

Search for sterile neutrinos with the T2K far detector

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T2K is a long baseline accelerator neutrino experiment in Japan which studies neutrino oscillations with a narrow-band muon neutrino beam peaked at 0.6 GeV. The large water Cherenkov detector Super-Kamiokande (SK) located 295 km away from the proton target acts as a far detector and provides high quality samples for oscillation analysis. In the present study the T2K setup is used to search for light sterile neutrinos.

Sterile neutrinos are hypothetical particles that do not interact via weak interactions and couple with active neutrinos only through mixing. They are present in many extensions of the Standard Model and can have any masses from 0 to the GUT scale. Light sterile neutrinos of eV masses could modify the standard 3-flavour oscillation pattern and explain anomalies observed in some oscillation experiments.

A sterile neutrino analysis at T2K was developed to constrain θ_{24} and θ_{34} mixing elements in the 3+1 sterile neutrino model. This is the first study of sterile neutrinos at T2K which is based on SK data. To enhance the sensitivity to the effects related to the presence of sterile neutrinos, a joint analysis is done using both charged-current and the newly implemented neutral-current (NC) oscillation samples (NC π^0 with 2 rings observed and NC gamma de-excitation) at the far detector. The primary sensitivity for this sterile search comes from NC samples where we are looking for a deficit due to the oscillations to the sterile neutrino.

The analysis strategy and the results obtained for the current T2K data (2010-2017 data taking) are presented.

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