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Study of Avalanche Photodiodes as photosensors for liquid xenon scintillation light[1] PETER SHAGIN, ROMAN GOMEZ, UWE OBERLACK, Rice University, RICHARD FARRELL , MICKEL MCCLISH, Radiation Monitoring Devices, Inc., PRICILLA CUSHMAN, BRIAN SHERWOOD, University of Minnesota — We report on measurements with large area Avalanche Photodiodes (APD) as photodetectors for the ultraviolet scintillation light of liquid xenon (LXe). The APD, fabricated by Radiation Monitoring Devices Inc., was mounted inside the LXe detector, and scintillation light produced by Po-210 alpha particles was measured for a wide range of voltages and temperatures between 167 K and 178 K. The dark current of the cooled APDs is much reduced, and a maximum stable gain of 5600 was achieved. Based on a Monte Carlo simulation for the scintillation light collection, the quantum efficiency of the APD was estimated to be 34% at 175 nm. We performed quantum efficiency scans of the APD at UV and optical wavelengths at room temperature to evaluate the uniformity of the response. The high quantum efficiency and gain of the APD, together with its compactness, relatively large area (~ 1 cm^2), and the favorable ratio of active to passive sensor area, make it an interesting alternative to PMTs for UV photon sensing in LXe detectors, especially for experiments requiring a high light yield. Possible applications include positron emission tomography, neutralino dark matter search, or Compton Telescopes for gamma-ray astronomy.

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