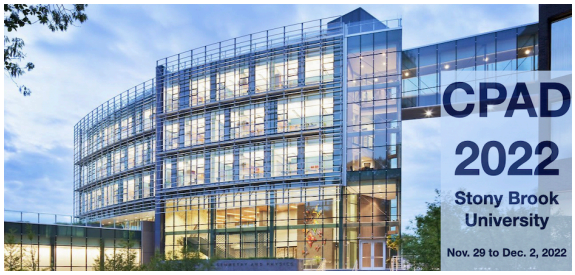

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Searching for Light Dark Matter with Narrow-Gap Semiconductors: The SPLENDOR Project

Wednesday, 30 November 2022 14:15 (20 minutes)

Understanding the particle nature of dark matter, which makes up approximately 85\% of the matter content in the universe, remains one of the biggest open questions in the fields of particle physics and cosmology. After decades of null results in searches for weakly interacting massive dark matter candidates, experimental and theoretical efforts have shifted towards lighter mass dark matter candidates with masses below $\mathcal{O}(\mathrm{MeV})$. These light mass dark matter particles present a substantial detection challenge, as their relatively low kinetic energy limits the energy deposited in a target to be sub-eV. The low momentum interactions are also highly delocalized, and a detailed understanding of the collective modes of the target material is critical to predicting DM scattering rates.

The SPLENDOR project (Search for Light Dark Matter with Narrow-Gap Semiconductors) proposes to use narrow-bandgap single-crystal semiconductors as ionization detectors to search for this light dark matter. We have developed a series of magnetic Zintl semiconductors and charge-density-wave semiconductors with electronic bandgaps on the order of $1 - 100\,\mathrm{meV}$, which would allow for sensitivities to fermionic dark matter with sub-MeV masses and bosonic dark matter with sub-eV mass. The detectors will be operated at mK temperatures, with the excited charge signal being read out with low-noise cryogenic HEMT based amplifiers. In this talk I will give an overview of the SPLENDOR project, and discuss our recent progress in the material growth and characterization, as well as the progress we have made in realizing the low noise charge readout. I will also touch on potential applications beyond dark matter searches, such as far-IR and THz photon detection.

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