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Sterile Neutrino Search with Atmospheric in DUNE

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Being less well-known particles, neutrinos are one of the best starting points for new physics searches in particle physics. In this scope, the hypothesis of the existence of non-weakly interacting “sterile” neutrinos is a promising route to explore to go beyond the Standard Model.

The most direct way to explore this hypothesis is to study the oscillation patterns of active neutrinos, as adding one (or more) extra mixing state will modify the oscillation probabilities and thus the number of events we expect to see in a neutrino detector. As such, most experiments focused on neutrino oscillation studies might be able to constrain the existence of sterile neutrinos.

My work focuses on the possibility for the long baseline Deep Underground Neutrino Experiment (DUNE) to get physical constraints on sterile parameter values using atmospheric neutrinos. In addition to beam neutrinos which are the main focus of DUNE, atmospheric neutrinos allow for a wider range of energies and baselines, which both have an impact on neutrino oscillation probabilities. This, combined with the expected reconstruction performance for both neutrino energy and direction, might give DUNE a particular insight in the search for sterile neutrinos.

Auteur principal: SIRONNEAU, Camille (APC lab)

Orateur: SIRONNEAU, Camille (APC lab)

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