

Atmospheric neutrino oscillation analysis with neutron detection in SK-Gd

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In Super-Kamiokande, a 50-kton water Cherenkov detector, gadolinium (Gd) was loaded at concentrations of 0.01% in 2020 and of 0.03% in 2022, and a new observation phase called SK-Gd was started. The detection efficiency of neutrons is greatly improved to 50% with 0.01%Gd and to 65% with 0.03%Gd because gadolinium has a large cross section for neutron capture and produces high-energy gamma rays.

In this poster, we will report how the physics sensitivity of atmospheric neutrino oscillation analysis improves with this improved neutron detection capability. Atmospheric neutrino oscillations are good probes of the mass hierarchy and also sensitive to Δm_{23}^2 , θ_{23} , and δ_{CP} , and the gadolinium is expected to improve their sensitivity in two main ways.

First, neutron tagging improves neutrino-antineutrino separation and thereby increases sensitivity to the mass hierarchy. Second, it allows improved kinematic reconstruction of the neutrino by accounting for more information carried by the hadronic system.

We report on the improvement of the sensitivity of the oscillation analysis, considering the uncertainty of the reconstruction.

Poster prize

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