

Hierarchy independent sensitivity to leptonic δ_{CP} with low energy atmospheric neutrinos

Monday, August 26, 2019 7:00 PM (2 hours)

One of the important unknowns in neutrino oscillation physics is the leptonic CP phase δ_{CP} . Because of ambiguity between δ_{CP} and neutrino mass hierarchy, experiments have to be designed in such a way as to measure these parameters independent of each other. Long baseline experiments like DUNE is exclusively designed to measure δ_{CP} in regions without hierarchy ambiguity and atmospheric neutrino experiments like INO are designed to measure hierarchy without δ_{CP} ambiguity. However atmospheric neutrinos are not usually used to probe δ_{CP} . Here we present the study that, at sub GeV energies atmospheric neutrinos can be used to probe δ_{CP} irrespective of mass hierarchy. We show that when the events are binned as a function of $(E_l, \cos \theta_l)$, the energy and direction of the final state leptons, a consistent distinction between various δ_{CP} values is obtained. Since there is no sensitivity to the mass ordering/hierarchy, δ_{CP} can be measured without hierarchy ambiguity at these energies. A χ^2 analysis assuming a generic detector with perfect resolutions and efficiencies, and which can separate charged current $\nu_e, \bar{\nu}_e, \nu_\mu$ and $\bar{\nu}_\mu$ events will also be discussed.

Working Group

WG1 : Neutrino Oscillation Physics

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Session Classification: Poster session