

論文内容の要旨

Study of neutral-current de-excitation gamma-rays with the T2K neutrino beam
(T2K ニュートリノビームを用いた中性カレント反応による脱励起ガンマ線の研究)

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This thesis presents a study of low energy neutrino-induced events such as nuclear deexcitation gamma-rays from neutral-current (NC) interactions using the Tokai-to-Kamioka (T2K) neutrino beam. So far, long baseline neutrino experiments analyzed neutrino events only above $O(100)$ MeV. This thesis gives the first measurement of low energy events in a long baseline neutrino experiment.

We selected low energy NC candidate events at the Super-Kamiokande (SK) detector using T2K data collected from January 2010 to March 2011, which amounts to 1.43×10^{20} protons on target. After thorough reduction which intensively rejects beam-unrelated backgrounds, there remained 20 observed events in the reconstructed energy range of 4–30 MeV while the expectation is 22.8 ± 6.2 beam-related events and 0.6 beam-unrelated events.

The result of the measurement was applied to a sterile neutrino search, which measures the depletion of the total neutrino flux at the far detector via an NC channel. Also, as the beam neutrino energy is similar to those of atmospheric neutrinos, the result provides us precious information of atmospheric neutrino backgrounds for low energy astrophysics analyses at a water Cherenkov detector such as SK.