Contribution ID: **52** Type: **not specified**

Directional Dark Matter Detection and Beyond: Diamond as a Platform for Mineral Detectors

Tuesday, April 14, 2026 4:30 PM (30 minutes)

Diamond is uniquely suitable as a model system for mineral-based detection of dark matter (DM) and neutrinos, benefitting from an unmatched suite of quantum defect sensors for imaging damage tracks, the wide availability of high-quality synthetic samples, and decades of systematic gemological study producing vast, well-characterized libraries of natural samples. Insights from diamond therefore have broad applicability to the wider mineral detection program. Beyond its role as a model system, synthetic diamond uniquely enables directional WIMP detection, overcoming the 'neutrino fog' limitation of conventional detectors. We present progress on developing diamond as a mineral detector on three experimental fronts. First, we describe our experiments studying the formation and properties of damage tracks from nuclear recoil cascades in diamond via ion implantation, including confocal microscopy, Kinetic Monte Carlo annealing simulations, spin measurements, and track morphology analysis. Second, we report progress in developing a light-sheet quantum diamond microscope, enabling high-speed, high-resolution 3D imaging of diamond lattice strain. Third, we describe ongoing work in machine-learning-accelerated molecular dynamics simulations, achieving a 100x speedup over conventional methods, as well as development of neural network algorithms for nuclear recoil event reconstruction.

Do you plan to give the talk in person?

No

Author: ANG, Daniel (University of Maryland)

Co-authors: TANG, Jiashen; CAMP, Mason; SHEN, Maximilian; LIYANAGE, Gavishta; BHARATHULWAR, Chinmay; BHATTACHARYA, Priyanshu; COOK, Anson; WALSWORTH, Ronald

Presenter: ANG, Daniel (University of Maryland)