On the Nature of the Ether-Drift, Magnetic Strength, and Dark Matter

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ABSTRACT

A new in principle idea on the generality of the nature of the ether-drift and magnetic strength is set forth in this paper. The idea is based on a hypothesis, expressed earlier by the present author, according to which a huge world of ponderable particles at the subelectronic level fills the space of the universe. Vortical fluxes of the particles form the transversal (cylindrical) field-space, which is perceived and detected as a magnetic field. Near Earth's surface, these (magnetic) fluxes are detected within optical and millimeter bands as ether-drift. It is shown that the subelectronic particles, constituents of the interstellar and intergalactic magnetic fields, can be regarded as real candidates for the nonbaryonic dark matter in the universe.

Key words: general physics, classical field theory, ether, magnetic field, units and standards, particle theory, astrophysics, dark matter

Ŕesumé

Une nouvelle idée de principe sur la généralité de la nature de la dérive de l'éther et de la force magnétique est avancée dans cet article. L'idée est basée sur une hypothèse, exprimée plus tôt par l'auteur, selon laquelle un monde énorme de particules pondérables de niveau sous électronique remplit l'espace de l'univers. Des flux de vortex de particules forment l'espace champ (cylindrique) transversal, qui est perçu et détecté en tant que champ magnétique. Près de la surface de la terre, ces flux (magnétiques) sont détectés à l'intérieur des bandes optiques et millimétriques comme la derive de l'éther. Il est démontré que les particules sous électroniques, constituants des champs magnétiques interstellaires et intergalactiques, peuvent être considérés comme de réels candidats pour la matière grise « non-baryonique » dans l'univers.

1. Introduction

The previous work of the author [1] was devoted to the problem of the mass of photons and neutrinos. There it was shown that the mass of a photon is not equal to zero and its value correlates with the masses of neutrinos estimated in recent years. The consideration in the work was based on the results of a detailed analysis carried out in Ref. [2] concerning the atomic structure and the nature of wave processes. The presumed parameters of the wave space, composed of subelectronic particles of the resulting masses, in reference to the above photons and neutrinos, were calculated in Ref. [1].

In the reference works it was stated that myriad particles of the subelectronic level are involved in the wave process caused by perturbation of electron states in atoms. There is a huge world of tiny particles that belong to the level lying below the electron one. For them, Earth is in to the highest degree a rarefied spherical space. These particles pierce Earth just as freely as asteroids pierce the space of the solar system and galaxies. Calculations performed in Ref. [1] showed that their masses coincide with the masses ascribed in the last decade to neutrinos.

It was also supposed that just the directed motion of the subelectronic particles, i.e., their fluxes, form observable fields in space regarded in contemporary physics as magnetic fields. This means that the fluxes of subelectronic particles, called the magnetic field, surround a conductor with a current, a bar magnet, and our Earth and fill up interplanetary, interstellar, and intergalactic spaces. The vortical fluxes of the particles belong to the cylindrical (transversal) field-space of the subelectronic level. As appears from Ref. [1], the mass spectrum of the particles coincides with the mass spectrum of the neutrinos. The ultimate estimated value of the mass of electron neutrinos, known from the literature, does not exceed $m_\nu = 20\,eV \approx 4\times10^{-5} m_e$. The dominant values of masses of subelectronic particles, which were derived in Ref. [1], range from $m = 68.22\times10^{-7}\, m_e$ to $m_\nu = 136.44\times10^{-9} m_e$.

We believe that the aforementioned supposition (hypothesis) put forward first in Refs. [1] and [2] can contribute to an understanding of the nature of dark matter and untangle as a result some problems of physics and astrophysics. It can help to reveal the nature of the ether-drift, which was measured credibly enough in detailed experiments carried out by Miller on sensitive apparatuses from 1906 through the mid-1930s [3, 4]. His results were repeated in 1929 by Michelson, Pease and Pearson [5]. Experiments by other researches, including those performed quite recently in 2001 and 2002 [6, 7], confirmed and specified Miller's results on the ether-drift speed and its direction.

It should be noted that the preliminary Michelson-Morley experiment of 1887 [8] involved only 6 h of data collection over 4 days. Therefore the slight positive result obtained in this (imperfect as it turned out latter) experiment had relatively high uncertainty. Naturally, modern physics ignored this originally obtained result as unconvincing. Unfortunately, the negative conclusion on the existence of the ether, hasty made in 1887 just on the basis of this preliminary result, was accepted and used by leading physicists as the firm argument in the well-known struggle of physical ideas on the structure of space that took place at that time, the time of the appearance of the relativity theory.

Analysing the results of the aforementioned experiments [3-8], we find that ether-drift proved to move approximately along the same direction as the horizontal component of Earth's magnetic field in the middle altitudes. No scientists had previously turned their attention to this important circumstance. The axis of the drift appears to be roughly perpendicular to the plane of the ecliptic.

Resting on the above finding and the data obtained for the ether-drift speed, we put forward here an idea that the observed ether-drift is nothing else but the directed motion (flux) of subelectronic particles, identical to the magnetic flux. This idea allows us, knowing the speed of the flux ("ether-drift") and the characteristic parameters of the magnetic field, to estimate the concentration of subelectronic particles in the flux. We can thus estimate thus the concentration of subelectronic particles both near the Earth's surface and in interstellar space, in particular, in the Milky Way galaxy, whose magnetic field strength is known on average, and then in intergalactic space. In the latter case indeterminacy of such estimation will be, obviously, much higher because of the high indeterminacy in the order of magnitudes for intergalactic magnetic strengths, which are only roughly estimated at present. In this way, the new idea can shed light on the nature of dark matter. The latter issue is one of the main aims of the present paper, which is based on the ideas and results of Ref. [1] and is its natural continuation.

From measurement of the rotation parameters of spiral galaxies like the Milky Way, calculations show that at least 90% of the mass of any galaxy – and possibly as much as 99% of the mass of the universe – is in the form of matter that cannot be seen and called therefore dark matter. There are a few candidates for dark matter in galaxies. Among them are the so-called massive astrophysical compact halo objects (MACHOs) (such as planets, dead or unborn stars, black holes, etc.), which do not emit electromagnetic radiation. A significant amount of dark matter, as astrophysicists assume, can be "hidden" in neutrinos if their mass is in the range $(0.2-1.0)\times 10^{-4}\, m_e$ $((10-50)\, eV \times c^{-2})$ or at least more than $2\times 10^{-6}\, m_e$ $(1 eV \times c^{-2})$. Convincing evidence that neutrinos have mass of the latter magnitude was obtained in the SuperKamioKande experiment in Japan [9]. Another hypothetical candidate for dark matter is the family of heavier neutral particles predicted by the so-called supersymmetric (SUSY) extension to the standard model. They are known as weakly interacting massive particles (WIMPs) (the most known among them is the neutralino).

We assume that subelectronic particles, including those having mass equal to the mass ascribed in Ref. [1] to photons and neutrinos, are reliable candidates for the dark matter demonstrated in this paper.

The supposition set forth here that the observed phenomenon called ether-drift is due to the flow of subelectronic particles is based on, and originates from, a new view of the nature of both magnetic fields and wave physical field-spaces in general. What is specific in this view, in the understanding of nature, is considered in detail in Ref. [2]. We begin here from the concise elucidation of the main aspects and definitions of just this question.

Obviously, the nature of wave field-spaces is the question of the principle of the whole of physics. The elucidation below, in the beginning, is necessary as the basis for further consideration to achieve the purpose announced here.

2. The main parameters of the wave physical space

We regard [2] the *mass* of physical space m as the *amount of physical space* of an *embeddedness* ε, defined by the equality

$$m = \varepsilon V = \varepsilon_r \varepsilon_0 V\,, \tag{1}$$

where V is the volume of the space. The embeddedness $\varepsilon = \varepsilon_r \varepsilon_0$, in other words, is the density of the space, where ε_r is the relative density and $\varepsilon_0 = 1\, g \times cm^{-3}$ is the absolute unit density of the space. The notion of “embeddedness” originates from the dynamic model of elementary particles [10]. According to the latter, the physical field-space of the universe represents by itself an infinite series of spaces embedded in each other. All details concerning this notion can be found in Ref. [10], which is accessible online in PDF format.

For a more accurate description of the wave physical space, we operate with the *kinematic vector-speed E*, at the level of the basis space. To stress its directed character, one can use the symbol **E**. The reference dimensionality of the vector-speed E is $cm \times s^{-1}$.

The dynamic vector, conjugate to the kinematic E vector, is defined as

$$D = \varepsilon E = \varepsilon_r \varepsilon_0 E\,. \tag{2}$$

We can see that the D vector is a vector of the *density of momentum of physical space* with the embeddedness ε; its dimensionality is $(g \times cm \times s^{-1}) \times cm^{-3}$.

Vectors D and E are used for the description of the longitudinal wave field. The analogous pair of vectors H and B presents the transversal wave field

$$H = \varepsilon B = \varepsilon_r \varepsilon_0 B\,. \tag{3}$$

Vectors D and E describe the *spherical* (“electric”) wave field of the basis space; while H and B describe the *cylindrical* (“magnetic”) wave field of the same basis space.

Along with the “right” embeddedness $\varepsilon = \varepsilon_r \varepsilon_0$, we operate also with the “inverse” embeddedness:

$$\mu_0 = 1/\varepsilon_0 \quad \text{and} \quad \mu_r = 1/\varepsilon_r\,. \tag{4}$$

Then (2) and (3) take the form

$$E = \mu_r \mu_0 D, \qquad B = \mu_r \mu_0 H\,. \tag{5}$$

We postulate the validity of the equality $\varepsilon_r = 1$ for the basis space. This is quite natural because, at this level, the embeddedness, in essence, relates to the space itself, *i.e.*, the *self-embeddedness* of the space takes place.

Thus, in wave field-spaces, the *central field-space* of exchange is inseparable from its *negation*, which is represented by the *transversal field-space* of exchange. The central field of exchange is described by the two vectors E and D; the analogous vectors, B and H, describe the transversal field. The B vector is the *speed-strength vector* and the H vector is a *vector of the density of momentum* of the transversal exchange.

Both fields-spaces (central and transversal) form the unit contradictory *longitudinal-transversal field-space* with the following vectors:

$$\hat{A} = E + iB \qquad \text{and} \qquad \hat{C} = D + iH\,. \tag{6}$$

In the general case each vector of exchange (*E*, *D*, *B*, and *H*) has contradictory potential-kinetic character (that is, designated by the symbol ^) [2, 11]. Therefore, more correctly, (6) must be presented in the following form:

$$\hat{A} = \hat{E} + i\hat{B} \quad \text{and} \quad \hat{C} = \hat{D} + i\hat{H}\,, \tag{7}$$

where i is the unit of negation of the central field by the transversal field. Thus the letter i indicates the transversal character of the field of $\hat{B}$ and $\hat{H}$ vectors as against the central field of *E* and *D* vectors. Simultaneously, the letter i indicates the potential character of the corresponding vectors as the negation of the kinetic ones because

$$\hat{E} = E_k + iE_p\,, \qquad \hat{B} = B_k + iB_p\,,$$

$$\text{and} \quad \hat{D} = \varepsilon_0 \varepsilon_r \hat{E}\,, \qquad \hat{H} = \varepsilon_0 \varepsilon_r \hat{B}\,. \tag{8}$$

Obviously,

$$A_k = E_k + iB_k\,, \quad C_k = D_k + iH_k \tag{9}$$

and

$$A_p = E_p + iB_p\,, \quad C_p = D_p + iH_p\,. \tag{10}$$

Each vector of exchange belongs to the generalized vector of exchange

$$\hat{\Psi} = U + iV\,, \tag{11}$$

where $\hat{\Psi} \in (\hat{E}, \hat{B}, \hat{D}, \hat{H}, \hat{A}, \hat{C})$. This vector satisfies the wave equation

$$\Delta\hat{\Psi} - \frac{\partial^2 \hat{\Psi}}{\partial \tau^2} = 0\,, \tag{12}$$

The longitudinal-transversal field of exchange $\hat{A} = \hat{E} + i\hat{B}$ is an image of the longitudinal-transversal structure of the world. At the subatomic level it is called the electromagnetic field, in which the field of the transversal exchange (or more exactly the transversal subfield of the longitudinal-transversal field) is termed the magnetic field and the longitudinal subfield is called the electric field. The binary field-spaces are the basis of the space of the universe.

Strictly speaking [2], the electromagnetic field must be called by only one name: the electric (or magnetic) longitudinal-transversal field with longitudinal-transversal charges. This is a very important question of the logical semantics of the field, which inclines to definite concepts. From the point of view of semantics, the name “electromagnetic” field makes no sense. It literally means the “amber-magical” field. This is, roughly speaking, the “alias” or the pseudonym. We should refrain from the pseudonym because it initially generates the erroneous concepts and directions of research. Moreover, on the basis of the pseudonym, cognition of the nature of electromagnetic phenomena becomes impossible.

The intensity of the electromagnetic field should be described by the vector of velocity of exchange $\hat{\mathbf{E}}$ (the strength vector) of the logical structure:

$$\hat{\mathbf{E}} = \hat{\mathbf{E}}_l + \hat{\mathbf{E}}_\tau , \qquad (13)$$

where $\hat{\mathbf{E}}_l$ is the vector of the longitudinal electric subfield and $\hat{\mathbf{E}}_\tau$ is the vector of the transversal electric subfield.

To an equal degree, the electromagnetic field can be called the longitudinal-transversal magnetic field with the corresponding vectors of the longitudinal $\hat{\mathbf{B}}_l$ and transversal $\hat{\mathbf{B}}_\tau$ magnetic subfields:

$$\hat{\mathbf{B}} = \hat{\mathbf{B}}_l + \hat{\mathbf{B}}_\tau \qquad (14)$$

Binary fields-spaces are elementary links in a chain of mutually negating longitudinal-transversal field-spaces that form the multidimensional spatial structure of the matter-space-time of the universe.

The fields of transversal exchange are, mainly, the fields of cylindrical structure. The presence of a field of the cylindrical structure points to the motion in the field of matter-space-time.

Physicists study the longitudinal-transversal field of exchange of the *subatomic microlevel* “from above” (because they tower over this field in laboratory conditions); therefore they clearly see its longitudinal and transversal sides. But at the same time they are inside the cosmic longitudinal-transversal field. Being on Earth, they feel only the longitudinal side of the field and not its transversal component, which is represented by the shells of the gravitational field of the Sun and its planets.

In such a situation, when “complexes of sensations” do not help, it is necessary to turn to reason and dialectics. Only they will lead the researcher to the understanding of the fact that the gravitational field is also the longitudinal-transversal field, analogous to the longitudinal-transversal field of the subatomic level.

3. Dimensionality of H and B vectors

The following three systems of units were introduced in physics before the appearance of the SI units:

1. CGS, for the description nonelectromagnetic phenomena;
2. CGSE, for the description of the electric (longitudinal) subfield;
3. CGSM, for the description of the magnetic (transversal) subfield.

The CGS system was first applied to mechanical phenomena and then extended to enable thermal measurements (by the addition of the inconsistently defined calorie). Now this system, called the Gausian (or symmetric) system, can be called the circulational system, because it unites in a single whole the CGSE and CGSM systems through the circulational equation of exchange [2]:

$$\Gamma = \frac{1}{c}\frac{dq}{dt} = \frac{1}{c} I , \qquad (15)$$

where $\Gamma = 2\pi r H = 2\pi r \varepsilon_0 \varepsilon_r B$ is the circulation of the momentum density vector H (3) or the circulation of the linear density of tangential (transversal) flow of speed-strength B (5) – the parameters of the transversal ("magnetic") subfield. Historically, the circulation Γ was referred to as the current in the magnetic system of units I_m. Electric current I is the parameter of the longitudinal subfield.

The circulation expresses the law of total current in so-called Gaussian units:

$$\oint (Hdl) = (1/c)I \,. \tag{16}$$

On the basis of (15) it is possible to introduce the circulation charge:

$$q_\gamma = \frac{1}{c} q = \int \Gamma dt \,. \tag{17}$$

The following relation was found between theoretical A (in the framework of the present approach) and phenomenological A_E parameters [2, 12]:

$$A_E = (\sqrt{4\pi\varepsilon_0})^k A \,, \tag{18}$$

where k is an integer. In particular, the exchange charge q and the Coulomb charge q_E are related as

$$q = \sqrt{4\pi\varepsilon_0} \times q_E \,. \tag{19}$$

The speed-strength vectors E and B and the electric induction and magnetic induction vectors E_E and B_E are connected as

$$E = E_E / \sqrt{4\pi\varepsilon_0} \qquad \text{and} \qquad B = B_E / \sqrt{4\pi\varepsilon_0} \,, \tag{20}$$

We are interested in the dimensionality of the velocity-strength B (known as the magnetic field induction): the gauss and the tesla.

According to the definition in Section 2, the B vector is the vector of the rate of exchange in the transversal ("magnetic") field, and its objective dimensionality is $cm \times s^{-1}$. According to (20), the dimensionality of the phenomenological magnetic induction vector B_E , expressed in gauss G_E, is

$$\dim(G_E) = \dim(B_E) = \dim\left(\sqrt{4\pi\varepsilon_0} \times B\right) = g^{1/2} \times cm^{-1/2} \times s^{-1} \,. \tag{21}$$

An objective measure of the magnetic gauss is equal to

$$1G = \frac{1G_E}{\sqrt{4\pi\varepsilon_0}} = 2.820947918 \times 10^{-1}\, cm \times s^{-1} \,, \tag{22}$$

The phenomenological magnetic tesla is equal to 10^4 gauss:

$$1T_E = 1\times 10^4 G_E \,. \tag{23}$$

Hence the following objective tesla T corresponds to the phenomenological tesla T_E:

$$1T = 1\cdot 10^4 G = \frac{10^4}{\sqrt{4\pi\varepsilon_0}} = 2.820947918\cdot 10^3 \; cm\times s^{-1}, \tag{24}$$

Let us turn now to the transversal (magnetic) field of Earth, namely to its horizontal component B_h (analogous to the magnetic intensity, former magnetic field strength). The experimental data show that the daily solar variations of B_h (in years of low magnetic activity and tranquil days, for middle latitudes) have a broad range (Ref. [13, p. 997]):

$$B_h = (0.7-4)\times 10^{-4}\, Oe \,. \tag{25}$$

We take for the estimation $B_h = 2.5\times 10^{-4}\, Oe$. Its objective measure, making allowance for (22), is

$$B_h = 2.5\times 10^{-4}\, Oe = 2.5\times 10^{-4}\times 2.820947918\times 10^{-1} \approx 7\times 10^{-5}\, cm\cdot s^{-1} \,. \tag{26}$$

In the CGS system vectors H and B are equal in value of their units, 1 G to 1 Oe. The same equality in value is maintained in the description of the fields presented here. Actually, according to the above definition, the relation between vectors H and B is expressed by (19), $H = \varepsilon_r \varepsilon_0 B$, where the absolute unit density $\varepsilon_0 = 1\; g\cdot cm^{-3}$ and the relative density $\varepsilon_r = 1$. Hence the *density of momentum of the geomagnetic field* is

$$H = \varepsilon_r \varepsilon_0 B = 7\times 10^{-5}(g\cdot cm^{-3})(cm\cdot s^{-1}) \,. \tag{27}$$

This value gives the magnetic moment μ caused by moving charges in the unit volume V of the field:

$$\mu = HV = 7\times 10^{-5}\; g\cdot cm\cdot s^{-1} \approx 1.97\times 10^{-8}\; J\cdot T^{-1}, \tag{28}$$

where $1T = \frac{10^4}{\sqrt{4\pi}}\; cm\cdot s^{-1}$ [2].

4. The density of magnetic field-spaces

Thus, according to the definition, the H vector represents by itself the *density of momentum* of the transversal (magnetic) field-space; therefore the following equality is valid:

$$H = \rho\upsilon, \tag{29}$$

where ρ is the density (equal to the mass of all subelectronic particles in the unit volume V of the space) and υ is the speed of their ordered motion in the direction defined by the vector H. This equality is valid if we accept the hypothesis, set forth first in Refs. [1] an [2], that the magnetic field is the flux of subelectronic particles. Thus, knowing the speed of the flux of these particles, (29) enables estimation of the density of the subelectronic particles that fill the space and detected at their motion as the magnetic field.

The precise ether-drift experiments carried out up to 1929 [5] found a maximal ethereal wind speed of about $6\times10^5\,cm\cdot s^{-1}$ at an altitude 1830 *m* (the Mount Wilson observatory, Pasadena). The direction of the ether-drift, as we have found by analyzing the experimental results, almost coincides with the direction of the magnetic field, H_h. Experiments repeated later also confirmed this conclusion. Galaev's studies [6, 7] showed that the horizontal component of the ethereal wind speed reaches a value $1.414\times10^5\,cm\cdot s^{-1}$ in Kharkov, at a height above sea level of 42 *m*. At a height of 4.75 *m*, the average speed is about $4.35\times10^4\,cm\cdot s^{-1}$. It is equal to $2.05\times10^4\,cm\cdot s^{-1}$ at a height of 1.6 *m*.

We assume that the speeds of fluxes (registered as magnetic fields) of such an obtained order can also exist near the surfaces of other similar objects in the universe. Let us take at first for calculations, as the minimal speed, the speed at a height of 4.75 *m* [7]:

$$\upsilon = 4.35\times10^4\,cm\cdot s^{-1}. \tag{30}$$

The corresponding maximal density of geomagnetic space of the particles at this height is

$$\rho = H/\upsilon \approx 1.6\cdot10^{-9}\ g\cdot cm^{-3}. \tag{31}$$

The masses of subelectronic particles, which one can regard as the most probable main components of magnetic fluxes, were estimated in the previous paper [1]. It was shown that the most probable particles could be, among others, the two with masses:

$$m = 68\times10^{-7}\,m_e \approx 6.19\times10^{-33}\ g, \tag{32}$$

$$m_\nu = 136.44\times10^{-9}\,m_e \approx 1.243\times10^{-34}\ g, \tag{33}$$

where $m_e = 9.109382531\times10^{-28}\ g$ is the electron mass.

If we take the first particles of mass *m* (32), then their corresponding maximal concentration, moving with the speed (30), is

$$n = \rho/m = 2.58\times10^{23}\,cm^{-3}. \tag{34}$$

For m_ν particles (33) we have

$$n_\nu = \rho / m_\nu = 1.29\times10^{25}\, cm^{-3}. \qquad (35)$$

The velocity-strength of the *interstellar* magnetic field B_{is} (of the Milky Way) is about 10^{-6} times the strength of Earth's field [14] (which is 0.65 *Oe* on the magnetic pole and 0.35 *Oe* on the magnetic equator [13]) and has approximately the magnitude

$$B_{is} = 0.5\times10^{-6}\, Oe. \qquad (36)$$

Its objective measure, in accordance with (22), is

$$B_{is} = 0.5\times\cdot10^{-6}\times2.820947918\times10^{-1} \approx 1.41\times10^{-7}\, cm\cdot s^{-1}. \qquad (37)$$

The *density of momentum* H_{is} and the magnetic moment of the unit volume of interstellar magnetic field μ_{is} are equal, correspondingly, to

$$H_{is} = \rho_{is}\upsilon = 1.41\times10^{-7}\,(g\cdot cm^{-3})(cm\cdot s^{-1}), \qquad (38)$$

and

$$\mu_{is} = H_{is}V = \rho_{is}\upsilon V = 1.41\times10^{-7}\, g\cdot cm\cdot s^{-1} = 3.98\times10^{-11}\, J\cdot T^{-1}. \qquad (39)$$

Assuming at the first approximation that in interstellar space the *minimal speed* of magnetic fluxes is equal to the speed measured for ether-drift at a height of 4.75 *m* above sea level [7], *i.e.*, under the condition $\upsilon = 4.35\times10^{4}\, cm\cdot s^{-1}$, we arrive at the corresponding *maximal density* of the interstellar magnetic field:

$$\rho_{is} = H_{is}/\upsilon \approx 3.24\times10^{-12}\, g\cdot cm^{-3}. \qquad (40)$$

We assume that quanta of mass $m_\nu = 136.44\times10^{-9} m_e$ dominate in cosmic magnetic fields. As was shown in our previous paper [1], their frequency $<\nu> = 1.23\times10^{11}\, s^{-1}$ of the millimeter band is close to the mean value of the whole electromagnetic spectrum. This is all the more so because this frequency is the region of the cosmic microwave background radiation [15]. If these particles are the main components of magnetic fields, then their maximal concentration in the field (at the above conditions) is

$$n_\nu = \rho_{is}/m_\nu = 3.24\times10^{-12}/(136.44\cdot10^{-9}\times9.11\times10^{-28}) = 2.6\times10^{22}\, cm^{-3}. \qquad (41)$$

The maximal possible modulus of elasticity of such field-spaces is

$$E_\nu = \rho_{is} c^2 \approx 2.9 \times 10^9 \; dyne \cdot cm^{-2}. \quad (42)$$

Thus, we have arrived at the parameters of space, which have the same order of magnitude as obtained in the previous paper based on another approach. The two middle columns in Table 1 demonstrate this fact. The practical coincidence of the results obtained in different (in principle) ways justifies the validity of both concepts (ways), presented here and in Ref. [1].

Table 1. The Density, Base Wave Speed and Modulus of Elasticity of a Wave Space Consisting of m_ν Particles at a Height of 4.35 *m* Above Sea Level[(a)]

Parameters	*Air*	$m_\nu - space$ ($n = 2.6 \cdot 10^{22}$;	$3 \cdot 10^{22} cm^{-3}$ [1])	*Sea Water*
$\rho \; (g \cdot cm^{-3})$:	1.21×10^{-3}	3.24×10^{-12}	3.76×10^{-12}	1.02338
$c \; (cm \cdot s^{-1})$:	3.44×10^4	3×10^{10}	3×10^{10}	1.5×10^5
$\rho c^2 \; (dyne \cdot cm^{-2})$:	1.42×10^6	2.9×10^9	3.38×10^9	2.3×10^{10}

(a) The data are derived in two ways, in comparison with the corresponding parameters of air and see water. The second column contains the present data calculated here for the ether-drift speed $\upsilon = 4.35 \times 10^4 \; cm \cdot s^{-1}$ and $B_h = 2.5 \times 10^{-4} \; Oe$. The third column shows the data obtained earlier in [1].

Parameters of the medium (magnetic field-space) composed of m_ν particles, calculated under the condition that the speed of the magnetic flux is higher than (30) and is about $6 \times 10^5 \; cm \cdot s^{-1}$ (detected as the ether-drift, or ethereal wind, at a height of 1830 *m* above sea level [7]), are

$$\begin{aligned} &\rho = 2.35 \times 10^{-13} \; g \cdot cm^{-3}, \\ &n_\nu = 1.9 \times 10^{21} \; cm^{-3}, \\ &E_\nu = \rho c^2 = 2.1 \times 10^8 \; dyne \cdot cm^{-2}. \end{aligned} \quad (43)$$

The main role in the approach described here is played by the speed of magnetic fluxes accepted for calculations. The estimations presented above were carried out under the condition of *minimal speeds* typical for the fluxes registered just at the Earth's surface in middle latitudes as ethereal wind. Experiments carried out in Refs. [3] to [7] show that the ether has viscosity and the speed of the ethereal wind increases with increasing height above Earth's surface.

Apparently, the average speeds of magnetic fluxes in the cosmos exceed the speeds typical for Earth's surface taken above for estimates. Let us suppose therefore that in interstellar space the speed of magnetic fluxes approaches, or is equal to the speed of light, *i.e.*, $\upsilon = c$; this is quite possible. In this case the corresponding *minimal density* of the interstellar magnetic field-space composed of m_ν particles, of the same strength $B_{is} = 0.5\times10^{-6}\,Oe$ (36), will be equal to the value

$$\rho_{is} = H_{is}/c = 4.7\times10^{-18}\ g\cdot cm^{-3}. \tag{44}$$

The concentration and modulus of elasticity of the space of such a density composed of m_ν particles (33) are, respectively, equal to

$$n_\nu = 3.78\times10^{16}\ cm^{-3}, \tag{45}$$

$$E_\nu = \rho_{is}c^2 = 4.23\times10^{3}\ dyne\cdot cm^{-2}. \tag{46}$$

The last magnitude is about 10^{-3} times the modulus of elasticity of air, which is $1.42\times10^{6}\ dyne\cdot cm^{-2}$ (see Table 1).

An important question today in cosmology is how much mass is contained in the universe. There is a lot of uncertainty about the average density of the universe. Part of the problem lies in the fact that we can only see a mere 5-10% of the matter that's thought to make up the cosmos. The rest is mysterious "dark matter", whose presence is inferred from the gravitational motions of galaxies. We just don't know how much dark matter is out there.

The “critical density” of the universe is actually not “calculated” in the normal sense of the word. It actually comes out as a parameter in the Friedman equation for the expansion of the universe. It is really a function of how fast the universe is expanding. Hubble's law shows that the velocity of a galaxy is proportional to distance

$$\upsilon = H_0 r. \tag{47}$$

On this basis, the critical density is found to be

$$\rho = sH^2/8\pi G = 5\times10^{-30}\ g\cdot cm^{-3} \tag{48}$$

where $H_0 = (1.587-1.62)\times10^{-18}\ s^{-1}$ and $G = 6.6742(10)\times10^{-8}\ cm^3\cdot g^{-1}\cdot s^{-2}$.

Currently, the best-known values for Hubble’s constant H_0 and gravitational constant G give a value for the critical density of about $\rho = 1\times10^{-29}\ g\cdot cm^{-3}$. Recent measurements indicate that the actual density of our universe is very close to the critical density.

The Wilkinson Microwave Anisotropy Probe (WMAP, NASA Explorer Mission measuring the temperature of the cosmic background radiation) determined that the universe is flat, from which it follows that the mean energy density in the universe is equal to the critical density (within a 2% margin of error). This is equivalent to a mass density of $9.9\times10^{-30}\ g\cdot cm^{-3}$, which is equivalent to only 5.9 protons per cubic meter.

We should realize that there is some doubt in this value because it is the result of a long chain of estimations. What is more, the nature of the red shift has been questioned hitherto, just like the nature of the microwave background radiation [2, 15, 16].

It is highly plausible that dark matter of the universe, the still unknown nature of which is currently a big problem of astrophysicists, is partially hidden in invisible subelectronic particles of interstellar space of galaxies with the above parameters and mostly in intergalactic space.

Let us now estimate the values of the parameters ρ and n for the intergalactic magnetic field-space. Unfortunately, the strength of the intergalactic magnetic fields (IGMFs) has not been determined so far [17]. Most of the methods estimate the value of the fields in the range 10^{-10} to $10^{-20}\,G$ [18-21]. To interpret the microgauss magnetic fields, the seed fields required in so-called dynamo theories could be as low as $10^{-20}\,G$ [22, 23]. At present, theoretical calculations of primordial magnetic fields show that these fields could be of order $10^{-20}\,G$ or even as low as $10^{-29}\,G$, generated during the cosmological QCD or electroweak transition, respectively [24].

Obviously, indeterminacy in the values of the strength of IGMFs will result in indeterminacy in the calculated density of the space of IGMF. Among the values indicated in Refs. [17] to [24], we take the velocity-strength of IGMF of the order $1\times10^{-20}\,G$. This magnitude is more appropriate because it is almost in the middle between the upper and lower limits of the strengths indicated in the above references. An objective measure of the magnitude, according to (22), is

$$B_{ig} = 10^{-20}/4\pi\varepsilon_0 \approx 2.82\times10^{-21}\,cm\cdot s^{-1}. \tag{49}$$

The density of the momentum of the field is

$$H_{ig} = \varepsilon_r\varepsilon_0 B_{ig} = 2.82\times10^{-21}\,(g\cdot cm^{-3})(cm\cdot s^{-1}). \tag{50}$$

Hence the density of IGMF, at $\upsilon = c$ and $\varepsilon_r = 1$, is

$$\rho_{ig} = H_{ig}/c = 0.94\times10^{-31}\,g\cdot cm^{-3}. \tag{51}$$

We assume that among a whole spectrum of subelectronic particles the particles of masses $m = 68\times10^{-7}m_e$ and $m_\nu = 136.44\times10^{-9}m_e$ play a dominating role in the IGMFs. Note that the mass of these particles is a multiple of the fundamental measure (in units of the electron mass) in a quarter and a half of the fundamental period $\Delta = 2\pi\lg e = 2.7288$ [25, 26], respectively.

Concentrations of the particles of the mass $m = 68\times10^{-7}m_e$ in IGMF of density (51) would be:

$$n = \rho_{ig} / m = 1.51 \times 10^1\ cm^{-3}. \tag{52}$$

If the IGMF consists mainly of particles of mass $m_\nu = 136.44 \times 10^{-9} m_e$, their concentration in the field is

$$n_\nu = \rho_{ig} / m_\nu = 7.6 \times 10^2\ cm^{-3}. \tag{53}$$

Subelectronic particles represent a huge world of particles of the level of the universe, which is below the electron level. They take part in transient processes together with electrons. These particles form the transversal (magnetic) field of moving electrons and, hence, can be regarded as their satellites. Accordingly, their speed is of the same order as the speed of electrons. The maximal speed of an electron in the hydrogen atom is the Bohr speed υ_0. The relation between υ_0 and the speed of light *c* is equal in magnitude to the fine-structure constant [27]. On the basis of this fact, we can take for estimation, as the speed of fluxes of subelectronic particles (magnetic fluxes) υ in (29), the value υ_0:

$$\upsilon_0 = \alpha c = 2.187691263 \times 10^8\ cm \cdot s^{-1} \approx 2.19 \times 10^8\ cm \cdot s^{-1}, \tag{54}$$

where $\alpha = 7.297352568 \times 10^{-3}$. In this case all the above parameters, obtained for the speed *c*, will have to take into account the extra factor α.

The above-calculated parameters for the horizontal component of Earth's magnetic field at a height of 4.35 *m* above sea level, for interstellar and intergalactic magnetic field-spaces (at two speeds of magnetic fluxes, $\upsilon = c$ and $\upsilon = \alpha c$) composed of m_ν particles are presented in Table 2.

Table 2. The Calculated Density and Concentration of m_ν Particles Near Earth's Surface Magnetic Field(b), in Interstellar and Intergalactic Magnetic Fields(c);

	B_h (26) 2.5×10^{-4} *Oe*	B_{is} (36) 0.5×10^{-6} *Oe*		B_{ig} (49) 1×10^{-20} *Oe*	
υ $(cm \cdot s^{-1})$	4.35×10^4	2.19×10^8	3×10^{10}	2.19×10^8	3×10^{10}
ρ $(g \cdot cm^{-3})$	3.24×10^{-12}	6.4×10^{-16}	4.7×10^{-18}	1.29×10^{-29}	0.94×10^{-31}
n_ν (cm^{-3})	2.6×10^{22}	5.15×10^{18}	3.78×10^{16}	1.04×10^5	7.6×10^2

(b) The first column.

(c) B_h, B_{is} and B_{ig} are the strengths of corresponding magnetic fields.

We see thus that the estimated densities of the IGMFs range from 1.29×10^{-29} to $0.94\times10^{-31}\, g\cdot cm^{-3}$, *i.e.*, just near the critical density of the universe $5\times10^{-30}\, g\cdot cm^{-3}$ (48) obtained from the Friedman equation on the basis of the Hubble's constant H_0 and gravitational constant G.

5. Conclusion

The mass that astronomers infer for galaxies including our own is more than 10 times as large as the mass that can be associated with stars, gas, and dust. This mass was called baryonic matter and was made up of protons, neutrons, and electrons. Until about 20 years ago, astronomers thought that the universe was composed almost entirely of this baryonic matter. However, in the past decade, there has been ever more evidence accumulating that suggests there is something in the universe that we cannot see, perhaps some new types of particles (nonbaryonic matter) or even a new form of matter or new forces.

The nonbaryonic matter problem has found in the present paper a new resolution. It became possible on the basis of understanding, from a new point of view, the nature of longitudinal-transversal (electromagnetic) wave fields. This understanding resulted in objective dimensionalities for magnetic field parameters (vectors H and B) expressed by the integer dimensionalities of matter, space, and time (g, cm, and s) [2]. The key idea set forth here that ether-drift is the flux of subelectronic particles identical with magnetic flux originates from the aforementioned understanding what is the magnetic field.

As appears from this paper, the plausible candidates/particles for the nonbaryonic dark matter can be subelectronic particles of the masses ascribed to them in Ref. [1], especially ranging from $m = 68\times10^{-7} m_e$ to $m_\text{v} = 136.44\times10^{-9} m_e$. These particles fill the space of the universe, along with other objects and particles, and just their directed motion in space defines the field that we call the magnetic field and detect also near Earth's surface as ether-drift.

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