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Laser-Driven Photon Emission in SiPMs with MIEL

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Silicon Photomultipliers (SiPMs) are tightly-packed arrays of single-photon avalanche diodes (SPADs), biased above breakdown, that undergo a self-sustaining charge avalanche process upon absorption of an incident photon. Due to its compactness, high single-photon resolution, low-noise and ability for operation at cryogenic temperatures, the SiPM is emerging as a baseline photon sensing solution in a number of rare-event searches in physics, notably the planned nEXO neutrinoless double-beta decay experiment. An unfortunate byproduct of the avalanche process is the production of secondary photons. These can trigger avalanches in neighbouring SPADs, or leave the SiPM entirely and trigger a neighbouring sensor –this has a systematic effect on detector performance. The Microscope for Injection and Emission of Light (MIEL) is a custom setup developed at TRIUMF enabling the study of secondary photon emission in SiPMs, by stimulating a SPAD using a laser. The setup is used to view the light emission geographically on the SiPM surface, and obtain a spectral distribution for emitted photons.

Author: CHARLESWORTH, Zachariah

Co-authors: CAPRA, Andrea (TRIUMF (CA)); DE ST. CROIX, Austin (TRIUMF/UBC); MIN, Byeongguk (Inha University (KR)); Mr MCCARTHY, Duncan (TRIUMF); RETIERE, Fabrice; MARTIN, Juliette (The University of Edinburgh, TRIUMF); RAYMOND, Kurtis (Simon Fraser University); Ms MAHTAB, Mahsa (TRIUMF); Ms HENRIKSSON-WARD, Maia (TRIUMF); Mr PATEL, Mayur (TRIUMF); Mr MASSACRET, Nicolas (TRIUMF); Mr ALBANO, Noah (TRIUMF); Mr MARGETAK, Peter (TRIUMF); Mr UNDERWOOD, Ryan (TRIUMF); KOULOSOUSAS, Seraphim

Presenter: CHARLESWORTH, Zachariah

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