MAGIC

Science of the Cosmos

Contribution ID: **96** Type: **not specified**

Neutrino oscillation on the non-commutative spacetime

Neutrinos are observed in nature with three flavor eigenstates, which are quantum superpositions of mass eigenstates. This misalignment between flavor and mass eigenstates leads to a quantum interference phenomenon during propagation: the neutrino oscillation, where a neutrino created with one flavor can later be detected with another. This discovery revolutionized particle physics by demonstrating that neutrinos must have nonzero mass, contrary to their original description as massless particles in the Standard Model. In this work, we investigate how non-commutative spacetime, characterized by a minimal length scale via the Quesne–Tkachuk algebra, modifies neutrino oscillations. By incorporating the algebra's deformation parameter β into the neutrino effective mass, we derive a 2- flavor neutrino oscillation probability in the non-commutative spacetime that depends not only on the standard mass-squared differences but also on the fourth-order mass difference scaled by β. The comparison between both oscillation probabilities exhibits a beat pattern due to the additional non-commutative phase, that is responsible for a small shift in neutrino oscillation probability graphics. Finally, we examine the influence of primordial magnetic fields on relic neutrinos through spin-flavor oscillations.

Author: NADAL CAMARGO, Luisa (UFRGS)

Co-authors: ZEN VASCONCELLOS, CESAR AUGUSTO (UFRGS/ICRANet); Dr HADJIMICHEF, DIMITER (UFRGS); Mr OLIVEIRA FERREIRA, Thiago (unesp)

Presenter: NADAL CAMARGO, Luisa (UFRGS)