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(G*) Laser Stimulated emission of SiPMs

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Silicon PhotoMultipliers (SiPMs) have been adopted in many applications due to their ability to reliably detect single photons with excellent timing resolution. These applications range from detecting scintillation photons in large area particle physics experiments, to light detection for LiDAR or other industry uses. Due to the large internal gain of these devices ($\sim 10^6$), a large number of secondary photons are produced during the detection process, which can induce false signals in the SiPM and degrade their timing or energy resolution. The characterization of these secondary photons is important for designing future SiPM devices that mitigate these byproducts. At TRIUMF we developed an instrument to simultaneously stimulate individual micro-cells of SiPMs and measure their secondary emission. The setup features a cooled X-Y stage to enable characterizing emission at a wide range of temperatures (20°c to -187°c) and to match experimental conditions of LXe and LAr common in the next generation of particle physics experiments. The measurements obtained are used alongside an effective transmission model to deduce an absolute spectrum of secondary photons produced during the detection process. In this work we have characterized Hammamstu VUV4 and Fondazione-Bruno-Kessler (FBK) VUV HD3, two candidate SiPM devices for the nEXO neutrinoless double beta decay experiment. And it will also be illustrated how this work is important for the design of a detector concept for dark matter search in silicon using avalanche diode arrays.

Keyword-1

SiPM

Keyword-2

Stimulated Emission

Keyword-3

Dark Matter Detection

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