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Incorporating theoretical blazar models into neutrino stacking analyses with KM3NeT/ARCA

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After IceCube's identification of the blazar TXS 0506+056 as the first cosmic neutrino source candidate, blazars have started to be considered among the most promising neutrino source classes. An improvement of the observations is expected thanks to the development of next-generation neutrino telescopes, such as KM3NeT/ARCA. KM3NeT/ARCA is a deep-sea Cherenkov neutrino telescope currently under construction in the Mediterranean Sea. Once completed, it will cover a volume of one cubic kilometer and will be capable of detecting neutrinos with energies ranging from 100 GeV up to multi-PeV. Thanks to its modular design, it is currently operational in a partial detector configuration. This contribution introduces, for the first time, a framework that integrates theoretical blazar models—computed using the LeHa code—into binned likelihood stacking analyses based on KM3NeT/ARCA's data. Modeling proton-photon interactions and the resulting radiative processes requires complex numerical simulations to accurately predict the expected neutrino spectra. In parallel, statistical likelihood methods are being developed to identify a potential neutrino signal above the observed background. By incorporating these theoretical models within the statistical data analysis, the proposed methodology aims to improve the sensitivity of neutrino searches from various blazar sub-classes, enabling a deeper understanding of the link between photon and neutrino emissions from astrophysical sources.

Affiliation

University of Bologna and INFN-BO

Auteur principal: CARENINI, Francesco

Co-auteur: CERRUTI, Matteo (Université de Paris - APC)

Orateur: CARENINI, Francesco

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