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KM3NeT/ORCA: Measuring neutrino oscillations and the mass hierarchy in the Mediterranean

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ORCA (Oscillations Research with Cosmics in the Abyss) is the low-energy branch of KM3NeT, the next generation underwater Cherenkov neutrino detector currently being built in the Mediterranean. Its primary goal is to resolve the long-standing question of the neutrino mass hierarchy, i.e. whether the mass eigenstate ν_3 is heavier (normal hierarchy) or lighter (inverted hierarchy) than the ν_2 and ν_1 states.

Atmospheric neutrinos crossing the Earth matter undergo matter effects, which are resonant in the few GeV energy range and are influenced by the mass hierarchy. The ORCA design foresees a dense configuration of multi-PMT optical modules, exploiting the excellent optical properties of deep seawater to accurately reconstruct both cascade events (mostly ν_e) and track events (mostly ν_μ) down to a few GeV. Hence, with a wide range of baselines through the Earth and a total instrumented mass of several megatons, ORCA will have very good sensitivity to the mass hierarchy.

This contribution reviews the methods and technology, and discusses the sensitivity studies both for the neutrino mass hierarchy and for obtaining new constraints on other key parameters such as the atmospheric mixing angle θ_{23}. Additional prospects, e.g. using atmospherics to probe new physics or constrain the matter composition of the Earth, will be discussed as well.

Summary

General presentation and status of ORCA ; focus on the sensitivity study to the Neutrino Mass Hierarchy and other oscillation measurements.

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