..., \tag{4}$$

but also must recognize that gravitation come forwards in nature as a grand unification. Herewith the gravitational (G) rest mass and charge of the neutrino are strictly its grand united (GU) mass and charge which include the gravitoelectric (GE), gravitoweak (GW) and the gravitostrong (GS) parts.

For our further purposes it is desirable to present Newton's and Coulomb's forces explained by the corresponding components of grand united masses and charges of interacting objects in general form as follows:

$$F_{N_{\nu\nu}}^{GK} = G_N \left(\frac{m_\nu^{GK}}{R}\right)^2, \quad F_{C_{\nu\nu}}^{GK} = \frac{1}{4\pi\epsilon_0}\left(\frac{e_\nu^{GK}}{R}\right)^2, \tag{5}$$

where $K = E$, W, S, and G_N is the constant of gravitation.

Exactly the same one can define the structure of the studied forces for grand united masses and charges:

$$F_{N_{\nu\nu}}^{GU} = G_N \left(\frac{m_\nu^{GU}}{R}\right)^2, \quad F_{C_{\nu\nu}}^{GU} = \frac{1}{4\pi\epsilon_0}\left(\frac{e_\nu^{GU}}{R}\right)^2. \tag{6}$$

Inserting (3) and (4) in (6) uniting the findings with (5) and having in view of equalities

$$|\vec{m_\nu}^{GU}|^2 = (m_\nu^{GE})^2 + (m_\nu^{GW})^2 + (m_\nu^{GS})^2 + ...,$$

$$|\vec{e_\nu}^{GU}|^2 = (e_\nu^{GE})^2 + (e_\nu^{GW})^2 + (e_\nu^{GS})^2 + ...,$$

which become possible owing to the vector nature of their structure [9], we are led to the implication that

$$F^{GU}_{N_{\nu\nu}} = F^{GE}_{N_{\nu\nu}} + F^{GW}_{N_{\nu\nu}} + F^{GS}_{N_{\nu\nu}} + ..., \tag{7}$$

$$F^{GU}_{C_{\nu\nu}} = F^{GE}_{C_{\nu\nu}} + F^{GW}_{C_{\nu\nu}} + F^{GS}_{C_{\nu\nu}} + ... \tag{8}$$

Furthermore, if it turns out that the gravitoelectric $F^{GE}_{\nu\nu}$, gravitoweak $F^{GW}_{\nu\nu}$ and the gravitostrong $F^{GS}_{\nu\nu}$ forces among the two neutrinos are, according to an idea of each of (5), equal to

$$F^{GK}_{\nu\nu} = F^{GK}_{N_{\nu\nu}} + F^{GK}_{C_{\nu\nu}}, \tag{9}$$

a grand united force $F^{GU}_{\nu\nu}$ between themselves may be expressed from point of view of any of (6) in general form:

$$F^{GU}_{\nu\nu} = F^{GU}_{N_{\nu\nu}} + F^{GU}_{C_{\nu\nu}}. \tag{10}$$

This solution together with (7) - (9) allows to conclude that

$$F^{GU}_{\nu\nu} = F^{GE}_{\nu\nu} + F^{GW}_{\nu\nu} + F^{GS}_{\nu\nu} + ... \tag{11}$$

Such a regularity leading to the appearance of grand united gauge field of strong and electroweak matter takes place owing to the unified gravitational structure of fundamental forces. They constitute herewith the interaction grand united force which come forwards in nature as a unique gravity.

Insofar as the magnetic forces are concerned, we start from a requirement [15] that a possibility of the existence of Dirac fermions having simultaneously as well as the magnetic charges is not excluded. Therefore, to include the magnetic forces in the discussion one must write (1) and (2) at the account of magnetic rest mass m^M_ν and charge e^M_ν for the neutrino. This gives the right to replace (11) for

$$F^{GU}_{\nu\nu} = F^{GEM}_{\nu\nu} + F^{GW}_{\nu\nu} + F^{GS}_{\nu\nu} + ..., \tag{12}$$

in which appears a contribution of the united gravitoelectromagnetic force

$$F^{GEM}_{\nu\nu} = F^{GE}_{\nu\nu} + F^{GM}_{\nu\nu}, \tag{13}$$

where the corresponding gravitomagnetic force has the size

$$F^{GM}_{\nu\nu} = F^{GM}_{N_{\nu\nu}} + F^{GM}_{C_{\nu\nu}}. \tag{14}$$

There exists, however, the possibility [16] that any electrically charged particle testifies in favor of the existence of a kind of the magnetically charged monoparticle possessing the magnetic rest mass and charge. Such a sight to nature of fundamental symmetry between the electricity and the magnetism quality explains the fact that the presence of the photon γ_E with the electric mass [3, 6] and charge [17] implies the existence of a kind of the monophoton γ_H with the magnetic mass and charge. From this point of view, the gravitoelectromagnetic field $(\vec{E}, \vec{H})$ must arise as the field of the unified system of the photon and monophoton (γ_E, γ_H) where the two pairs of forces of the gravitoelectric and the gravitomagnetic nature are united. We can therefore call the latter an electromagnetic boson:

$$\gamma_{EM} = (\gamma_E, \gamma_H). \tag{15}$$

Such a photon together with intermediate particles of weak interaction constitutes an electroweak boson:

$$\gamma_{EW} = (\gamma_{EM}, W), \tag{16}$$

where W denotes the weak neutral or charged bosons.

These facts and all what neutrino mass and charge say about the structure of gravity lead us to the implication that the gravitational field is strictly a grand united field of the unified system of the most diverse combinations of the photon, monophoton, weak bosons and strong gluons (g) where the four pairs of forces of the micro world interaction are united. However, such characteristics as the spin - isospin and the internal symmetries of the structural particles play here a crucial role. In this, complicated structure is said of the graviton which can be called a grand united boson:

$$\gamma_{GU} = \{\gamma_{EM}, W, g\}. \tag{17}$$

Here it is essentially to note that at the availability of the electric mass, the neutrino must possess each of charge [14, 18] e^E_ν, magnetic [19] μ^E_ν, anapole a^E_ν and electric dipole d^E_ν moments [20]. Such a connection between the mass of a particle and its Coulomb's nature can explain also the existence of gravitational field of magnetic moment [21] as well as of charge [14], anapole and electric dipole currents. It is not excluded, however, that from point of view of mass - charge duality of matter, any of existing types of charges come

forwards in the system as the source of a kind of the dipole moment [22]. Therefore, if it turns out that $e_\nu^K(\mu_\nu^K)$ and $a_\nu^K(d_\nu^K)$ characterize respectively the vector and axial - vector components of the neutrino interaction with all gauge bosons, this will indicate to the appearance of vector and axial - vector parts of the graviton field.

At first sight, it appears that here as a unique boson (17) gravitons may be described by vector field. But this is not quite so. The point is that the same vector constitutes only the straight line. The same corresponding individual force nohow influence to a given procedure and that, consequently, field of such an action remains still linear. Unlike this, the gravitational force arises as a consequence of harmony of the four pairs of fundamental forces. However, at the interratio of intragraviton forces, their individual vectors become naturally warping vectors which constitute only the curve line.

It is already clear from said that curvature of space and time reflects the availability of harmony of forces of a different nature. Therefore, to understand the nature of elementary particles at high dynamical level one must consider the individual field of each of gauge bosons as a naturally warping field of the unified system of the two vector fields of Newton's and Coulomb's nature where a fundamental part is said of mass - charge duality of matter [9]. This becomes the more so interesting, if include in the discussion of interratio of intranuclear forces. Their harmony answers to the rotation of electrons around the nucleus. At such a situation, the vectors of individual forces must be naturally warping. As a consequence, the motion of electrons with linear velocity is orbital, and not straight line.

One of further predictions of our theory is the existence of antigravity [23]. From its point of view, the latter reflects just characteristic features of strong and electroweak phenomena because they constitute a grand united gravity. In other words, a question about an invariance of the gravitational interaction concerning C, P and T, and also their combinations CP and CPT is intimately connected with the behavior of its structural parts.

The violation of P - parity at the expense of a particle rest mass [24] leads to the origination of interconversions $\nu_L \leftrightarrow \nu_R$ and $\overline{\nu}_R \leftrightarrow \overline{\nu_L}$, for example, at the longitudinal polarized neutrinos (antineutrinos) scattering on nuclei [25, 26]. In the framework of the standard electroweak theory, the existence of such transitions implies the absence of chiral invariance.

According to the correspondence principle, the neutrino chirality is basically violated due to helicity nonconservation [26] as a consequence of the availability of mass [27, 28]. Therefore, chiral and mirror symmetries may exist only in the case where gravity is absent.

Thus, it follows that if nature itself is not in force to create a quality picture of the micro world fundamental interactions regardless of gravity then unlike earlier known, our grand unification theory must be chirally antisymmetrical theory describing simultaneously both left - and right - handed neutrinos. Thereby it predicts as well as the coexistence of massive neutrinos of Dirac and Majorana types [24].

At the same time it is well known that the standard electroweak theory is based on groups $SU(2)_L$ and $U(1)_\gamma$ which constitute an electroweakly united group G_{EW} namely

$$G_{EW} \supset SU(2)_L \otimes U(1)_\gamma. \tag{18}$$

According to this theory, right - handed neutrinos have no neither weak, electromagnetic nor any other the interaction, and left - handed neutrinos can interact only with field of weak emission. It is accepted in addition that the same photon leads to the appearance of both electric and magnetic fields.

To define compound structure of electroweak group (18) from point of view of the discussed grand unification theory one must use an idea of each of (15) and (16) that

$$U(1)_\gamma \Longrightarrow U(1)_{\gamma_{EM}} \Longrightarrow U(1)_{\gamma_E} \otimes U(1)_{\gamma_H}, \tag{19}$$

$$SU(2)_L \Longrightarrow SU(2)_{L,R} \Longrightarrow SU(2)_L \otimes SU(2)_R. \tag{20}$$

In these circumstances, the presentation (18) is replaced for

$$G_{EW} \supset SU(2)_L \otimes SU(2)_R \otimes U(1)_{\gamma_E} \otimes U(1)_{\gamma_H} \tag{21}$$

and it is assumed that in the framework of chirally antisymmetrical electroweak theory, there exists a fundamental symmetry between the gravitoelectricity and the gravitomagnetism.

Passing to a question about gauge group of the suggested grand unification, one can as a starting recall that color (C) group $SU(N_C)_C$ at $N_C = 3$ has important consequences for strong interactions and their unification with electroweak ones [29]. There are, however, many uncertainties both in nature and in structure of leptonic, hadronic and purely neutrino [24] families of

elementary particles. Nevertheless, if it turns out that lepton number may be accepted as the fourth color [30], this indicates to the existence of color group $SU(4)_C$ including as well as the neutrino strong interaction [31]. The latter together with an electroweakly united group (21) would lead us to the implication that

$$G_{GU} \supset SU(4)_C \otimes SU(2)_L \otimes SU(2)_R \otimes U(1)_{\gamma_E} \otimes U(1)_{\gamma_H} \qquad (22)$$

and group of grand unification G_{GU} describes the gravitational interaction with the unified field of emission.

Insofar as the form of grand united interaction is concerned, we must have in view of earlier treated that each of electromagnetic, weak and strong bosons come forwards in the system as the source of a kind of the warping field which constitute one component of a unique gravity. Thereby it plays an important part in establishing the fundamental symmetry between the gravitational and the gauge fields. In other words, a mass - charge duality quality explains the nature of well known gravity - gauge duality [32]. In this, the current - current structure is said of the gravitational interaction.

At first sight, such a conclusion is not very standard. On the other hand, as follows from considerations of symmetry, number of components in all types of fundamental forces must coincide [9]. At the same time the nature itself has simultaneously both an electroweak and the strong interactions. This becomes possible owing to their unified gravitational behavior.

If now taken into account that nobody is in force to separate any particle by part in the mass or charge individual components dependence, no doubt that the gravitational field come forwards in nature as the unified and the whole. Therefore, according to the discussed theory, it should be expected that ether exists as a grand unification of naturally united gauge fields.

To characterize such a unusual picture from point of view of highly mysterious Michelson - Morley experiment [33, 34, 35], it is very important to elucidate whether there exists a connection between the mass of the photon and its spin nature, if yes, what expected dependence says about the light scattering on the suggested world medium.

From this purpose, we must at first recall the neutrino polarization. As known [36], massless neutrinos are strictly longitudinal polarized. However, at the availability of a non - zero mass, the longitudinal neutrinos in the nucleus charge field will convert into the transversal ones, and vice versa [37].

They confirm of course the fact that the same neutrino must have either longitudinal or transversal polarization. Then it is possible, for example, transitions between the two neutrinos of the most diverse types of polarization may serve as an indication to the existence of fundamental differences both in nature and in masses of longitudinal and transversal particles [26, 37].

There exists a range of other phenomena, in which an intimate connection is said between the photons in their polarization type dependence. One of them is that the same massive photon must not be simultaneously both longitudinal and transversal bosons. It nohow has the longitudinal as well as the transversal polarization, if its mass is absent. Unlike massless neutrinos, the photons with zero mass are strictly circular polarized. It is fully possible, therefore, that the availability of mass in photon transforms the circular polarization into the longitudinal or the transversal ones. As a consequence, the longitudinal photons in the nucleus field can be converted into the transversal ones, and vice versa.

A given circumstance is not casual or explained by predictions of supersymmetry. It reflects just a sharp spin polarization type dependence of the photon mass and nature.

The difference in nature of longitudinal and transversal particles leads to their interconversion. In these conditions, an incoming flux of longitudinal (transversal) polarized neutrinos or photons at his passage through the nucleus suffers considerable warping on the trajectory.

From point of view of nuclear target itself, this angular deflection testifies in favor of its rotation around his axis, at which curvature of field of action is strongly changed. Analogous situation takes place in the case where originates an instantaneous reestablishment of harmony of interacting forces. Such an order, however, may exist even regardless of the source of field.

Returning to the Michelson - Morley ether experience [33, 34, 35], we recall that its purpose was to discover an absolute speed of an ether wind concerning the Earth and thus, establishing the existence of truly stationary frame of reference, in which it is at rest.

For this was used physical instrument (Fig. 1) called a Michelson interferometer. In it an incoming beam of light A with the aid of a half - silvered glass plate splits into the two interperpendicular parts C and D moving with corresponding speeds concerning the ether. Next, these beams are reflected

from a non - transparent mirrors placed at equal distances from a half - transparent glass plate. The optical system of such that both beams C and D are returned to the same screen, in which appears their interference picture.

If any of light beams C or D in the interferometer changes length of his path, the picture of interference bands must be moved in optical device. To observe this shift one must rotate an instrument around the stationary basis at an angle 90^0, at which the two light beams exchange orientations of their paths (Fig. 2) concerning the direction of an ether wind. In these circumstances, one of light beams C(D) or C'(D') in Michelson's and Morley's opinion at his passage through the ether from a half - silvered glass plate to detector suffers the delay at the time. As a consequence, an interference picture will move in optical system in the apparatus rotation dependence.

According to the description of both authors, the interference bands of the two observed beams in comparison with a certain middle position of the screen twice in one turn of an instrument must move at first to the right direction and next, to the left ones, and vice versa.

Such a shift, however, was not discovered at all. But unlike earlier expected, the displacement of interference pictures depending on an angle of turn of the device was only in one direction namely either to the right or to the left. To this unexpected phenomenon Michelson and Morley apply as to one of the available obstacles of unknown origination and exclude its from the further consideration. At these conditions, a proof has been obtained that ether not exists, and the speed of light in vacuum is the same in all directions and do not depend on the motion of its source and of the observer.

Of course, such an implication were based actually on the assumption of that the existence of an ether see would lead to the delay at the time of one of light beams C(D) or C'(D') at the rotation of instrument. This is explained by some predictions of classical theory of an ether wind. It states that ether is strictly truly stationary medium, in which moves all physical objects and therefore, their velocity is intimately connected with its nature.

The absence of an ether see implies that all matter moves in absolutely empty space. Such a possibility is, however, realized only in the case where space is naturally straight linear, and not warping.

From our earlier developments, we find that the unified world picture of all physical phenomena is created on the basis of grand unification of naturally

united fundamental forces. Their gauge field of action is strictly warping. This curvature leads us once again to the conclusion that ether exists in nature as a unique gravity which unites the strong and electroweak matter.

If such an idea is accepted, the purpose of the Michelson - Morley experience is reduced to the definition of speed of a gravitational wind concerning the Earth and thereby to the establishment of its existence.

As a consequence, at the turn of interferometer at an angle 90^0, the two light paths exchange their orientations in comparison with the direction of a gravitational wind. In these conditions, one of light beams C(D) or C'(D') passing through the gravitational see from a half - transparent glass plate to the optical device similarly to the above - mentioned angular deflection in the nucleus field of the flux of longitudinal (transversal) polarized neutrinos or photons suffers considerable warping on the trajectory, and not delay at the time. Therefore, the observed shift of interference bends depending on an angle of rotation of the apparatus must be either to the right or to the left direction concerning a certain middle of their position.

Such a geometrical picture of the phenomenon unexpectedly discovered in the Michelson - Morley experience may serve as the first laboratory confirmation of an angular deflection of light as a consequence of interconversion of light beams in their spin polarization type dependence.

However, from point of view of general theory of relativity, gravity can essentially change the trajectory of light. Thus, if an absolute emptiness is nohaw in force to bend light, we must recognize that an ether see exists as a gravitational field.

According to the suggested grand unification theory, this implies that gravity is responsible for generalized principle of Einstein's relativity. In other words, all physical phenomena originate in an absolutely warping gravitational see, in which nobody is in force to observe the strictly straight linear and uniform motion of one particle concerning the second ones.

Such a unified world curvature reflects the availability of a unique harmony of naturally warping forces.

Here an important circumstance is the fact that light used in Michelson's interferometer has the gravitoelectromagnetic structure. Its source must be unified system of the photon and monophoton which come forwards in nature either as a particle (15) or as an electromagnetic wave.

At the availability of a non - zero mass, the structural bosons of a given system suffer the periodical interconversion [16]. The speed of these transitions coincide with individual velocities of the photon and monophoton and do not depend on speed of the united system itself. Therefore, the electromagnetic light with his constant speed regardless of whether it has corpuscular or wave nature, must possess either longitudinal or transversal polarization owing to which, ether becomes in force to bend its trajectory. Of course, in such phenomena appears as well as a fundamental part of an absolute symmetry law between the electricity and the magnetism.

Another consequence of the discussed ether experience is that warping of electromagnetic light in Michelson's interferometer reflects the availability of gravitoelectromagnetic component of a unique gravity. Thereby it says in favor of correspondence principle which states that each of gauge bosons may serve as the source of a kind of light. From its point of view, the existence of strong and weak light beams is by no means excluded experimentally. They together with electromagnetic light constitute naturally united light beam which come forwards in the universe either as a grand graviton (17) or as a gravitational wave. In this, a great responsibility is said of gravity for the structure of light as well as for its behavior.

So, it is seen that naturally light namely light of an astronomical objects has the gravitational nature. Its source is unified system of electromagnetic, weak and strong bosons which constitute the corresponding components of a unique gravitational light.

This convinces us here in that each type light must exist as a consequence of the availability of a kind of the united force. Such a sight to nature of light is quality confirmed also by the comparatively new laboratory measurements of gravitomagnetic force of the Earth [7]. Insofar as the absence of the reliable practical information about the graviton mass is concerned, we recognize that the above - noted regularities of naturally united gravitational field take place regardless of whether or no an innate supersensitive detector there is at our disposal for their discovery.

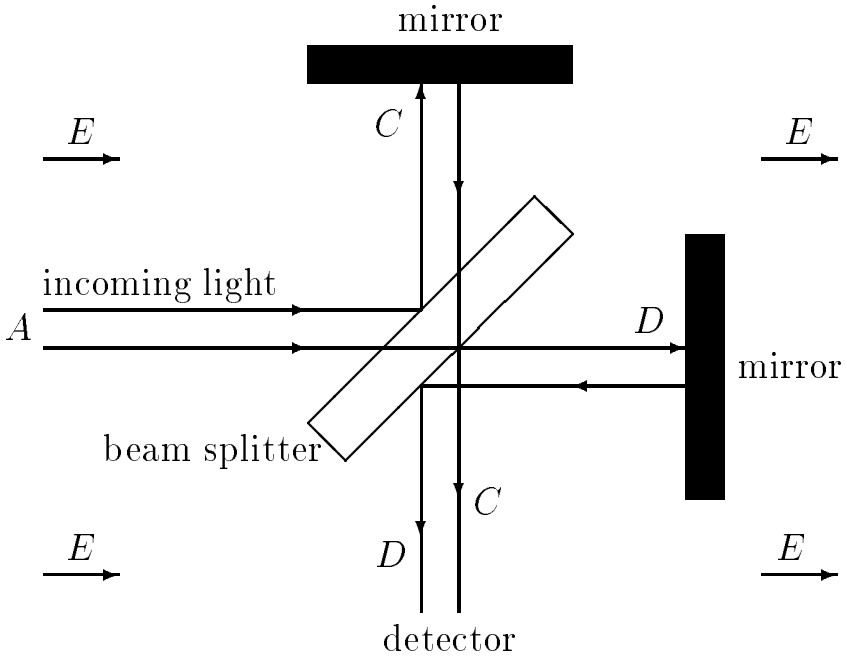

Fig. 1. Scheme of the Michelson - Morley ether (E) experience.

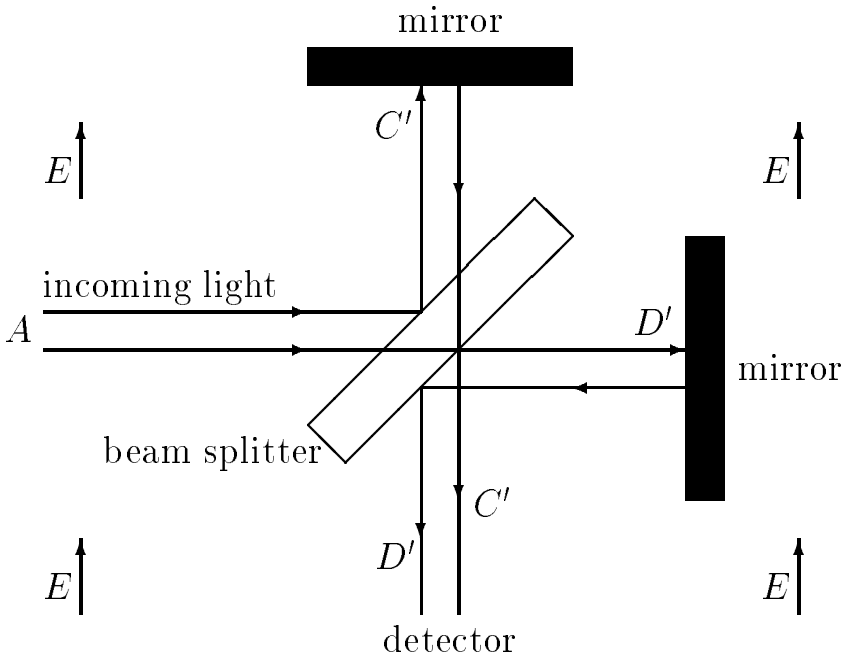

Fig. 2. Ether (E) at the rotation of Michelson's interferometer.

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