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Exploiting KM3NeT/ORCA data to study atmospheric tau neutrinos

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The next generation of neutrino experiments aims to provide high-precision measurements of the neutrino oscillation parameters in order to reveal the major unknowns in neutrino physics. Among them, validating the three-neutrino flavor paradigm while testing the non-unitarity of the neutrino mixing matrix remains one of the most exciting, as it allows the
exploration of new physics scenarios.

KM3NeT/ORCA is a water Cherenkov neutrino detector being built in the Mediterranean Sea. Its primary physics goal is to achieve an early determination of the neutrino mass ordering from the oscillation of atmospheric neutrinos traversing the Earth. In particular, its
large fiducial mass and the density of detection elements will enable unprecedented statistics for studying tau neutrinos. This talk presents the first results based on data from a partially instrumented detector volume, representing 5% of the final setup and an exposure of 433 kton-years. By studying the oscillation of atmospheric electron and muon neutrinos into tau neutrinos, the measurement of the normalisation factor, defined as the observed-to-expected tau neutrino ratio, as a constraint on the charged-current cross-section, is reported. Beyond the standard three-neutrinos flavor paradigm, a first test of the non-unitarity mixing matrix in the atmospheric sector is also presented. Event reconstruction and selection procedures, the analysis strategy, and future prospects are discussed in detail.

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