Stimulated Secondary Emission of Single Photon Avalanche Diodes

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Large-area next-generation physics experiments rely on using Silicon Photo-Multipliers (SiPM) devices to detect single photons. SiPMs are a 2D array of Single Photon Avalanche Detectors (SPADs) and are capable of producing an easily measurable fast signal of a single photon using the generation of electron avalanches. Secondary photons are produced during this avalanche and can lead to delayed or direct cross-talk between SPADs on the same device or can trigger signals on other SiPMs. The Microscope for the Injection and Emission of Light (MIEL) was developed to measure the source of photons near their operating voltages. The setup was used to characterize the stimulated emission of SPADs from Hamamatsu VUV4 and Fondazione Bruno Kessler (FBK) HD3 devices, which were operated at a range of temperatures from 20°C to -187°C. Calculations were performed, which showed that these devices produce anywhere from 40-150 photons during the avalanche, and roughly 0.5-1.5 photons escape the SiPM per avalanche. This work sets the stage for future characterizations of other SiPM devices.

Early Career

Yes

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