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Sensitivity of the JEM-EUSO detector to UHE tau neutrino

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The ultra high energy cosmic neutrinos are source of knowledge for both astrophysical mechanisms of particle acceleration and fundamental interactions. They open a window into the very distant and high-energy Universe that is difficult to access by any human means and devices. The possibility of detecting them in large exposure space-based apparatus, like JEM-EUSO, is an experimental challenge.
The Extreme Universe Space Observatory on-board the Japanese Experiment Module (JEM-EUSO) on the International Space Station (ISS) is an innovative space mission designed to detect ultra-high energy cosmic rays (UHECRs). When high energy cosmic particles interact with the atomic nuclei of air molecules they initiate extensive air showers (EAS). Orbiting the Earth with period of 90 minutes, at an altitude of about 400 km, JEM-EUSO will detect the light from isotropic nitrogen fluorescence excited by the extensive air showers and Cherenkov radiation reflected from the earth surface or dense clouds.
In this paper we present an estimation of the feasibility of detection of UHE tau neutrino by the JEM-EUSO telescope. The interactions of tau-neutrino in sea water and earth crust has been investigated. The estimation of the propagation lenght end energy of the outgoing tau-lepton shows that if the decay of tau occurs in the atmosphere close enough to the earth surface, e.g. below $\sim 5km$ altitude, the cascade is intensive enough and the generated light can be detected from space.
The geometrical aperture of the JEM-EUSO detector for Earth-skimming tau neutrino events has been estimated for clear sky condition, nadir mode and an average background. The results indicate that the trigger probability of the JEM-EUSO telescope increases up to ~ 100 % at energies $E\nu_\tau \geq 8 \times 10^{19}$ eV.

Collaboration

JEM-EUSO

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