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Detection prospects for multi-GeV neutrinos from collisionally heated GRBs

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Neutrinos with energies ranging from GeV to sub-TeV are expected to be produced in Gamma-Ray Bursts (GRBs) as a result of the dissipation of the jet kinetic energy through nuclear collisions occurring around or below the photosphere, where the jet is still optically thick to high-energy radiation. So far, the neutrino emission from the inelastic collisional model in GRBs has been poorly investigated from the experimental point of view. In the present work, we discuss prospects for identifying neutrinos produced in such collisionally heated GRBs with the large volume neutrino telescopes KM3NeT and IceCube, including their low-energy extensions, KM3NeT/ORCA and DeepCore, respectively. To this aim, we evaluate the detection sensitivity for neutrinos from both individual and stacked GRBs, exploring bulk Lorentz factor values ranging from 100 to 600. As a result of our analysis, individual searches appear feasible only for extreme sources, characterized by gamma-ray fluence values at the level of Fγ ≥ 1e-2 erg cm−2. In turn, it is possible to detect a significant flux of neutrinos from a stacking sample of ~900 long GRBs (that could be detected by current gamma-ray satellites in about five years) already with DeepCore and KM3NeT/ORCA. The detection sensitivity increases with the inclusion of data from the high-energy telescopes, IceCube and KM3NeT/ARCA, respectively.

Summary

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