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From Materials to Readout: Advances in VUV Photodetection

Efficient detection of vacuum ultraviolet (VUV) scintillation light is essential to fully exploit the physics potential of next-generation neutrino and dark matter experiments. We are pursuing a broad R&D programme aimed at improving VUV photodetection through innovations in both sensor materials and readout architectures. On the sensor side, we investigate novel concepts including amorphous selenium photodetectors and graphene-based surface engineering for enhanced VUV sensitivity and cryogenic operation. In parallel, we explore Photon-to-Digital Converters (PDCs), or digital SiPMs, which integrate photon detection and digitization at the SPAD level, offering improved timing, dynamic range, and noise suppression. We present recent developments and discuss how the combination of advanced materials and digital readout technologies can enable the next generation of scalable, high-performance photosensors for particle physics applications.

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