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Session 10: Future neutrino oscillation experiments and their phenomenology

Neutrino mass hierarchy determination with KM3NeT/ORCA

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KM3NeT, located in the abysses of the Mediterranean Sea, is a distributed research infrastructure that will host a km^3 -scale neutrino telescope (ARCA), offshore from Capo Passero in Italy, for high-energy neutrino astronomy, and a megaton scale detector (ORCA), offshore from Toulon in France, for the determination of the neutrino mass hierarchy.

For both cases, the detector arrays comprise a three dimensional grid of photomultiplier tubes designed to detect the Cherenkov light induced by charged leptons produced by neutrino interactions in and around the instrumented volume. KM3NeT has developed a cost effective Optical Module based on many small 3" photomultiplier tubes. Depending on the neutrino energy range of interest, the Optical Modules are configured in a dense (ORCA) or sparse (ARCA) geometry. Recently, the first KM3NeT detection strings have been successfully deployed and are providing high quality data. The construction of the infrastructure will be completed by 2020.

The ORCA array, 115 strings with an instrumented volume of about 8 Mton, is optimised for the study of atmospheric neutrinos in the energy range 3-30 GeV. Physics studies demonstrate that the neutrino mass ordering can be determined with a significance of 3-7 sigma (depending on the true value of the hierarchy and the value of mixing angle $\sin\theta_{23}$) after three years of operation, i.e. as early as 2023. Simultaneously, ORCA will provide a 3% measurement of the mass difference squared (ΔM_{32}^2) in the atmospheric sector and a 4%-10% (depending on its true value and the true hierarchy) measurement of θ_{23} .