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Progress on the development of a wavelength-shifting optical module

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We report on the development of a photon sensor sensitive to single photons that employs wavelength-shifting and light-guiding techniques to maximize the collection area and to minimize the dark noise rate. The sensor is tailored towards applications in ice-Cherenkov neutrino detectors using inert and cold, low-radioactivity and UV transparent ice as a detection medium, such as IceCube-Gen2 or MICA. The goal is to decrease the energy threshold as well as to increase the energy resolution and the vetoing capability of the neutrino telescope, when compared to a setup with optical sensors similar to those used in IceCube. The detector captures photons with wavelengths between 250 nm to 400 nm. These photons are re-emitted with wavelenghts above 400 nm by a wavelength shifter coating applied to a 90 mm diameter polymer tube which guides the light towards a small-diameter PMT via total internal reflection. By scaling the results from smaller laboratory prototypes, the total efficiency of the proposed detector for a Cherenkov spectrum is estimated to exceed that of a standard IceCube optical module by a factor of 2.7. The status of the prototype development and performance of its main components as well as the potential for future IceCube extensions will be discussed.

Collaboration

– not specified –

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