

Enhanced photon detection efficiency for next-generation neutrino telescopes using photon traps

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We propose a photon trap designed for improved photon detection efficiency in a cost-efficient way. Wavelength Shifting plastic sheets (WLS) are deployed at the bottom of a PMT, surrounded by dichroic film by which photons are efficiently trapped and guided to the PMT. We measured wave-length dependent transmittance of a commercially available dichroic film in water, a key variable determining photon trapping efficiency. We ran a Geant4 based simulation with the property of the commercially available dichroic film as a realistic case. We also ran a simulation with a hypothetical dichroic film whose bandpass is optimized to absorption and reemission spectra of the WLS and the quantum efficiency of the PMT, as an ideal case. The preliminary results of the photon collection and detection efficiency enhancements are computed, as well as timing distribution of the photons. We discuss how this new conceptual design can be applied to next-generation neutrino telescopes.

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Collaboration

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Subcategory

Experimental Methods & Instrumentation

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