Existence of dark matter with observed properties of cosmic microwave background radiation substantiates three conservation laws of classical physics and all principles of quantum mechanics as creates the value of Planck’s constant

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Abstract. Astronomical data indicate a presence of dark matter (DM) in the space, what is necessary for explanation of observed dynamics of the galaxies within Newtonian mechanics. DM, at its very low density (~10^{-26} kg/m^3), constitutes main part of the matter in the Universe, 10 times the mass of all visible cosmic bodies. No doubt, namely properties of DM, which fills space, must determine its physical properties and fundamental physical laws. Taking into account observed properties of cosmic microwave background radiation (CMBR), whose energy is ~90\% of all cosmic radiation, and understanding that this radiation is produced by DM motion, conservation laws of classical physics and principles of quantum mechanics receive their materialistic substantiation. Thus, CMBR high homogeneity and isotropy (~10^{-4}), and hence the same properties of DM (and space) justify momentum and angular momentum conservation laws, respectively, according to E. Noether’s theorems. CMBR has black body spectrum at ~2.7K with maximum wavelength ~1.9\cdot10^{-3} m, what allows calculate the value of mechanical action produced by DM thermal motion (~7\cdot10^{-34} J\cdot s). This value corresponds well to the Planck’s constant, which is the mechanical action too, what gives materialistic basis for all principles of quantum mechanics. Obtained results directly confirm the reality of DM existence, and show that CMBR is an observed display of DM thermal motion. Understanding that namely from DM occur known creation of electron-positron pairs as contrarily rotating material vortexes (according to their spins) let substantiate positron nature of ball lightning what first explains all its observed specific properties.

1. Introduction

Three fundamental laws of classical physics (conservation laws of momentum, angular momentum and energy) and also known principles of quantum mechanics (Planck’s constant, Heisenberg’s uncertainty principle, de Broglie’s wave mechanics, etc) have no physical (materialistic) vindication of their origin. All they are not derived from any higher order laws (principles), but nevertheless they are used with confidence since they are in good agreement with experimental data. However, they do not contradict to known experimental data only if they are used in the different domain of physics (classical or quantum). Thus, there are grave problems in fundamental physics: revealing of the reason of strongly different description (classical or quantum) of physical processes in the nature and of physically inexplicable idea of corpuscular-wave dualism. These problems demonstrate the
incompleteness of understanding of the real reasons of classical physics laws and quantum mechanics principles and point out the necessity for hunting the reasons of their genuine origin.

No doubt, that all fundamental laws of classical physics and the principles of quantum mechanics must have their materialistic substantiation on the base of observed properties of the nature. Actually, as may be shown [1, 2], now accumulated data about observed properties of the cosmic space let give such substantiation by using the recently (1965) established properties of cosmic microwave background radiation (CMBR) [3] and taking into account the existence of dark matter (DM), which fills all ambient space [4-7]. Given substantiation is based on reasonable assumption that observed well known properties of CMBR, which also exists in all ambient space, is produced by certain motion of DM, which should has the same space properties as CMBR.

Really, observed high spatial homogeneity and isotropy of CMBR and, naturally, the same properties of its producing DM, validate conservation laws of momentum and angular momentum, correspondingly, in accord with known E. Noether’s theorems (1918) [8, 9]. These mathematical theorems assert that to each conservation law of physics match up the certain property of space, particularly, conservation laws of momentum and angular momentum will hold true only if the space is, correspondingly, highly homogeneous and highly isotropic.

Besides, as shown [1, 2], CMBR emitting properties (blackbody spectrum at temperature T~2.7K with maximum wavelength \( \lambda \approx 1.9 \times 10^{-4} \) m) let obtain the kinetic energy of producing this spectrum an equilibrium thermal motion of DM (with the use of Boltzmann’s constant). From the value of kinetic energy of such DM motion (obviously with the speed of electromagnetic waves \( c = 3 \times 10^8 \) m/s) an action function value for DM seesaw motion may be calculated. Obtained value of this action function \((-7 \times 10^{-34} \text{J-s})\) is well equal to Planck’s constant \( h = 6.6 \times 10^{-34} \) J-s, which really is an action function too. This result discovers materialistic origin of Planck’s constant, as the result of DM thermal motion, and gives, obviously, materialistic base to Heisenberg’s uncertainty principle and to others conceptions of quantum mechanics, which all follows directly from the existence of Planck’s constant [10].

As clear, such motion of DM must strong disturb a spatial motion of light elemental particles (like electron) what may be correctly described by the methods of quantum wave mechanics [10], proposed by L. de Broglie. But DM motion could not disturb significantly a spatial motion of much heavier particles (atoms, molecules and so on), so their spatial motion may be well described by the laws of classical physics. Thus, DM thermal motion explains the logical necessity of different classical or quantum description of physical processes in the nature and the reason of used corpuscular-wave dualism approach. Simply speaking, spatial motion of light elemental particles (like electron, etc) undergo to strong influence from DM, and their disturbed motion may be well described by wave mechanics with the use of Planck’s constant produced by DM motion. But, when such light particles interact (encounter) with another particles, they act as a corpuscular, which they really are.

Taking into account the existence of DM and reasonable comprehension, that electron-positron pairs (both of which is stable elemental material particles) are created from DM as material vortexes (according to their spins), let substantiate positron nature of mysterious atmospheric phenomenon – ball lightning (BL). As shown [11, 12], understanding of BL nature as a bunch of big amount of positrons allow first explain all observed specific properties of BL, particularly, its ball-shaped luminescence, visible size and life time, which are determined by behavior in the air of X-ray radiation from annihilation of BL positrons with electrons of the air molecules.

2. Substantiation of Fundamental Conservation Laws of Classical Physics

Well known fundamental laws of classical physics (momentum, angular momentum and energy conservation laws), which are used for description of observed physical processes in nature, have not its certain substantiation. Another words, the reason of their performance is not established exactly, and besides, what is important, the bound of applicability of these laws is not established too.

Known (from 1918) E. Noether’s mathematical theorems denote conditions for realization of these three fundamental laws, according to them ambient space must exhibit right properties. Momentum conservation law takes place if space is uniform, angular momentum conservation law takes place if
space is isotropic, and energy conservation law takes place if trend of physical processes is independent on its starting moment. As clear, in order to these fundamental laws could really take place in the nature, the space must obeys the properties stated by E. Noether’s theorems.

Usually the applicability of conservation laws of classical physics is based simply on assumption that ambient space is empty and possess the properties of Euclidian geometry (the spatial homogeneity and isotropy), what accords to conditions of E. Noether’s theorems. Indeed, resent cosmological data indicate that real space is not empty, since it is filled by DM [4, 7], which existence in cosmic space was suggested long ago by classical astronomy to explain observed dynamics of galaxies according to Newtonian mechanics. As may be shown [1, 2], namely the properties of DM with the observed properties of CMBR, which is producing by DM motion, determine the applicability of conservation laws of classical physics and known principles of quantum mechanics.

As discovered in 1965 by Arno Pensias and Robert Wilson, the observed from the Earth a weak (like a noise) cosmic microwave radiation are characterized by high isotropy and a temperature about ~3K (for that they received Nobel Prize in physics in 1978). Now is well established, that this radiation, which is known as CMBR, is the most powerful among the all detected radiations from the space (about 90% of their total energy) and is characterized by very high isotropy and also by high homogeneity. Besides, as is established, CMBR has the blackbody spectrum at the temperature ~2.7K and the maximum of its radiation wavelength at ~1.9·10^{-3}m.

It is clear that observed high isotropy and high homogeneity of CMBR mean that its producing DM has the same properties (in large space scale). Hence the ambient space, filled by DM, is also highly isotropic and highly uniform, what according to E. Noether’s theorems give real materialistic base for realization in the nature of the fundamental laws of the angular momentum and the momentum conservation, correspondingly. As to fundamental law of energy conservation, it takes place, according to E. Noether’s theorem, if run of observed physical processes is not depend on their starting moment, what means “time” constancy (or uniform flow of “time”). Such condition is well consistent with observed independence of behavior (on starting moment) of all physical processes in our materialistic nature. In this connection it should be understand that the mankind always use for metering the “time” flow any other physical processes, which are used as a “reference clock”.

It is well known that as a “reference clock” mankind has used in its long history many very different materialistic processes taking place in the nature. Now as a “reference clock” an “atomic clock” is used, which is based on the frequency of atomic radiation (that also means the use of real materialistic process). Therefore, it is clear, that kinetic properties of all physical processes taking place in the nature come to know by mankind due to their comparison with any other physical (materialistic) process. No doubt, such understanding means that in nature really there is no “time”: neither absolute “time” no relative “time”. The overall using by mankind the concept of “time” is simply a very convenient parametrical approach to describe observed kinetics of physical processes in our materialistic nature (no more, then that).

As a resulting important conclusion, it must be underlined that fundamental laws of classical physics operate well in the nature not because of the E. Noether’s theorems exist by itself, but since the real properties of ambient space, which is filled by DM, are in accord with conditions of E. Noether’s theorems.

3. Materialistic Base of Known Principles of Quantum Mechanics

As well established CMBR has the blackbody spectrum at temperature ~2.7K with maximum wavelength ~1.9·10^{-3}m. Taking into account the existence of DM which fills all the space, it is reasonably assume that observed CMBr is produced by equilibrium thermal motion of this DM. Such materialistic point of view, which let substantiate the applicability of fundamental laws of classical physics, as it is shown above, no doubt must also reveal the materialistic reason of quantum mechanics and its principles, including the known value of Planck’s constant.

The fact that CMBR has blackbody spectrum at T≈2.7K demonstrates that DM, which creates the CMBR, is in equilibrium seesaw motion at this temperature. Taking into account that DM is really in
equilibrium motion, the value of kinetic energy of DM seesaw motion \( (\varepsilon) \) should be equal to DM thermal energy, which may be obtained from DM temperature with the use of the universal Boltzmann’s constant \( k=1.38-10^{-23} J/K \), which connect temperature of equilibrium thermal motion of some parts of any matter with mean-square velocity of motion of these parts. In the case of DM seesaw motion, the velocity of this motion is obviously equal to the electromagnetic wave speed \( (c=3-10^8 m/s) \) since these waves propagate namely in DM filling all ambient space. Obtained value of DM kinetic energy is \( \varepsilon=3kT/2=5.6-10^{-23} J \) that let estimate the mean mass of these matter parts, namely, an effective mass of DM \( (m) \), which produces such DM seesaw motion: \( m=2\varepsilon/c^2\approx1.2-10^{-39} kg \).

It is clear that observed maximum wavelength of CMBR \( (\lambda\approx 1.9-10^{-3} m) \) is well equal to the mean value of the amplitude of DM seesaw motion, and that this amplitude corresponds to the damping length of DM seesaw motion. It is also clear that \( \lambda \) means the damping length for DM effective mass momentum \( (p) \), which is equal to \( p=m\cdot c \). The established parameters of DM seesaw motion (the effective mass \( m \), its motion speed \( c \) and the damping length \( \lambda \) for \( p \)) let estimate the value of mechanical action (an action function) for such DM seesaw motion by two known manner (from conceptions of classical mechanics and of quantum mechanics).

According to conception of classical mechanics an action function value \( (S) \) is a measure of physical motion and is equal to the product of energy and a “time” of this energy existence (dissipation). Taking into account that full circle path of DM seesaw motion energy is equal to \( 2\pi \), then its “time” is equal to \( 2\lambda/c\approx 1.3-10^{-11} s \). So it may be obtained that \( S \) value for DM seesaw motion is equal to

\[
S=2\varepsilon\lambda/c=5.6-10^{-23}\cdot1.3-10^{-11} J\cdot s\approx7.3-10^{-34} J\cdot s
\]

As it is seen, such classically obtained estimation of the value of an action function of DM seesaw motion corresponds well to the Planck’s constant \( h \), which physically is an action function too.

As it usually accepted in quantum mechanics the \( S \) value should be obtained by multiplying the mechanical momentum and its damping length. In the case of DM seesaw motion its mechanical momentum is equal to \( p=m\cdot c \) and damping length of this momentum is equal to \( \lambda \). So, according to the manner of quantum mechanics, an action function of DM seesaw motion should be equal to multiplication of \( p \) and \( \lambda \):

\[
S=m\cdot c\cdot \lambda \approx 1.2-10^{-39}\cdot 3.10^8\cdot 1.9-10^{-3} \approx 6.8-10^{-34} J\cdot s
\]

As it is obvious, such obtained estimation of the value of an action function of DM seesaw motion also corresponds well to the Planck’s constant \( h \).

It is clear that obtained two estimations of \( S \) value for DM seesaw motion discover the origin of Planck’s constant \( h \) in the nature as the result of DM thermal seesaw motion at DM temperature \( \approx 2.7 K \). No doubt, what important to note, that if DM temperature (or any other DM parameter) will change, then it will courses the change of DM action function and, correspondingly, the change of the value of Planck’s constant \( h \). Obviously, at that all known nature properties (of microcosm first of all) should be changed, but if all they will be changed very slowly (or in-phase to each other) then their change will not be checked by any observations.

As clear, the obtained result for \( h \) origin from DM seesaw motion gives materialistic base to the Heisenberg’s principle of uncertainty and to all other conceptions of quantum mechanics.

It should be underlined, that DM thermal seesaw motion gives full vindication of adaptability of statistical physics. Really, the DM thermal motion (at \( \approx 2.7 K \)) means, like to known thermal Brownian motion, that the trajectories of all material bodies are get entangled in some extend and, correspondingly, they may be intersected by itself. Such real property of body trajectory rejects the one of the main postulate of classical mechanics (about nonintersecting body trajectories) and prove the truth of Boltzmann’s approach in statistical physics.

4. Estimation of Dark Matter Density in the Universe

As shown, damping length of seesaw motion of DM effective mass is equal to \( \lambda\approx 1.9-10^{-3} m \), what taking into account the effective mass value \( (m\approx 1.2-10^{-39} kg) \) let to obtain an estimation of very
interesting cosmological parameter, namely, the density of DM ($\rho$). The knowledge of $\rho$ value is necessary for solving one of the important cosmological problems, which concerns the understanding of stability of our Universe.

The proposed estimation of $\rho$ is based on reasonable assumption that damping length ($\sim 1.9 \times 10^{-3}$ m) of DM seesaw motion includes not one but many ($>10$) effective masses of DM. Such assumption corresponds to known damping behavior of Langmuir longitudinal waves in plasma, where their damping length exceeds even the value of Debye screening length, which includes very many particles of plasma. For example, in the case of intersellar space plasma Debye screening length includes more than 100 active particles of plasma. The use of analogy between the damping length of DM seesaw motion and damping behavior of Langmuir longitudinal waves in plasma is reasonable as sustained CMBR producing by DM seesaw motion is similar to existing sustained waves in plasma.

As reasonable, it may be assumed that damping length of DM seesaw motion ($\sim 1.9 \times 10^{-3}$ m) includes about 30 effective mass $m\approx 1.2 \times 10^{-39}$ kg, what gives for the density of DM the value

$$\rho \approx m/(30/\lambda)^3 \approx 5 \times 10^{-23} \text{kg/m}^3.$$  

The $\rho$ value, obtained at such assumption, responds well to the critical density ($\rho_c \approx 0.9 \times 10^{-28}$ kg/m$^3$) of space matter for the case of stationary Universe. These results are in agreement with recent data from space vehicles (Planck and others satellite data), which have established the stable state of our Universe. Such agreement is important since all these data indicate in general the absence of the Universe inflation problem, what leads to another problem presumption of mysterious dark energy, which has no its clear physical sense yet. It may be shown, that these two problem ideas are eliminated by accounting the existence of DM, i.e. by the fact that the space is really material medium.

As known the problem assumption that our Universe is expanding was caused by observed red shift of frequency (reduction of energy) for electromagnetic waves coming from deep cosmic space. Moreover, this red shift (and reduction of wave energy) increases with increasing space distance, from which electromagnetic waves are coming. Such red shift (and reduction of energy) may be simply explained by natural dissipation of energy of electromagnetic waves while they are propagating through the filled by DM space, which is real material medium. As clear, such dissipation must increase with increasing space distance, what logically explains the observed red shift increase with space distance. This materialistic explanation of observed red shift, known as concept of tired light, is natural and evidently true since it eliminates both obviously mysterious ideas about Universe inflation, induced by physically queer assumption of Big Bang, and about physically unexplained reason of dark energy.

5. Creation of Electron-Positron Pairs from Dark Matter: on Substantiation of Positron Nature of Mysterious Ball Lightning

The existence of DM in the space and reasonable comprehension that electron-positron pairs are created from this DM (as material vortexes according to their spins) let substantiate positron nature of yet misunderstood atmospheric phenomenon – ball lightning (BL). It is shown [11, 12], that understanding of BL physical nature as a bunch of big amount of positrons let explain all observed specific properties of BL. Main known properties of BL (ball-shaped luminescence, visible size and time of life) are determined by behavior in the air of X-ray radiation from annihilation of BL positrons with electrons of the air molecules. Efficient creation of positrons in thundereclouds at streak lightning was revealed recently (2009) with the use of space telescope Fermi (by registration the X-ray radiation, which is specific for electron-positron annihilation) [13]. This fact is confirmed by mountain station observations [14], which also show the appearance at mighty streak lightning of many very hot electrons and gamma quanta. Their appearance is due to high electric fields in thundereclouds (up to 200 MV), what at mighty streak lightning leads to strong heating of electrons and to their multiplication by ionization of air molecules. As known such hot electrons at their retardation in the electric field of nucleus (of air molecules) effectively produce the bremsstrahlung (gamma quanta with MeV energy), and these gamma quanta create (also effectively) in the nucleus electric field of air molecules) the electron-positron pairs.

The possibility of positron confluence (at first sight unbelievable for the same charges) may be
reasonably substantiated for the case, when positrons are created concurrently and next to from all ambient DM [11, 12]. Since every positron is material vortex and its electric field results from DM polarization by its rotation, it is clear that, if all nearest DM will be consumed for creation of many positrons, so at this moment around thus created positrons will be not enough DM to produce their electric fields, which lead to their mutual repulsion. Thus, such created positrons, being an identical material vortex, may confluence in one rotating bunch. According to the energy conservation law the rotation speed of growing positron bunch should diminish so that its surface speed remains constant [12]. So electric field of positron bunch (due to DM polarization by BL rotation) should stay small and positive, as it is marked for BL in [15], where the most full data of observed BL properties are presented. It is necessary to note, that there are many evidences of witnesses, who observed BL rotation, when BL was moving near them. As to this intrinsic BL property, most indicative is the unique case, when the rotation of emerging and growing BL (after nearby impact of streak lightning into the ground) was observed and described by witness in [16]. Revealed (at explanation of positron nature of BL) conception of physical essence of electric field (and electric charge) of positron means that observed “electric charge” of any elemental particle is the result of its “electric field”, produced by nearest DM “polarization” due to particle rotation [17]. Besides, this conception shows that known universal constant “electric charge” of stable elemental particle (electron, proton and their antiparticles) is the consequence of angular momentum conservation law for such rotating particle, created from DM as stable material vortex.

6. Conclusions
Reasonable materialistic assumption that observed CMBR is produced by thermal motion of DM, which fills ambient space, let substantiate, using observed properties of CMBR, both the classical physics conservation laws and also the materialistic origin of all quantum mechanics principles since DM seesaw thermal motion creates the mechanical action equal to known value of Planck’s constant.

As shown, namely observed high spatial homogeneity and isotropy of CMBR and, naturally, the same properties of its producing DM, really validate the classical physics conservation laws of momentum and angular momentum, correspondingly. Whereas the conservation law of energy follows from observed stability of behavior (independence on starting moment) of physical processes in the nature.

As also shown, the Planck’s constant may be directly obtained from the features of CMBR, which is produced by equilibrium seesaw motion of DM at temperature \( \approx 2.7\text{K} \), taking into account that Planck’s constant is in their essence the mechanical action too. That result obviously gives materialistic ground for Heisenberg’s principle of uncertainty and, correspondingly, for all conceptions of quantum mechanics.

As about to the applicability bounds of classical physics fundamental laws, it is clear that conservation laws for momentum and angular momentum will take place everywhere, where DM is present with its high homogeneity and isotropy (at large scale). If it is not so, as it is near massive or charged bodies, the observed deviations from this laws are taken into account as usual by using corresponding potentials (gravitational or electrical). As regard to energy conservation law, it will be applied if parameters of DM seesaw motion (or that of CMBR) will be constant or vary enough slowly during considered time.

It is necessary underline that observed (from the Earth) weak \( \approx 0.1\% \) dipole anisotropy of CMBR obviously indicate the existence in space of some material substance (just DM), through which the Solar system moves (at the rate \( \approx 400\text{km/s} \)) in direction of the Leo constellation. This feature of CMBR is greatly important since it directly demonstrates that so called “vacuum” is not empty, but it is filled by now actively sought-for DM (or “ether” as it was earlier named).

Understanding of existence of DM with observed properties of CMBR let give materialistic substantiation to conservation laws of classical physics and to principles of quantum mechanics as creates the value of Planck’s constant from DM thermal motion. Such understanding also let substantiate positron nature of BL, what allow first explain all observed BL properties, and reveal
The physical essence of electric field (consequently, electric charge) of elemental particles, created from DM.

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