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Simulating neutrino echoes induced by secret neutrino interactions

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Beyond the Standard Model (BSM) interactions in the neutrino sector have been of much interest in cosmology and astroparticle physics. We developed a Monte Carlo code to investigate the neutrino time delay distribution caused by BSM interactions en route to the observer. While we find excellent agreement for small optical depths, the optically thick limit show features that are not described by simple analytical estimates. With this code, we can understand the effects of cosmological redshift, neutrino spectra and flavors. The code can be used to probe BSM interactions in current neutrino detectors such as IceCube and Super-Kamiokande, as well as future detectors.

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