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A New Probe of Relic Neutrino Clustering Using Decaying Heavy Dark Matter

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The existence of relic neutrino background is a strong prediction of big bang cosmology. But because of their extremely small kinetic energy today, the direct detection of relic neutrinos remains elusive. On the other hand, we know very little about the nature of dark matter. In this work, we show that heavy dark matter (with mass in the range of 10^9 to 10^{15} GeV) decaying into neutrinos will provide a new probe of relic neutrinos via resonant neutrino scattering. We find that the distinct resonant absorption feature is observable in the next-generation ultra-high energy neutrino telescopes (such as IceCube-Gen2) for a relic neutrino overdensity comparable to the current laboratory limits.

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