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Fluorescent Properties of Clevios For Use As Electrodes In DarkSide-20K

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Many particle and rare-event search detectors use liquid scintillators as the detection method. A popular candidate for scintillation fluids are noble elements such as Liquid Argon (LAr). LAr detectors typically store their scintillators inside an acrylic vessel, which can be coated with various materials. A common coating is 1,1,4,4-tetraphenyl-1,3-butadiene (TPB) which is a wavelength shifter that converts the ultraviolet (UV) scintillation into visible wavelengths that are detectable by the photodetectors, such as photomultiplier tubes. In the DarkSide-20K experiment clevios is an another coating on the acrylic, and will act as the electrodes. Acrylic is known to fluoresce in visible wavelengths when excited by UV light, and previous studies indicate that the clevios will also fluoresce under similar conditions, both of which could be a source of background in the experiment. The amount of light received by the photodetectors from the fluorescence can be compared to TPB when they are excited by the same wavelength and intensity of UV light. This comparison produces the relative light yield of acrylic or clevios to TPB. The fluorescence properties of these materials are measured at various temperatures between 300K and 4K. This includes all of the operating temperatures of noble liquids, with particular interest in 87K as that is the operating temperature of LAr, which is the liquid scintillator used in DarkSide-20k. The fluorescence properties are determined by exciting the acrylic using external UV sources to mimic scintillation events. We present the status of the study to determine the fluorescence of clevios, comparing it to standard materials used in liquid scintillators, such as TPB. These results will show how much clevios will contribute to background signals that are found in future liquid scintillator detectors.

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