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Investigating Neutrino Emission from Gamma-Ray (Galactic) Sources with KM3NeT/ARCA and ANTARES

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High-energy neutrinos are unique messengers that offer insights into the mechanisms powering the most extreme cosmic accelerators. Astrophysical sources capable of producing cosmic rays are expected to emit both neutrinos and gamma rays, establishing a strong connection between these two signals. By modelling the link between observed gamma-ray spectra and the expected neutrino flux, it is possible to identify promising targets for neutrino detection.

In this work, we focus on gamma-ray sources identified by experiments such as LHAASO and HAWC, estimating their neutrino emissions and evaluating their detectability with the KM3NeT/ARCA and ANTARES neutrino telescopes. KM3NeT/ARCA, currently under construction in the Mediterranean Sea, will ultimately instrument about one cubic kilometer of seawater. Although still being deployed, the detector is already collecting data with a partial configuration. ANTARES, located off the coast of Toulon (France), was the first deep-sea neutrino telescope in the Mediterranean; it operated from 2007 to 2022 with an instrumented volume of about 0.01 km^3.

The analysis combines the available ARCA dataset —corresponding to approximately 640 days of livetime —with the full dataset recorded by ANTARES over 15 years of operation. Both experiments are integrated within a common analysis framework, allowing for a joint search for neutrino emission from a selected catalogue of Galactic gamma-ray sources.

Sensitivity estimates for the completed ARCA detector are also provided based on detailed simulations. The combined dataset improves the coverage of the TeV–PeV energy range and enhances sensitivity across a wide portion of the sky.

These results support ongoing efforts to identify the sources of high-energy cosmic neutrinos and contribute to the broader field of multi-messenger astrophysics.

Collaboration you are representing

KM3NeT, ANTARES

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