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Ultra-high light yield scintillation crystal detector based on low-temperature CsI and SiPMs for CEνNS detection

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The first experimental measurement of coherent elastic neutrino-nucleus scattering (CEνNS) was successfully conducted using a CsI(Na) scintillation crystal detector. Recognizing that a higher light yield in scintillation crystal detectors correlates with greater physical sensitivity for CEνNS detection, we introduced a novel low-temperature CsI detector design employing SiPMs readout. This design capitalizes on the exceptional brightness of low-temperature CsI crystals combined with the ultra-high photon detection efficiency of SiPMs, thereby significantly improving the light yield and elevating CEνNS detection sensitivity to unprecedented levels. Positioned as a formidable contender for forthcoming CEνNS experiments, this innovative approach has been substantiated by our experimental group's development of a kilogram-scale low-temperature CsI detector [1]. This detector, notable for its leading international standards in light yield and energy resolution, serves as a preliminary proof of concept for the technical feasibility of our proposed scheme. This presentation delineates the detector scheme's characteristics, elucidating the principal prototype's performance metrics, including light yield, energy resolution, and the influence of SiPMs noise and optical crosstalk on detector performance.

Collaboration (if any)

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