

IAF SYMPOSIUM ON ONGOING AND NEAR FUTURE SPACE ASTRONOMY AND
SOLAR-SYSTEM SCIENCE MISSIONS (A7)
Interactive Presentations - IAF SYMPOSIUM ON FUTURE SPACE ASTRONOMY AND SPACE
PHYSICS (IP)

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PROPOSAL OF CONSTRUCTION OF COSMIC ANTINEUTRINO DETECTOR

Abstract

The purpose of this investigation is to calculate the energy-momentum loss by electrons at the scattering of cosmic relic electron antineutrinos at transversely polarized ultra-relativistic electrons in a constant homogenous magnetic field and to propose the idea of detection of cosmic relic electron antineutrinos. We assume that the electron beam is accelerated in the range of energy $160\text{ MeV} - 150\text{ GeV}$ and pass through the Ge crystal that possesses strong electric field. At the same time the Ge crystal is cooled by a liquid helium (or nitrogen). In the frame of reference connected with the accelerated electrons the electric field of the crystal is felt as a magnetic field (an effective magnetic field) by the accelerated electrons. It is obvious that relic antineutrinos pass through the Ge crystal continuously. Depending on the energy of the accelerated electrons the strength of the effective magnetic field can increase in the frame of reference connected with the accelerated electrons essentially. In general, when the magnetic field strength is higher than several hundred Gausses the anti-Stokes scatterings of relic antineutrinos at ultra-relativistic electrons take place. In the considered electron antineutrino-electron scattering process the accelerated electrons transfer part of their energy and momentum to the relic antineutrinos. As a result, the scattered antineutrinos are accelerated. Numerical estimations show that when the energy of accelerated electrons is sufficiently high, the energies of the scattered antineutrinos can reach several GeV . So, the scattered antineutrinos are accelerated. Then, the accelerated antineutrinos pass through the medium that contains sufficiently high concentration of protons. The energy of the accelerated (scattered) antineutrinos is quite enough to initiate the reactions where neutrons and positrons are produced at the expense of the inelastic scattering of the accelerated electron antineutrinos at the protons of the medium. The produced positrons annihilate with the electrons of the medium and it leads to the production of the gamma (photon) pairs that are registered by the related counters. The production of the gamma pairs is confirmation of the relic electron antineutrino detection. Detection of relic antineutrinos enables us to obtain invaluable information from and beyond the boundaries of our Galaxy. At the same time relic antineutrinos carry important information on the early Universe.