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Detection of tau neutrinos by Imaging Air Cherenkov Telescopes

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This paper investigates the potential to detect tau neutrinos in the energy range of 1-1000 PeV searching for very inclined showers with imaging Cherenkov telescopes. A neutrino induced tau lepton escaping from the Earth may decay and initiate an air shower which can be detected by a fluorescence or Cherenkov telescope. We present here a study of the detection potential of Earth-skimming neutrinos taking into account neutrino interactions in the Earth crust, local matter distributions at various detector sites, the development of tau-induced showers in air and the detection of Cherenkov photons with IACTs. We analysed simulated shower images on the camera focal plane and implemented generic reconstruction chains based on Hillas parameters. We find that present IACTs can distinguish air showers induced by tau neutrinos from the background of hadronic showers in the PeV-EeV energy range. We present the neutrino trigger efficiency obtained for a few configurations being considered for the next-generation Cherenkov telescopes, i.e. the Cherenkov Telescope Array. Finally, for a few representative neutrino spectra expected from astrophysical sources, we compare the expected event rates at running IACTs to what expected for the dedicated IceCube neutrino telescope.

Collaboration

– not specified –

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182

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