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KM3NeT performance on oscillation and absorption tomography of the Earth

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The KM3NeT neutrino telescope, currently under construction, consists of two detectors in the Mediterranean Sea, ORCA and ARCA, both using arrays of optical modules to detect the emitted Cherenkov light from charged particles created in neutrino interactions. Although originally designed for neutrino oscillation and astrophysical research, this experiment also bears unprecedented possibilities for other fields of physics. Here we present its performance for neutrino tomography, i.e. the study of the Earth's internal structure and composition.

Owing to the different energy ranges covered by its two detectors ORCA and ARCA, KM3NeT will be the first experiment to perform both oscillation and absorption neutrino tomography. Resonance effects in the oscillations of GeV neutrinos traversing the Earth will allow KM3NeT/ORCA to measure the electron density along their trajectory, leading to potential constraints of the proton-to-nucleon (Z/A) ratio in the traversed matter. Absorption tomography aims at the detection of neutrinos in the TeV-PeV range with KM3NeT/ARCA. At PeV energies, the Earth is opaque for neutrinos which leads to a reduction of the upgoing neutrino flux at the detector side from which conclusions can be drawn about the density of the inner layers of the Earth.

We show here first sensitivity studies of the potential of KM3NeT to address open questions of geophysics concerning the chemical composition and matter distribution in the Earth's core and mantle through neutrino tomography.

Keywords

Atmospheric neutrinos; Absorption tomography; Oscillation tomography;

Collaboration

KM3NeT

other Collaboration

Subcategory

Experimental Results

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