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Searching light dark matter boosted by supernova neutrinos in Super-K, Hyper-K and DUNE

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We investigate a novel way of probing light dark matter boosted by supernova neutrinos incorporating the time-of-flight (TOF) information. The DM mass m_χ < O(10 MeV) can be boosted to relativistic speed and surpasses the detector energy threshold, eg. Super-K/Hyper-K/DUNE. The additional TOF manifests the direct m_χ measurement and is irrelevant to the DM-ν cross section $\sigma_{\chi\nu}$. The application of TOF to background suppression provides much improved sensitivities. In this talk, we will also show the resulting constraint from SN1987a and projected sensitivity from the next GC SN on DM-ν and DM-e cross sections with a broad range of m_χ. The results are improved by 1-3 order of magnitudes comparing to the existing bounds. Prospects of exploiting TOF information in other astrophysical systems to probe exotic physics with other DM candidates are discussed.

Submitted on behalf of a Collaboration?

No

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