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The measurement of the wavelength-dependent water transparency in Super-Kamiokande

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Cherenkov photon in water is scattered or absorbed by electrons, nuclei, and some other particles. Evaluating the extent of this attenuation is necessary to accurately extract physics in the Water Cherenkov experiment. Especially, in the atmospheric neutrino and proton decay analyses (GeV-scale physics), since the Cherenkov ring becomes unclear due to photon scattering, it affects the accuracy of Cherenkov ring counting and particle identification. On the other hand, in the solar neutrino and reactor neutrino analyses (MeV-scale physics), since the energy is determined by the number of photon hits at PMTs, it affects the accuracy of the energy. In addition, since 2020, Gadolinium was dissolved into pure water in the Super-K tank. Thanks to it, event identification using neutron capture in Gd was enhanced. Since the neutron capture signal is 8 MeV, it is important to correctly evaluate the photon attenuation in this case as well. Therefore, Super-K uses optical lasers with different wavelengths to measure the water transparency for each wavelength and introduces it into the MC simulations as wavelength functions. Recent years, we have done the first measurement using Geant4 based MC simulation. In this presentation, we will report the results of the wavelength-dependent water transparency conducted since 2019 and comparisons between Grant4 based MC and conventional GEANT3 based MC, and before and after Gd dissolving.

Collaboration you are representing

Super-Kamiokande

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