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Vacuum Ultraviolet Stability Measurements of Silicon Photomultipliers at Liquid Xenon Temperatures.

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Silicon photomultipliers (SiPMs) are single-photon-sensitive devices under consideration for light sensing in noble liquid detectors. One of the experiments considering SiPMs is the neutrinoless double beta decay experiment nEXO. nEXO plans to search for this decay with 5 tonnes of liquid xenon enriched in the isotope Xe-136 over a lifetime of 10 years. SiPMs will be placed inside the liquid xenon volume to detect scintillation light. This long operating time necessitates the characterization of the response of nEXO's SiPM candidates, either VUV4 HPK (Hamamatsu) or FBK HD3, under conditions similar to those of the experiment. While non-ionising radiation (bulk) damage on SiPMs has been well studied, ionising radiation (surface) damage in the top SiO2 layer of SiPMs, which causes surface currents, has not yet been investigated extensively. In this work, we present the study of VUV4 HPK SiPM performance at 165K (liquid xenon temperature) for different Vacuum UltraViolet (VUV) light exposure periods. Specifically, we investigate variations in dark count rates as a result of non-ionizing radiation damage, and leakage current variations caused by both ionizing and non-ionizing radiation damage of SiPMs. Latest results will be presented.

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