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The Diffuse Supernova Neutrino Background: an update on the theory and detection prospects

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A new estimate of the diffuse supernova neutrino background (DSNB) is presented, for scenarios with different core collapse rates and different distribution of black-hole forming collapses with the progenitor mass. The $\bar{\nu}_e$ component of the DSNB above 11 MeV of energy can be as large as $\phi \sim 3.7\ \mathrm{cm}^{-2}\mathrm{s}^{-1}$, and the contribution of black hole-forming collapses could dominate the flux above ~ 25 MeV.
We discuss the potential of detecting the DSNB at SuperK-Gd and JUNO, in about a decade-long period of operation, including realistic neutral-current background processes. The case when results from the two detectors are examined jointly is considered as well. We also examine an example of a future $\mathcal{O}(10)$ kt slow liquid scintillator detector, and show that there the chances of detecting the DSNB could exceed 99\%. Our results motivate stronger experimental efforts in reducing the lower energy backgrounds at SuperK-Gd.

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