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Generation of Secondary Electrons and Positrons in the Near-Earth Space Environment from the Data of Experiments PAMELA, FERMI and AMS (2006-2016)

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Abstract- In the article it is proposed to expand the framework of the standard model of generation and distribution of cosmic rays and, in addition to the model of inelastic interactions of the protons of the radiation belt and cosmic radiation with the nuclei of atoms of the residual atmosphere,, to consider the resonant mechanism of generation of secondary electrons and positrons in the near-Earth space environment. Based on the analysis of the data obtained in the PAMELA experiments, FERMI and AMS, a plot of the resonance curves for the generation of secondary particles was constructed and the probable cause is named of the relative growth of the positron flux in the total flux of secondary electrons and positrons, starting with the proton energy above W = 5 GeV.

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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 from protons is almost 100 times higher than that from cosmic radiation [1]. 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. Electron-positron ratios of secondary particles increase with the proton energy, starting from 5 GeV, which contradicts the standard model of generation and distribution of cosmic rays and can mean the existence of another source of positrons and electrons [2]. And such a source is - this is the etheric shell of the planet, formed by dark matter. There is a mechanism for the generation of secondary particles in the etheric shell of the Earth - this is a resonance, there are also theories that allow describing the irreversible process of particle formation [3, 4, 5]. Only there is no willingness of the scientific community to part with A. Einstein's relativistic dogmas GRT and recognize the new reality [6].

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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.

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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]. This contradicts the standard model of generation and distribution of cosmic rays and can mean the existence of other sources of primary positrons [2, pp. 173-174];

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 $v \to c$. The increase in particle mass at a rate occurs for other reasons (non-relativistic effect) [6].

The method of measuring the energy of relativistic particles by the deviation of charged particles in a magnetic field does not take into account the deformation of the electric field of moving charges and the decrease to zero of the interaction force with it and is therefore unacceptable. 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].

$$W \approx q\mathbf{B}r \qquad (5)$$

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, which is determined experimentally in the spectrometer with the help of Faraday cylinders.

Thus, the reliability of the conclusions about the complete elimination of relativistic protons from the total flux of secondary electrons and positrons 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 30 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 from protons is almost 100 times higher than that from cosmic radiation" [2]. 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].

Generation of secondary particles has two characteristic features [1]:

1) 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 7-9.

"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].

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.

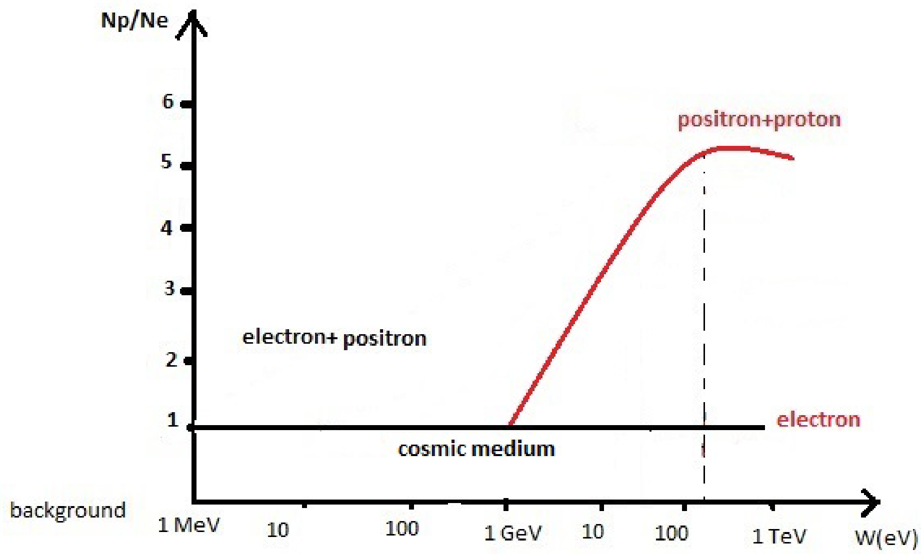

Figure 1: The Graph of secondary electrons and positrons from the data of PAMELA, FERMI and AMS

The experimentally obtained curves of the relative growth of the secondary electron and positron fluxes in the cosmic medium, starting with the cosmic-ray energy W = 1 MeV and ending with the cosmic-ray energy W = 200 GeV, allow us to conclude that the secondary electrons and positrons are generated in a resonant process (see Fig. 2) [5, 11pp. 25-29].

An experimental confirmation of this is the appearance of a flow of backward electrons with a "soft" energy spectrum in multi-wave Cerenkov generators, with the primary-electron energy W = 2 MeV [12].

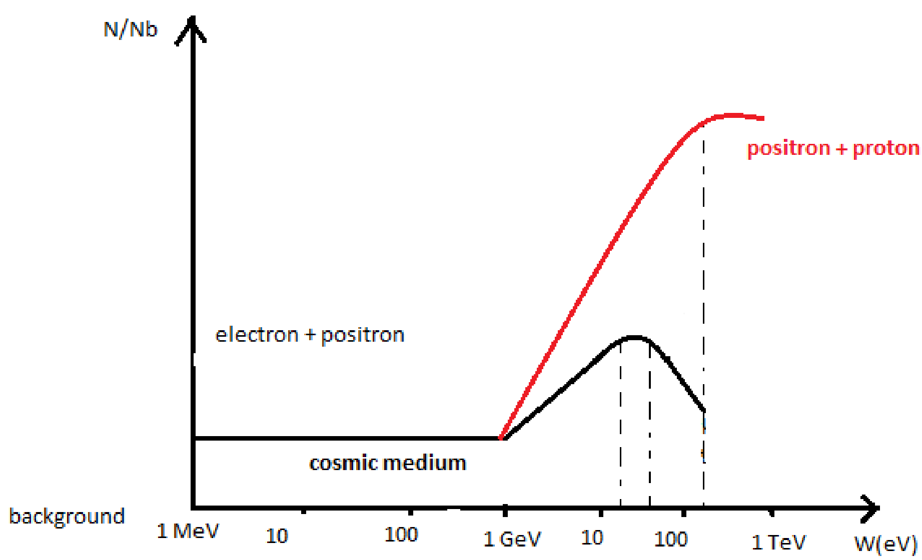

Figure 2: Graph of resonance curves of generation of secondary electrons and positrons

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).

Analysis of the resonance curves shown in Fig. 2 allows one to determine the frequency of the photon corresponding to the red boundary of the photoelectric effect for the near-Earth space environment and the resonance frequency [11 pp. 11-13]:

$$W k \geq 1 \text{ MeV} = 1.6493 \cdot 10^{-13} \text{ J}. \quad \nu k = 2.4891 \cdot 10^{20} \text{ Hz} \quad \omega k = 1.4945 \cdot 10^{21} \text{ Hz} \quad \lambda k = 1.23 \cdot 10^{-12} \text{ m}.$$

$$W r \approx 20 \text{ GeV} = 33 \cdot 10^{-10} \text{J}, \quad \nu r = 4.7 \cdot 10^{24} \text{Hz}, \quad \omega r = 2.82 \cdot 10^{25} \text{ Hz}, \quad \lambda r(de) = 6.39 \cdot 10^{-17} \text{ m}$$

If the PAMELA and AMS data is correct and there really is a second resonance maximum for positrons at W_r = 200GeV [7] , this may mean that the space medium exists in two phase states, respectively, as dark matter and dark energy. Then the natural frequency of the structural element of the dark energy will be:

$$W_r \approx 200\text{GeV} = 330 \cdot 10^{-10} \text{ J} \quad \nu_r = 4.78 \cdot 10^{25} \text{ Hz} \quad \omega_r = 28.2 \cdot 10^{25} \text{ Hz} \quad \lambda_r = 0.6 \cdot 10^{-17} \text{ m}$$

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. The same processes should be observed in accelerators and colliders. Following the deceptive logic of the modern theory, this dependence is drawn as a monotonically increasing curve. 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.

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