

Search for Lorentz invariance violation with ANTARES and KM3NeT/ORCA6

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Lorentz invariance (LI) is a fundamental symmetry in physics that ensures that the same equations can be used to describe experiments in any inertial laboratory. Many proposed quantum gravity theories predict a violation of this symmetry, which is referred to as Lorentz invariance violation (LIV). The “Standard-Model extension” parametrizes physically valid ways of including LIV into the Standard Model of particle physics by introducing a set of LI- and CPT-violating operators coupled with coefficients. A non-zero value of at least one of these coefficients results in a deviation of the predicted neutrino oscillation probabilities from the case of standard neutrino oscillations, which enables neutrino telescopes to measure or constrain these coefficients. The ANTARES neutrino telescope, which was in operation from 2007 to 2022, and the KM3NeT/ORCA neutrino telescope, which is currently being built and already taking data, are two water-Cherenkov telescopes located in the Mediterranean deep sea. Both experiments are sensitive to the atmospheric neutrino flux, which has energies and baselines suitable for constraining LIV coefficients, with neutrino interactions being detectable by KM3NeT/ORCA6 at energies above a few GeV. This contribution reports on the progress of a combined analysis of data collected with ANTARES and with KM3NeT/ORCA6, an early-stage implementation of KM3NeT/ORCA with only six of the planned 115 detection units. The analysis focuses on isotropic LIV coefficients up to mass dimension six, among which some are still unconstrained.

Poster prize

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