Contribution ID: **53** Type: **Parallel session talk**

Fabrication and characterization of selenium alloys by co-deposition for application specific

Wednesday 8 October 2025 15:40 (20 minutes)

Amorphous selenium (a-Se) has become of high interest in detectors for high-energy physics due to its versatility in application. It exhibits a number of ideal properties, including a low threshold field for impact ionization (<70 Vμm), high photoconversion efficiency over a broad range of frequencies, and the capability for uniform large area fabrication. A-Se can be fabricated on a variety of substrates and readout systems with minimal pos-fabrication processing, and can be integrated onto CMOS chips as a hybrid detector, which will allow for large area camera development by tiling. Many of the optical and electrical properties of a-Se can be tuned through alloying and doping, providing even greater control over the detector for specific applications. The Radiological Instrumentation Laboratory has recently reported on our investigations of alloying with type IV and VI semiconductors, demonstrating improved sensitivity in green to near-infrared wavelengths. However, precise control of the alloy composition and the inclusion of elements that have significantly different melting points requires the co-deposition of materials from multiple sources during thermal evaporation. In this work, we present our first studies on films fabricated from our newly installed co-deposition system and discuss how we can continue to tune the photoconversion layer to improve detector properties.

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Session Classification: RDC 2 Photodectors

Track Classification: RDC 2 Photodectors