KM3NeT/ORCA: Neutrino oscillation studies in the deep sea

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ORCA is the low-energy branch of KM3NeT, the next-generation Cherenkov neutrino observatory under construction in the Mediterranean Sea. A dense configuration of optical modules is foreseen to detect neutrinos down to a few GeV energy. The detector will be able to accurately reconstruct and distinguish two event topologies: track-like signatures from mostly ν_μ charged current interactions and cascade events dominated by the remaining neutrino interactions. With its instrumented volume of 8 Mm^3, ORCA will collect high statistics of atmospheric neutrinos that have traversed a wide range of baselines and matter density profiles while crossing the Earth.

These ingredients enable ORCA to resolve the neutrino mass hierarchy, i.e. determine whether the third neutrino mass eigenstate is lighter or heavier than the other two, with a significance of 3σ after 3-4 years of operation. ORCA will also be able to constrain other neutrino oscillation parameters such as θ_{23} and - by studying the appearance of tau neutrinos - the unitarity of 3-neutrino mixing.

The contribution reviews the technology, performance and main scientific objectives of the experiment. The current construction status and further science options including a possible neutrino beam to ORCA are outlined.

Subject

Neutrinos

Abstract Title

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