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The possibility of detecting TeV electrons and positrons of galactic cosmic rays using the Earth's magnetic field

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Various mechanisms for the production and acceleration of positrons to energies of ~ 10 GeV and above have been actively discussed since their excess in the PAMELA experiment was first detected. To test these theoretical models, measurements of positron flux at energies of ~ 1 TeV and above are necessary. However, modern methods of registering cosmic rays do not provide an opportunity to register the fluxes of positrons and electrons separately. A promising technique is to use synchrotron radiation of positrons and electrons in the Earth's magnetic field to detect them. In this work we modeled the process of detection of positrons and electrons by this technique in the TeV energy range. Estimated registration efficiency for polar latitudes are 5-35% higher than for equatorial latitudes. Using the experimental data of CALET, DAMPE and FERMI on the total electron-positron flux of galactic cosmic rays, the expected integral detector count rate for the ROSS(Russian Orbital Service Station) and ISS(International Space Station) orbit in the energy range of 1-4.5 TeV was obtained. The high-latitude ROSS orbit provides a higher count rate. The possibility of measuring positron energies by registering synchrotron photons emitted by them was also investigated. The energy resolution was 35-45% depending on the positron energy and the minimum number of detected photons.

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