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Neutrino oscillations as probes of spacetime structure

Neutrino oscillations constitute a quantum interference phenomenon associated with the mixing between the flavor states and mass states of these particles. Because of the phase accumulated during their propagation can depend on the geometry of spacetime, these phenomena offer a theoretical tool to study the influence of gravitational structures on quantum processes. In this context, we analyze the sensitivity of neutrino oscillations to different spacetime structures. For this purpose, we study neutrino propagation, the calculation of phases associated with mass states, and the corresponding transition probabilities between flavors. Subsequently, a comparison between different geometric configurations is carried out to determine how the characteristics of the geometry modify oscillation predictions and we aim to identify the parameters and conditions under which transition probabilities exhibit greater sensitivity to the geometric characteristics of spacetime. We will discuss if the results allow us to evaluate, from a theoretical perspective, the potential of neutrino oscillations as a probe of spacetime structure.

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