Immanuel Kant and Dead Matter

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Abstract: *A new Physics is born at the time of the crisis of theoretical physics and the entire scientific paradigm. The article proposes to come back to Immanuel Kant's philosophical heritage in order to better understand the concept of quantum vacuum (dark matter) in "New Physics" and its participation in all interactions in an open Universe filled with baryonic matter and dark matter (dead matter according to Kant).*

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1. INTRODUCTION

Stefano Veneroni, Docteur en Philosophie (PhD) de la Sorbonne – Paris IV, University of Eastern Piedmont, Vercelli, Italy, studying the legacy of Immanuel Kant, discovered in one of him works a mention of dead matter filling the entire Universe [1]. In the an essay of 1766, Dream of spirit-seer illustrated by dreams of Metaphysics., Kant writes On the page 55: "The characteristics of the dead matter which fills the Universe are stability and inertia; it further possesses solidity, expansion, and form, and its manifestations, resulting from all these three causes, admit of physical explanations, which, at the same time, are mathematical, and, collectively, are called mechanical"!!! [2]. But this is dark matter, the hypothetical presence of which scientists discovered at the end of the 20th century. Dark matter in Astronomy and Cosmology, as well as in theoretical Physics, is a *hypothetical* form of matter that does not emit electromagnetic radiation and does not directly interact with it. This property complicates and, possibly, even makes its direct observation impossible. The conclusion about the existence of dark matter is made on the basis of numerous, consistent with each other, but indirect signs of the behavior of astrophysical objects and the gravitational effects they create. Clarification of the nature of dark matter will help solve the hidden mass problem, which, in particular, consists in the anomalously high rotation speed of the outer regions of galaxies. Of particular interest to astronomers was the Andromeda nebula, in which the speed of stars around its center does not decrease, as celestial mechanics predicts, is inversely proportional to the distance to the center R, but remains almost constant (Figure 1). This may mean that the galaxy along its entire length contains a significant mass of invisible matter ("galactic halo")
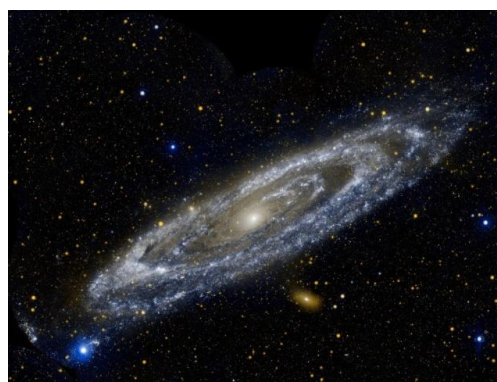

Figure1. *The beautiful Andromeda galaxy*

According to the observational data from the Planck space observatory published in March 2013, the total mass-energy of the observed Universe consists of:

- Dark energy (68.3%);

- Dark matter (26.8%);

- "Ordinary" (baryonic) matter (4.9%) [3].

Of the remaining 5% of baryonic matter, 4/5 of the mass falls on the interstellar medium, and only 0.5% of the average density of the Universe is concentrated in stars.

The dark galactic and intergalactic medium is, according to J. Maxwell's definition, a luminiferous medium in its properties very close to superfluid ³He-B at low temperatures [4].

That Maxwell himself endowed the light-carrying environment in which vortex electric fields and currents of displacement, necessary for him to derive the famous equations of electrodynamics, with properties surprisingly close to the properties of a superfluid quantum vacuum, have arisen [5]. Here are these properties:

1)the rotation of the particles of the medium, which, according to the quantum vacuum model, is comparable with the presence of spin in quantum forming the dark energy ;

2) the translational motion of particles of the medium without friction between themselves and without loss of energy, which can be interpreted as the absence of shear viscosity and superfluidity in the dark energy ;

3) the rotation of the particles of the quantum vacuum without slipping, which, essentially, is the rotational viscosity;

4) the formation of vortices during the propagation of electromagnetic waves, which fully coincides with the conclusions of the quantum vacuum model;

5) dielectric properties of the light-carrying environment the quantum vacuum. Maxwell called the component (dE / dt) in his equations "bias current", bearing in mind that an electric field is created in a luminiferous ether when excited due to the relative motion of its differently charged particles that form a dipole. In quantum electrodynamics (QED), this phenomenon the polarization is characterized by the production of electron and positron pairs in a physical vacuum (dark energy and dark matter) [6] ;

6) the formation of a significant mass in the dipoles, a much larger mass of particles of the medium, which is identical to the property of the vortices in the dark matter.

The last property of the quantum vacuum explains the mechanism of the phase transition of dark energy into dark matter, during the formation of massive domains in the gravitational and magnetic fields of galaxies. Tesla, refers to the work of Maxwell, wrote: "Almost thirty-three years ago, Maxwell, continuing the promising experience of Faraday 1845, developed an ideally simple theory that combined light, heat rays and the phenomenon of electricity, explaining their origin with vibrations of a hypothetical fluid of an incomprehensible thin structure called ether …" [7].

Most galaxies rotate so fast that they should break apart, but the invisible "halo" of dark matter should hold them together. The author of the local theory of the expansion of the Universe, a professor at Moscow State University A. Chernin, argues that in intergalactic space, where there is no gravity mass and magnetic field of large cosmic formations (galaxies) acting on dark energy, neither dark matter nor baryonic matter exists, but one dark energy [8]. For the dark energy and dark matter, the generalized vector Lame wave equation is valid. This equation is equivalent to two simpler wave equations, which describe elastic waves of two types: longitudinal waves that propagate with phase velocity *Vp* and transverse waves with phase velocity *Vs*. It can be gravitational, electromagnetic, and torsion waves. The speed of propagation of longitudinal waves is higher than the transverse. Gravitational waves can be attributed to the longitudinal waves since according to the calculations of Laplace, their speed should exceed the transverse electromagnetic waves at least 7000000 times. Otherwise, the retarded gravity of the Sun to cease to be strictly central and the planetary system fall apart very quickly due to cyclic torque [9]. Consider the famous "Einstein Field Equation" which governs the behavior of general relativity. The left-hand side describes the curvature of space-time, while the right-hand side describes the distribution of matters [10]:

$$R\mu\nu - \frac{1}{2}g\mu\nu \ = \ \frac{8\pi G}{c^4}\,T\mu\nu \qquad\qquad (1)$$

Where $R\mu\nu$ is the Ricci tensor; $g\mu\nu$ is the event space metric tensor; $T\mu\nu$ is the energy-momentum tensor of matter.

Einstein is talking about gravitational waves propagating in the free space, which means there is no matter, not even electromagnetic field, consequently the right hand side should be zero. So the equation is simplified to Rμν-1/2 gμνR=0, which is equivalent to a more concise form Rμν=0, which is also known as "Vacuum Einstein Field Equation". Both EFE and VEFE are nonlinear partial differential equations, while in the weak field setting, they can be approximated with linear equations. The linear EFE is similar to other wave equations like Maxwell's Equations, so Einstein predicted the existence of transverse gravitational wave and predicted that the speed of the gravitational waves is equal to speed of light. However, there is no free space in galaxies, there is dark matter there, which is five times more than baryonic matter and the right side of equation (1) cannot be equated to zero [11]. Therefore, Einstein's predictions regarding the type and the speed of gravitational waves in the new cosmology need to be clarified. A more complete equation of the field, taking into account the polarization medium of quantum vacuum (dark matter), was presented in 1998 by professor of the Institute of Mathematics of the Russian Academy of Sciences V. Dyatlov [12]. The new equations include the density of matter and its speed as independent variables, their closure is possible only with the use of continuum mechanics.

Quantum vacuum (dark matter and energy), by definition, is in a lower energy state with respect to baryonic matter. The behavior of dark matter in this energy state is similar to the behavior of atoms in a Bose-Einstein condensate (quantum fifth state of matter) obtained at a temperature of matter close to absolute zero - 273.5 Celsius or 0 Kelvin (Figure 2).
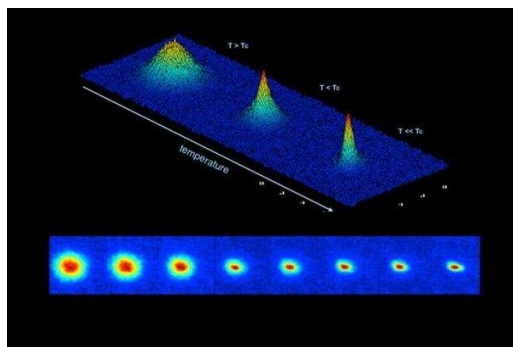
**Figure2**. *Bose-Einstein Condensate (BECs)*

In June 2020, the Bose-Einstein condensate was reconstructed in Earth orbit at the International Space Station (ISS) [13]. It was only there that they managed to create all the conditions for the appearance of the fifth quantum state of matter within a few seconds, but this turned out to be enough for scientists to get an idea of how dark matter moves and why we cannot see and feel it.

The transition of dark matter to baryonic matter is accompanied by absorption of energy, and the reverse transition of baryonic matter to dark matter is accompanied by the release of energy. An example is the polarization of quantum vacuum (dark matter) when exposed to strong electric and magnetic fields or cosmic radiation, accompanied by the formation of electron-positron pairs in a vacuum due to which the vacuum itself becomes unstable. The conditions for the transition of baryonic matter to dark and vice versa do not fit into the scope of standard model.

2. COSMOLOGY OF THE 21ST CENTURY AND THE DEAD MATTER OF IMMANUEL KANT

In our time of the 21st century, the century of radio telescopes, satellites and space probes, cosmology has received the opportunity to look deeply into the structure of the Universe, and we find there dead matter predicted by Immanuel Kant in the 18th century. ESA XMM-Newton X-ray Observatory discovered three massive filaments of hot gas in a cluster of galaxies. So exposed part of the cosmic skeleton that permeates the entire universe. Galaxies gather to form groups and even large agglomerates called clusters. These clusters are the most massive space structures held by gravity. Clusters contain a large amount of hot gas and even more invisible dark matter. On a universal scale, galaxies and clusters of galaxies are connected into a giant network, at the nodes of which are the

most massive clusters. XMM-Newton's new study discovered several filaments of galaxies, gas, and dark matter that flow to one of the most massive clusters of galaxies in the universe. This is the first discovery to confirm theoretical calculations. "It was an unexpected and long-awaited discovery!" Says Dominic Eckert of the University of Geneva, Switzerland, author of a report in the journal Nature. Figure 3 shows the image of the four galactic clusters that make up Abell 2744. Four very massive clusters of galaxies are visible where there is a higher concentration of galaxies (white and purple regions). Two clusters in the lower left corner of the image are in the early stages of the merge process. Two other clusters can be seen in the central part of the image just above the center.
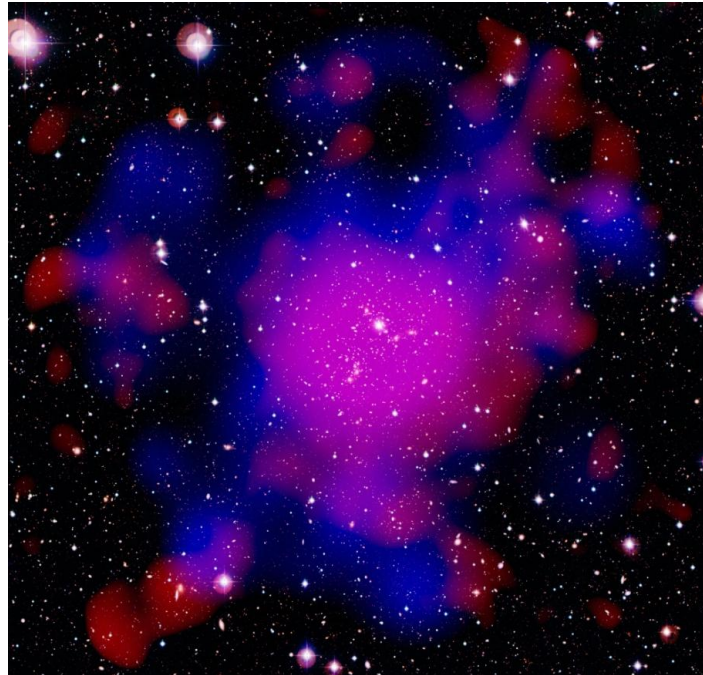
Figure3. *Components of the cluster of galaxies Abell 2744. White color - galaxies, red color - hot gas and blue color - dark matter.*

In early 2020, scientists managed to register small clumps of dark matter - only 1/10 000 and even 1/100 000 of the mass of the Milky Way. And for dark matter these are indeed very shallow meanings. Detection is made possible by gravitational lensing of light. If there is even a small cluster of dark matter in the galaxy lying in the foreground, or on the line of observation, the observed picture is distorted. Based on these distortions, we can conclude about the size of the clots. As you know, massive objects can refract rays of light. Not much, but at large distances of millions of light-years, deviations will be noticeable. This characteristic gives rise to the effect of gravitational lensing, thanks to which we can see the light from distant stars that are behind galaxies or other massive objects (Fig.4)

Figure4. *The effect of gravitational lensing*

The Hubble observation yields new insights into the nature of dark matter and how it behaves. "We made a very compelling observational test for the cold dark matter model and it passes with flying colors," said Tommaso Treu of the University of California, Los Angeles (UCLA), a member of the observing team [14]. Since gravitational fields are not shielded by material bodies, the trajectory of the gravitational waves will differ from electromagnetic waves.

The presence of additional gravitating masses of dark matter in near-Earth space was discovered during experiments with artificial earth satellites equipped with magnetometers. With the help of magnetometers, it was possible to detect moving vortex quantum spinors of dark matter in the near-earth medium having the form of tangential cylinders, with axes parallel to the axis of rotation of the Earth [15]. The velocity of the satellite relative to dark matter was determined from the change the intensity of the magnetic field. The experiments were conducted in the A.F. Mozhaysky Military-Space Academy in the 90s of the 20th century, under the leadership of the Deputy Head of the Academy for by Scientific Work, Professor V.Fateev. Head of the Department is Colonel V.L. Groshev published the results of dark matter detection in his book [15]. Academy staff found that in areas of tectonic faults, where there is intense electromagnetic and gravitational energy interaction between the liquid magma of the Earth and the cosmic dark matter, are formed toroidal luminous vortices with sizes ranging from micro particles to tens of meters (rotators, spinors, hadrons) [15]. Such spheres, formed by dark matter, should exist around other planets, stars and galaxies. This discovery allowed researchers to amend the law of universal gravitation of Newton and propose a new formula for calculating time on artificial satellites of the Earth instead of the relativistic Einstein-Lorentz formula. Now when calculating the motion of a spacecraft according to Newton's law of gravitation $F = Gm_1m_2/r^2$, it is necessary to take into account and the additional variable mass of dark matter that forms a sphere around astrophysical bodies. When the spacecraft leaves the planet, the position of the center of gravity of the masses in the planetary system Earth - the sphere will constantly shift in accordance with the flight of the ship due to dark matter [16]:

$$F = G\frac{(Me+Md)m}{R^2}$$
(1)

where Me is Earth's mass,

Md is variable mass of dark matter in near-Earth space,

m is spacecraft mass,

R is distance between the ship and the center of gravity of the system.

Availability of a sphere formed by dark matter near the sun can explain the strange acceleration, marked by American scientists in removing automatic interplanetary station "Pioneer 10" and "Pioneer 11" from the Sun at a distance of more 20a.e. when solar radiation effects has practically disappeared. Pioneer 10 and 11 were launched in the early 1970s and explored the outer solar system. But in 1980, mission scientists noticed that spacecrafts have unexpectedly drifted off course. Both spaceships experienced a slightly stronger force of attraction to the sun than expected, and since their launch, they have drifted off course by hundreds of thousands kilometer. Coherent radio Doppler data generated by the Deep Space Network with the Pioneer 10 and 11 spacecraft show an anomalous, constant, frequency drift that can be interpreted as an acceleration directed towards the Sun of magnitude $(8.74 \pm 1.33) \times 10^{-10}$ m·s^{-2} at distances between 20 and 70 AU (Anderson et al., Phys. ... Rev. D 65, 082004). But this is not the only problem regarding the trajectories of distant spacecraft. "Galileo", NEAR (sent to the asteroid Eros), "Rosetta" (to comet Churyumov – Gerasimenko), "Cassini", "Messenger" (to Mercury) - all of them at different times performed an accelerating maneuver near the Earth, using its gravity, in order to get energy and to accelerate or slow down, and in all experiments the acceleration / deceleration was anomalous, not quite consistent with the indicators of both Newtonian (which is natural) and Einstein's physics. The Voyager 1 and Voyager 2 spacecraft, which in 2012 gone even further from the Sun than the Pioneers, weren't a helpful as might have been expected in contributing to the investigation of the Pioneer anomaly because of the way in which they are stabilized. Unlike the Pioneers, which are spin-stabilized, the Voyagers have what is known as three-axis stabilization. This results in an greater uncertainty in the spacecrafts' theoretical positions. The uncertainty was great enough to mask any deceleration similar in magnitude to that seen in the Pioneer probes. In November 2018, after a 41-year voyage, Voyager 2 crossed the

boundary beyond which the influence of the Sun ends, and entered interstellar space. But the mission of the little probe has not yet been completed - it continues to make amazing discoveries. Voyager 2 discovered something amazing: the distance from the Sun, the density of space increases. Voyager 1, which entered interstellar space in 2012, transmitted similar indicators to Earth. New data have shown that the increase in density may be a feature of the interstellar medium. The solar system has several boundaries, one of which, called the heliopause, is determined by the solar wind, or rather by its significant weakening. The space inside the heliopause is the heliosphere, and the space outside is the interstellar medium. But the heliosphere is not round. It looks more like an oval, in which the solar system is at the forefront, and behind it is a kind of tail (Fig. 5). Voyager 1 crossed the heliopause on August 25, 2012 at a distance of 121.6 astronomical units from the Earth (121.6 times the distance from Earth to the Sun - about 18.1 billion km). When he first measured the plasma oscillations after crossing the heliopause on October 23, 2013 at a distance of 122.6 AU (18.3 billion km), he found a plasma density of 0.055 electrons per cubic centimeter. After flying another 20 AU (2.9 billion kilometers) Voyager 1 reported an increase in the density of interstellar space. to 0.13 electrons per cubic centimeter. In June 2019, Voyager 2's Instruments showed a sharp increase in density to about 0.12 electrons per cubic centimeter at a distance of 124.2 astronomical units (18.5 billion kilometers). What caused the increase in the density of space? One theory is that the lines of force of the interstellar magnetic field become stronger with distance from the heliopause. This can cause electromagnetic ion cyclotron instability. Voyager 2 did detect an increase in the magnetic field after crossing the heliopause.
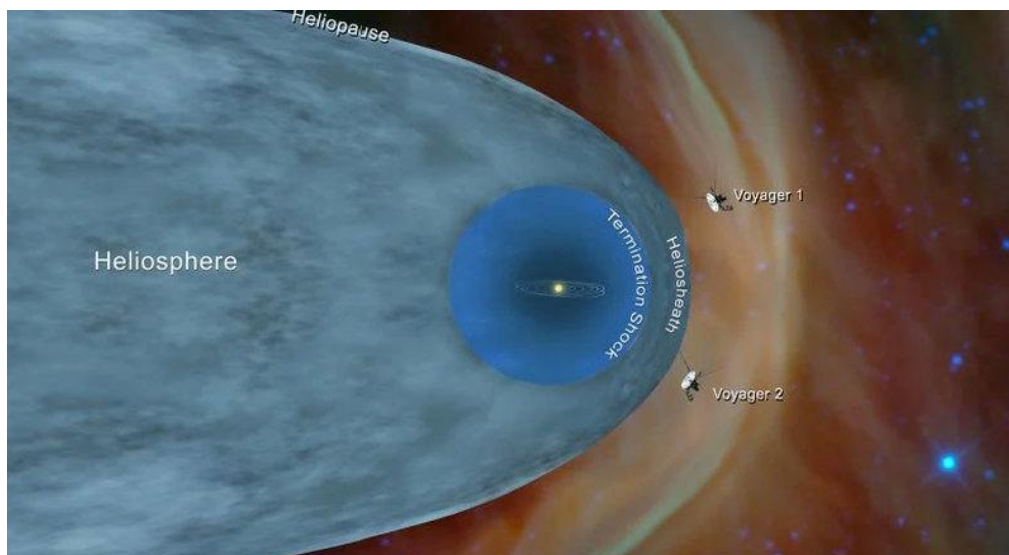
Figure5. *Voyager crossed the heliopause at the leading edge of the heliosphere, but with a difference of 67 degrees in heliographic latitude and 43 degrees in longitude.*

3. CONCLUSION

Epistemological optimism is a philosophical doctrine, which asserts the possibility of an absolutely complete, exhaustive knowledge of the world, and it is the opposite of agnosticism, which is a philosophical doctrine that denies the possibility of knowing the objective world and its laws. Today, a "New Physics" is being born, the object of consideration of which is, in addition to ordinary baryonic matter, quantum vacuum (dark matter), which takes part in all interactions in an open Universe. To overcome the crisis of theoretical physics, which led to the dominance of militant agnosticism in the scientific community, preaching the illusory nature of the universe, it is useful to turn to Kant's scientific heritage.

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