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Dark matter and generation of secondary electrons and positrons in the near-Earth space environment from the data of experiments PAMELA, FERMI and AMS

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Dark Matter and Generation of Secondary Electrons and Positrons in the Near-Earth Space Environment from the Data of Experiments PAMELA, FERMI and AMS

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I. Introduction

Primary high-energy electrons in cosmic rays are formed during acceleration in supernova remnants. Secondary electrons and positrons are generated in the cosmic medium by relativistic protons of the Earth's radiation belt and cosmic radiation and are within the boundaries of the Earth's magnetosphere, which is assumed to be 25000 km. It was established that the generation of secondary particles increases with increasing altitude (by decreasing the magnetic field B below 0.215 G). The obtained results are difficult to explain in the framework of the model of inelastic interactions of protons of a radiation belt with a residual atmosphere [1, p.224]. Electron-positron ratios of secondary particles increase with the proton energy, starting from 5 GeV, which contradicts the standard model of generation and can mean the existence of another source of positrons [2, p.173]. And such a source is - this resonant scattering in intergalactic plasma, formed by physical vacuum [3]. There is a mechanism for the generation of secondary particles in the physical vacuum - this is a resonance, there are also theories that allow describing the irreversible process of particle formation [4, 5,6]. All this represents The modern theory of resonance scattering in intergalactic plasma (or in a dark matter) is born at the interface of elementary particle physics, quantum electrodynamics (QED) and astrophysics and allows us to assert that the space medium can act as a support medium for the of cosmic microwave EmDrive engines.

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II. Experiments

The PAMELA magnetic spectrometer was launched aboard the Resurs-DK satellite to an elliptical near-polar orbit with a height of 350-600 km to study the fluxes of particles and antiparticles of cosmic radiation in a wide energy range from tens of MeV to hundreds of GeV. Continuous measurements of cosmic ray fluxes were carried out. The PAMELA device consists of a magnetic spectrometer based on a permanent magnet of ~ 0.4 T, surrounded by anti-coincidence detectors, an electromagnetic calorimeter, a time-of-flight system, scintillation counters and a neutron detector. The magnetic spectrometer has six silicon strip planes that measure the coordinates of the track with an accuracy of 3 mkm, which allows us to determine the sign of the charge of the particle and their stiffness by the deviation in the magnetic field. The electromagnetic calorimeter makes it possible to separate the electromagnetic and hadronic cascades and measure the energy of electrons and positrons with an accuracy of not worse than 10% from several GeV to hundreds of GeV. The time-of-flight system has a resolution of about 300 ps and makes it possible to separate low-energy protons from positrons up to 0.8-1 GeV. The authors of the PAMELA device assert that "the use of a full set of criteria provides a proton-screening coefficient at the level of 10^{-5}, which makes it possible to reliably isolate electrons and positrons against a background of protons." [1,2].

In my article, I will allow to disagree with the statement made by the creators of the PAMELA device about the reliable separation of relativistic protons of the Earth's radiation belt from secondary positrons. In doing so, I rely on two factors:

1. Conclusions to which the researchers come when analyzing the results of the PAMELA experiment:

"PAMELA, FERMI and others detect an increase in the relative share of positrons in the total flux of positrons and electrons in the cosmic medium, starting with photon energy above 30 GeV. According to new data, the AMS detector installed onboard the ISS, the positron spectrum becomes more rigid with increasing energy, while the electron spectrum varies little. The maximum increase in the number of positrons takes place at an energy Wp ≈200GeV." [7]. "Recent measurements of electron-positron ratios in PAMELA, FERMI and AMS experiments have shown that it increases with energy growth starting from 5 GeV…" [2, pp. 173];

2. The problem of the interaction of the cosmic medium with the electromagnetic energy of a moving charge and the replacement of the controversial idea of an increase in the mass of a moving charge to infinity as the speed of light approaches, to a more acceptable idea of the deformation of the electric field of a moving charge and the reduction to zero of the interaction force with it. The interaction of a moving electric charge q with an electric field E0, taking into account retarded potentials and deformation of the electric field E of a moving charge, can be described by the dependence [8]:

$$F = \mathbf{E}_0\, q \sqrt{1 - v^2 / c^2} \qquad (1)$$

Taking into account the mass of the charge and acceleration α, the dependence (1) can be written in the form:

$$F = \mathbf{E}_0\, q \sqrt{1 - v^2 / c^2} = m_v \alpha = \frac{m\alpha}{\sqrt{1 - \frac{v^2}{c^2}}} \qquad (2)$$

Within the framework of the relativistic concepts of modern electrodynamics dependence (2) is interpreted as the effect of "increasing the mass" m_o moving charge to infinity when approaching the speed of motion of the charge to the speed of light. However, equation (2) is a relativistic effect of reducing the force interaction of the moving charge with the electric field E0, formed by a stationary charge. The effects of delayed potentials and deformation of the electric field of moving charges leads to a restriction of the growth of the mass of the charge, at v→c. The increase in particle mass at a rate occurs for other reasons (non-relativistic effect). When the oscillation frequency of the electromagnetic field arising when a particle moves in a medium (dark matter) $\omega_B = \frac{mv^2}{\hbar}$, approaches the natural oscillation frequency of the particle $\omega_S = \frac{mc^2}{\hbar}$, resonance arises. Resonance is accompanied by an increase in the additional particle mass $\Delta m = \hbar\, \omega s / c^2$. The graph of the dependence of the mass of a particle on its velocity is simply a half of the amplitude-frequency characteristic of the forced oscillations of a harmonic oscillator without dissipation, while the increase in mass is absolute [6].

The most common instruments for the accurate measurement of the energy spectrum of constant and pulsed beams of charged particles are magnetic spectrometers. This method is based on the dependence of the radius of the cyclotron orbit on the kinetic energy of the particle. The equality of the Lorentz force and the centrifugal force when the particle moves around the circumference in a homogeneous magnetic field leads to the equation:

$$qvB = \frac{mv^2}{r} \qquad (3)$$

where q is the particle charge, v is its velocity, B is the magnetic field induction,
r is the radius of the cyclotron orbit, $m = m_o / \sqrt{1 - v^2 / c^2}$, m_o = rest mass,
c is the speed of light.

From the known q, r, B, we can calculate the kinetic energy of a particle:

$$W = m_o c^2 \left\{ \sqrt{\frac{q^2 \mathbf{B}^2 \mathbf{r}^2}{(m_o c^2)^2} + 1} - 1 \right\} \qquad (4)$$

In modern spectrometers, an approximate relation is used to estimate the kinetic energy of ultrarelativistic charged particles in a magnetic field when $qBr >> m_o c^2$ [9].

$$W \approx qBr \qquad (5)$$

where q is the particle charge,
B is the induction of a homogeneous magnetic field,
r is the radius of a circle described by a particle.

It is seen from expression (5) that the kinetic energy of a charged particle in a magnetic spectrometer is directly proportional to the charge value, which in classical electrodynamics does not depend on the velocity of the particle and the radius of the cyclotron orbit.

Thus, the reliability of the conclusions about the complete elimination of relativistic protons from the total flux of secondary electrons and positrons in the PAMELA magnetic spectrometer is doubtful. The tracks of relativistic protons in the magnetic field of the PAMELA spectrometer will be close to the positron tracks and, therefore, starting from 5 GeV, the PAMELA experimenters observe the growth of secondary positron fluxes (more precisely, protons and positrons). This can also be confirmed by the fact that the positron spectrum becomes more rigid with increasing energy, while the secondary electron spectrum varies little.

III. Data Analysis

Secondary electrons and positrons are generated in the cosmic medium by relativistic protons and cosmic radiation. It was established that the generation of secondary particles increases with increasing altitude [1, p.224]. The obtained results are difficult to explain in the framework of the model of inelastic interactions of protons of a radiation belt with a residual atmosphere. It is necessary to expand the framework of the model and, in addition to the residual atmosphere, include dark matter entering into it, interacting with cosmic radiation and relativistic protons of the radiation belt. Moreover, there is also a mechanism for generating secondary electrons and positrons-this is resonance [10, 11].

1) Generation of secondary particles has two characteristic features [1, p.223]: The energy spectrum of these particles is very "soft" with a sharp drop above 100 MeV, which can be explained by the resonance mechanism of particle generation.
2) Positrons predominate in the secondary particle flux. The ratio of positron fluxes to electron fluxes (Np / Ne) reaches 5, at a primary radiation energy W≥30GeV. In addition, the generation of secondary particles from relativistic protons of the Earth's radiation belt is almost 100 times higher than that from of cosmic radiation.

a) *Prevalence of positrons in secondary electron and positron fluxes*

"Recent measurements of electron-positron ratios in PAMELA, FERMI and AMS experiments have shown that it increases with energy growth starting from 5 GeV, which contradicts the standard model of generation and distribution of cosmic rays" [2, pp.173-174].

On the one hand, the predominance of positrons may indicate a more effective capture of electrons by the cosmic medium and the presence of a source of primary positrons, but on the other hand, the red branch in Fig. 1 may indicate that, at energies above W = 5 GeV, relativistic protons in a PAMELA magnetic spectrometer are summed up with secondary positrons.

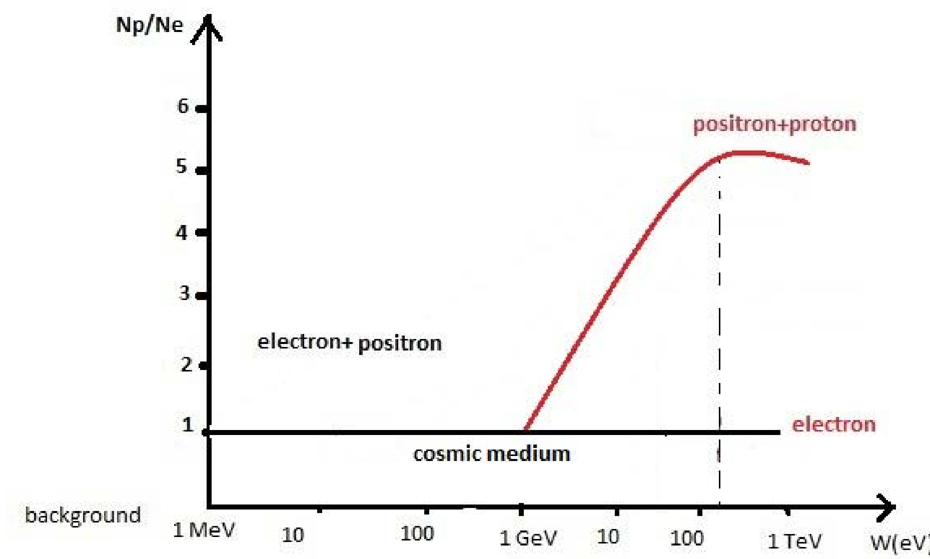

Fig. 1: Graph of secondary electrons and positrons from the data of PAMELA, FERMI and AMS

b) *Resonance effect of generation of secondary electron and positron fluxes*

Figure 2 shows the relative growth curves of the secondary electron and positron fluxes in the cosmic medium, beginning with the cosmic-ray energy W≥ 1 MeV and ending with the energy W = 200 GeV. They allow us to conclude that the process of production of electrons and positrons in a cosmic medium is resonant [5, 10]. The maximum of the total flux of electrons and positrons at the photon energy Wp ≈20 GeV corresponds to the natural frequency of the structural element of the cosmic medium (physical vacuum) ν_r = 4.6911 • 10^{24} Hz obtained by professor A.V. Rykov based on the parameters of the structural element of the cosmic medium (physical vacuum), including the charge of the dipole, as well as its electromagnetic parameters μ_o (magnetic permeability) and ε_o (dielectric constant) as early as 2000. [5]. According to Rykov, with the size of the structural element of the cosmic medium dipole r = 1.3988 • 10^{-15} m, the ultimate deformation (destruction boundary) dr = 1.0207 $\cdot 10^{-17}$ m. is related by the relation dr = α r , where α = 0.0072975 is the fine structure constant. Destruction boundary corresponds to the external photon energy W ≥ 1 MeV (the initial boundary of the photoelectric effect in the physical vacuum. The photon frequency ν_i = 2.4891$\cdot 10^{20}$ Hz). The deformation in physical vacuum is less than dr should be of an electroelastic character, and at higher values, deformation leads to the destruction of the dipole and to the creation of an electron-positron pair. Today this fact has been confirmed experimentally. The resonant maximum of the total spectrum of electrons and positrons at an external radiation energy Wp≈ 20 GeV was detected by Yu.V.

Galaktionov during its accurate measurements in the detector AMS experiment at the International Space Station [3, Fig. 16]. Thus, Yu.V. Galaktion managed to prove experimentally the presence of dark matter in the near-Earth environment.

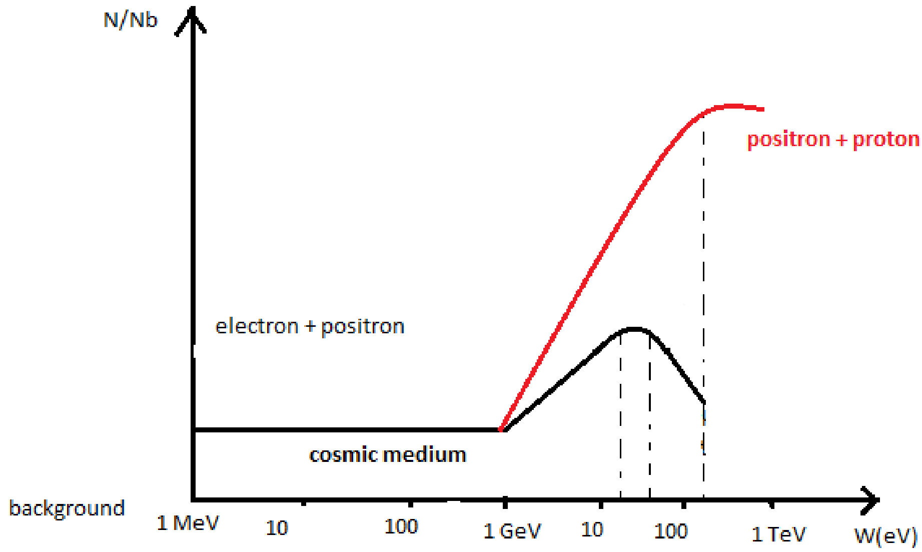

Figure 2: Graph of resonance curves of generation of secondary electrons and positrons

The summation of relativistic protons, starting at W = 5 GeV, with secondary positrons in the PAMELA magnetic spectrometer (the red branch of Figure 2) distorts the results of the experiments and masks the resonant maximum of the generation of secondary electron and positron fluxes relative to their background values (N / Nb). A similar graph is presented in Ref. [3 p. 56, Fig.16 (the result of measuring the total spectrum of electrons and positrons)].

Analysis of the resonance curves shown in Fig. 2 and Fig 16 [3] allows to determine the photon frequency corresponding to the natural frequency of the structural element of the space medium (dark matter) and its wavelength. The frequency corresponding to the resonance energy of the photon (ν) and the natural frequency of the structural element of the cosmic medium (dark matter) is defined as the frequency of the Schrodinger and de Broglie wave functions (for resonance, they describe the same probability density for finding the particle at any point in space):

$$\nu = W / h \text{ or } \quad \omega = W / \hbar \quad \text{and} \quad \lambda = 2\pi c / \omega \qquad (6)$$

where W - the photon energy

h - Planck constant $h = 6.6260 \cdot 10^{-34}$ J / Hz

$\hbar = h / (2\pi)$ $\hbar = 1{,}0546 \cdot 10^{-34}$ J / Hz

c - the speed of light c = 299792458 m / s

Thus, it is possible to determine the natural frequency of the structural element of the cosmic medium (dark matter) and wavelength:

$$W_r \approx 20 \text{ GeV} = 33 \bullet 10^{-10} \text{J}, \quad \nu_r = 4.7 \bullet 10^{24} \text{ Hz}, \quad \omega_r = 2.82 \bullet 10^{25} \text{ Hz}, \quad \lambda_r = 6.39 \bullet 10^{-17} \text{ m}$$

IV. Conclusion

Experiments PAMELA, FERMI and AMS give the researcher a unique opportunity to simultaneously measure secondary electron and positron fluxes, which is extremely important for the development of a standard model for the generation and distribution of cosmic rays. Direct experimental determination of the resonance dependence of birth N elementary particle pairs of frequency ν is almost completely silenced by modern physics. Following the deceptive logic of the modern theory, this dependence is drawn as a monotonically increasing curve. The same processes should be observed in accelerators and colliders [8]. An experimental confirmation of this is the appearance of a flow of backward electrons with a "soft" energy spectrum in multi-wave Cherenkov generators, with the primary-electron energy W = 2 MeV [12]. The resonant nature of the secondary electrons and positrons under the influence of external radiation is a fundamental process of the universe is birth in the space environment divergent flows or drains and sources. The instability of the physical vacuum in external fields is a purely quantum phenomenon. In [13], details of exact numerical, as well as asymptotic calculations of the vacuum instability effect in the presence of the so-called peak electric field are given. In quantum electrodynamics (QED), this phenomenon is characterized by the production of electron-positron pairs from a physical vacuum. Experiments allow us to state that cosmic medium can act as a support medium for engines EmDrive. Here is the conclusion of NASA researchers, obtained by studying the mechanism motion of the microwave Roger Shawyer engine EmDrive in a vacuum: "The quantum physical vacuum a dynamic medium and could potentially be modeled at the microscopic scale as an electron-positron plasma. If the vacuum is indeed mutable and degradable as was explored, then it might be possible to do / extract work on / from the vacuum, and thereby be possible to push off of the quantum vacuum and preserve the laws of conservation of energy and conservation of momentum" [14]. A new theory of intergalactic plasma is born at the junction of the three directions of physics: elementary particle physics, quantum electrodynamics (QED) and astrophysics, and it is necessary to unite the efforts of scientists engaged in the study of the of mechanism of formation of electron-positron pairs in a physical vacuum when exposed to cosmic radiation, relativistic particles or electric field.

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