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Search 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 permits 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 hadronic background coming from a similar direction. 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 and GRBs. The analysis of about 30 hours of data taken toward the sea leads to a point source sensitivity for tau neutrinos at the level of the down-going point source analysis of the Pierre Auger Observatory, but the diffuse limit is less constraining with respect to the IceCube diffuse results for tau neutrinos.

Experimental Collaboration

the MAGIC Collaboration

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