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Searching for quantum gravity effects in atmospheric neutrinos with IceCube data

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Although we do not yet have an accepted theory of quantum gravity, we can predict some of its features. One such predictions is that space-time fluctuates at tiny distances, perhaps even producing microscopic short-lived "virtual" black holes. These effects are difficult to probe experimentally, because they are only expected to be large at energies and distances approaching the Planck scale. However, a promising area where a sensitivity to quantum gravity signals might be achieved is in neutrino oscillations. This is due to the long travel distances of neutrinos, where tiny perturbations to their propagation might accumulate to a measurable signal once they reach a detector. Specifically, fluctuations of space-time and interactions with microscopic black holes lead to loss of coherence and damping of neutrino oscillations. We aim to search for such a signal in atmospheric neutrino data from the IceCube Neutrino Observatory. This will be the most sensitive experimental test to date on neutrino decoherence resulting from Plack scale physics.

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Field of study

Quantum Physics

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