

Large Neutrino "Collider"

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We propose using current and future large-volume neutrino telescopes as "Large Neutrino Colliders" ($L\nu$ Cs) to explore TeV-scale physics beyond the Standard Model. Cosmic neutrinos with energies above 100 PeV colliding with nucleons in the detector reach center-of-mass energies beyond the 14 TeV limit of the Large Hadron Collider (LHC). Using recently predicted and measured high-energy and ultra-high-energy neutrino fluxes from IceCube and KM3NeT, we estimate mass-scale sensitivities for representative new physics scenarios at 1-30 km³ $L\nu$ Cs. Our results demonstrate that $L\nu$ Cs provide a novel avenue to probe multi-TeV particles with sensitivities comparable to, or even surpassing, those of the LHC.

Primary author: 谢 (XIE), 可平 (Keping) (李政道研究所)

Presenter: 谢 (XIE), 可平 (Keping) (李政道研究所)

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