



Contribution ID : 317

Type : Poster

Research and development of highly efficient liquid scintillators for large-scale neutrino experiments

Tuesday, 29 November 2022 17:10 (120)

Liquid scintillators have always been an important part of many experiments in neutrino physics. Currently, the so called “standard” liquid scintillator consisting of linear alkylbenzene (LAB), 2,5-diphenyloxazole (PPO) and 1,4-Bis(2-methylstyryl)benzene (bis -MSB) is used in many experiments. As an alternative to the “standard” LAB-based liquid scintillator, a new highly efficient liquid scintillator with organosilicon scintillation fluor, so called NOL (Nanostructured Organosilicon Luminophore), was proposed and developed. The light yield and emission kinetics of the new LAB-based scintillator with NOL fluor have been extensively characterized and studied. The light yield of the developed liquid scintillator is almost two times higher than that of traditional LAB-based liquid scintillator with PPO fluor. The fastest decay time constant of the emission kinetics is in the range of about 9 to 14 ns, depending on the fluor concentration, and the contribution of the fastest component accounts for 80% of the total light yield. The scintillation parameters have also good long-term stability. The developed liquid scintillators based on LAB and NOL are planned to be used in a prototype of Baksan Large Neutrino Telescope, which is proposed to be constructed at the Baksan Neutrino Observatory.

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Session Classification : Poster Session

Track Classification : Neutrino physics