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Constraining sterile neutrinos by core-collapse supernovae with multiple detectors

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The eV-scale sterile neutrino has been proposed to explain some anomalous results in experiments,such as the deficit of reactor neutrino fluxes and the excess of $\bar{\nu}_\mu \to \bar{\nu}_e$ in LSND. This hypothesis can be tested by future core-collapse supernova neutrino detection independently since the active-sterile mixing scheme affects the flavor conversion of neutrinos inside the supernova.
In this work, we compute the predicted supernova neutrino events in future detectors – DUNE, Hyper-K, and JUNO – for neutrinos emitted during the neutronization burst phase when the luminosity of ν_e dominates the other flavors.
We find that for a supernova occurring within 10 kpc, the difference in the event numbers with and without sterile neutrinos allows to exclude the sterile neutrino hypothesis at more than 99% confidence level robustly. The derived constraints on sterile neutrinos mixing parameters are comparably better than the results from cosmology and on-going or proposed reactor experiments by more than two orders of magnitude in the $\sin^2 2\theta_{14}$-Δm^2_{41} plane.

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