Contribution ID: **385** Type: **Poster**

A salt-rich liquid detector for novel neutrino experiments

Friday, 21 June 2024 17:30 (2 hours)

The lithium chloride aqueous solution has great potential to be the detection medium of a novel neutrino detector for multiple purposes. The nuclide ^{7}Li provides a charged-current interaction channel with a high cross-section for the MeV-scale solar electron-neutrinos, enabling measurement of the solar neutrino spectrum. Its advantages in studying the upturn effect of solar neutrino oscillation, light sterile neutrinos, and Earth matter effect are investigated in detail. Meanwhile, the contained ^{35}Cl, ^{6}Li, and ^{1}H can capture the neutrons generated from inverse beta decay. This feature enables a delayed-coincidence detection for electron-antineutrinos, crucial for measurements of the neutrinos from the Earth, nuclear reactors or celestial objects. A saturated lithium chloride solution, containing 45.3%w/w salt in water, is prepared and purified for the large liquid neutrino detector. Its optical properties and the light yields are measured. The solution shows little absorption in the sensitive wavelength range of the bialkali photomultipliers. The attenuation length is evaluated to reach 50 meters at 430 nm. In addition to being a pure Cherenkov detector medium, a wavelength shifter, carbostyril 124, is added to the LiCl aqueous solution. The compatibility and the enhancement of the light yield are confirmed, enabling the development of a Cherenkov-enhanced lithium-rich detector. The experimental results prove that the salt-rich liquid detector is a practical candidate for a novel neutrino experiment.

Poster prize

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Session Classification: Poster session and reception 2

Track Classification: Solar neutrinos