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Sensitivity for tau neutrinos at PeV energies and beyond with the MAGIC telescopes

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The MAGIC telescopes, located at the Roque de los Muchachos Observatory (2200 a.s.l.) in the Canary Island of La Palma, are placed on the top of a mountain, from where a window of visibility of about 5° in zenith and 80° in azimuth is open in the direction of the surrounding ocean. This allows to search for a signature of particle showers induced by earth-skimming cosmic tau neutrinos in the PeV to EeV energy range arising from the ocean.

We have studied the response of MAGIC to such events, employing Monte Carlo simulations of upward-going tau neutrino showers. The analysis of the shower images shows that air showers induced by tau neutrinos can be discriminated from the background of very inclined hadronic showers. We have calculated the point source acceptance and the expected event rates, assuming an incoming tau neutrino flux consistent with IceCube measurements, and for a sample of generic neutrino fluxes from photo-hadronic interactions in AGNs. The analysis of 30 hours of MAGIC data taken towards the sea leads to a sensitivity to tau neutrinos of the same order of the down-going point source study of the Pierre Auger Observatory, but is less sensitive than the diffuse study of the IceCube Experiment.

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