

Characterization of New VUV Silicon Photomultipliers with Low Dark Noise at Low Temperature

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Silicon photomultiplier (SiPM) has a low radioactivity, compact geometry, low operation voltage, and good photo-detection efficiency for vacuum ultraviolet light (VUV). Therefore it is expected to replace photomultiplier tubes (PMTs) for future dark matter experiments with liquid xenon (LXe) such as DARWIN/XLZD. However, SiPM has nearly two orders of magnitude higher dark count rate (DCR) compared to that of PMTs at the LXe temperature, which is ~ 165 K. This type of high DCR mainly originates from the carriers generated by band-to-band tunneling effect. To suppress the tunneling effect, we have developed a new VUV SiPM with lowered electric field strength in cooperation with Hamamatsu Photonics K. K. and characterized its performance at LXe temperature. We demonstrated that the newly developed SiPMs had 5-7 times lower DCR at low temperatures compared to that of the conventional SiPMs, reaching 0.05 Hz/mm^2 . In this presentation, details of the characterization will be presented.

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No

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