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Primary scintillation in Xe for electrons and alpha-particles

Xenon scintillation has been widely used in rare event detection experiments, such as neutrinoless double beta decay and dark matter [1,2]. Yet, experimental values on the primary scintillation yield in the absence of recombination remain scarce and dispersed. The mean energy required to produce a vacuum ultraviolet scintillation photon (Wsc) in gaseous xenon has been measured in the range of 30-120 eV [3]. Lower Wsc-values are often found for alpha particles when compared to electrons produced by gamma or x-rays, being this difference not understood. We carried out a systematic study of the absolute primary scintillation yield in Xe at the atmospheric pressure, using a Gas Proportional Scintillation Counter. A simulation model of the detector's geometric efficiency was developed and benchmarked using waveform-shape analysis of primary and secondary scintillation signals. Wsc-values in the range of 30-50 eV were obtained for gamma and x-rays with energies from 5.9 up to 60 keV, and for ~2-MeV alpha particles. No significant differences were found between alpha particles and electrons.

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