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Search for Fermionic Dark Matter using Astrophysical Neutrinos and Quantum Gravitational Decoherence

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A model involving quantum gravitationally induced decoherence is proposed to investigate on the properties of fermionic dark matter using astrophysical neutrinos.

The main assumption of the model is that interactions of particles with the spacetime foam violate global quantum numbers such as lepton number and only conserve unbroken gauge quantum numbers.
Hence, if N hypothetical fermionic dark matter species exist transforming as a singlet under $SU(3)_{\mathrm{c}} \times U(1)_{\mathrm{EM}}$, quantum gravity interactions cannot distinguish between neutrinos and these unknown degrees of freedom.

Applying this phenomenological $3 + N$ flavor model to systems of high energy neutrinos shows that these effects lead to a uniform flavor distribution over all neutral fermionic species in an initially pure neutrino beam after sufficiently long distances.
Therefore, fluxes of neutrinos from astrophysical origin are expected to differ drastically from the standard expectation depending on the number of additional dark matter fermions present.

Consequently, future neutrino experiments could provide new clues about the fermionic dark sector.

Summary

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