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Slow liquid scintillator for scintillation and Cherenkov light separation

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Slow liquid scintillator (water-based or oil-based) is proposed as the detection material of a few future neutrino experiments. It can be used to distinguish between scintillation and Cherenkov light. Thus neutrino detectors with it will have the directionality and particle identification for charged particles, so that a better sensitivity is expected for low energy (MeV-scale) neutrino physics, solar physics, geo-science and supernova relic neutrino search. Linear alkylbenzene (LAB) is the primary component or ingredient of these liquid scintillators. We studied all the relevant physical aspects of different combinations of LAB, 2,5-diphenyloxazole (PPO) and p-bis-(o-methylstyryl)-benzene (bis-MSB), including the light yield, time profile, emission spectrum, attenuation length of scintillation emission and visiable light yield of Cherenkov emission. We also measured the attenuation spectrum of some relevant neutrino detector material, like acrylic. Some formulations allow a good separation between Cherenkov and scintillation light, and a reasonable high light yield can also be achieved. The expected improvement on physics with such type of liquid scintillator will also be discussed.

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