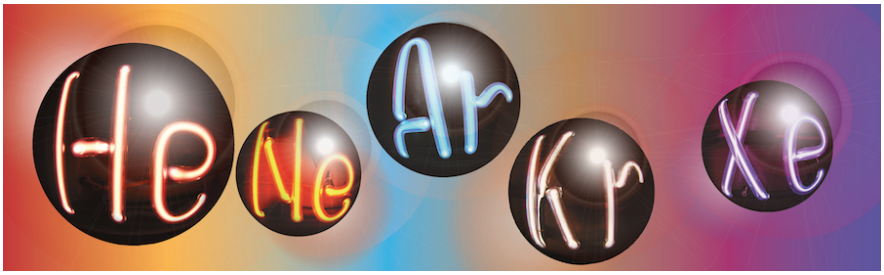

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Amorphous Selenium as a Scalable Path to Integrated Charge-and-Light Readout in Noble-Element Detectors

Efficient detection of vacuum-ultraviolet scintillation light remains a central challenge for liquid noble detectors, particularly as future experiments move toward highly segmented, pixelated readout architectures. Amorphous selenium (a-Se) offers an appealing path toward scalable, cryogenic photon detection because it combines low dark current, thin-film manufacturability, broad spectral sensitivity, and compatibility with direct VUV-to-charge conversion. We present recent progress on the testing and characterization of a-Se-based photon detectors for liquid noble applications, spanning material studies, device fabrication, and cryogenic detector response. Prototype sensors have been characterized as a function of temperature and electric field, with measurements targeting low-photon-yield response and operating regimes relevant to liquid argon and liquid xenon TPCs. We also describe progress toward transparent graphene top electrodes, including transfer methods optimized to avoid crystallization or delamination of the underlying a-Se. In parallel, EXAFS measurements of a-Se and Se/Te alloys provide element-specific information on short-range structural evolution at cryogenic temperatures and under optical illumination. These combined studies connect microscopic material behavior to device-level performance, advancing a-Se photodetectors toward use in integrated charge-and-light sensing for future noble-element experiments.

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