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Crystal Damage Mapping with NV Centers in Diamond for Directional Dark Matter Detection DAVID PHILLIPS, Smithsonian Astrophysical Observatory, MASON MARSHALL, Department of Electrical and Computer Engineering, University of Maryland, RAISA TRUBKO, Department of Physics, Harvard University, PAULI KEHAYIAS, Sandia National Labs, MATTHEW TURNER, Department of Physics, Harvard University, MARK KU, Department of Electrical and Computer Engineering, University of Maryland, ALEX SUSHKOV, Department of Physics, Boston University, RONALD WALSWORTH, Department of Electrical and Computer Engineering, University of Maryland — A proposed diamond-based detector for weakly interacting massive particle (WIMP) dark matter would combine the advantages of solid-state semiconductor detectors with directional detection capability, allowing WIMP searches below the neutrino floor. This crucially relies on the ability to detect and map damage to the diamond crystal lattice at the nanoscale, to determine the direction of incoming WIMP candidates. Nitrogen vacancy (NV) centers are a prime candidate to enable this because of their strain sensitivity and well-characterized quantum properties. We present recent progress on techniques using NV centers to locate and map nuclear-recoil-induced damage, including crystal lattice strain and induced lattice vacancies.

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