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Suppressing Optical Crosstalk in SiPMs

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Compared to conventional photomultiplier tubes (PMTs), silicon photomultipliers (SiPMs) based on multi-cell geiger-mode avalanche photodiodes (GAPDs) have advantages with regards to photon detection efficiency, compactness, robustness and tolerance of both magnetic fields and intense light sources. In addition, SiPMs can be cost effective for applications that require many channels with small unit area. Because of these advantages, SiPMs are starting to replace PMs in many applications.
When used in the cameras of Imaging Atmospheric Cherenkov telescopes, the optical crosstalk of SiPMs needs to be reduced in order to suppress accidental triggers due to the high rate of night sky background caused by scattered starlight and moonlight, and the fluorescence of excited molecules in the atmosphere.
In this contribution, the propagation properties of optical photons in SiPMs are investigated through systematic measurements of the optical crosstalk with varying SiPM pixel and GAPD cell sizes and with and without coatings on the SiPMs. It was observed that a significant portion of the optical crosstalk is mediated by the coating. The propagation of optical photons in the bulk silicon of the SiPM is also discussed.

Primary author: TAJIMA, Hiroyasu (Nagoya University)

Co-authors: OKUMURA, Akira (Nagoya University); ZENIN, Anatolii (Nagoya University); HIDAKA, Naoya (Nagoya University); YAMANE, Nobuhito (Nagoya University); NAKAMURA, Yuki (Nagoya University)

Presenter: TAJIMA, Hiroyasu (Nagoya University)

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