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Influence of gravity on the quantum speed limit in neutrino oscillations

The quantum speed limit (QSL) specifies the shortest amount of time required for a quantum system to evolve from an initial to a final state. In this work, we look into QSL for the unitary evolution of neutrinos and antineutrinos in the presence of a gravitational field. Since the transition probabilities between neutrino and antineutrino in the framework of one and two flavors depend on the strength of the gravitational field, the QSL time behavior indicates fast flavor neutrino-antineutrino transitions as the gravitational field strength increases. Subsequently, we observe quick suppression of entanglement by exploring the speed limit for entanglement entropy of neutrino-antineutrino oscillations in the early universe and surrounding black holes.

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