

Abstract Submitted  
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**Toward Directional Detection of Dark Matter in Diamond** MASON MARSHALL, RAISA TRUBKO, Center for Astrophysics, Harvard & Smithsonian, PAULI KEHAYIAS, Sandia National Laboratories, MATTHEW TURNER, Department of Physics, Harvard University, DAVID PHILLIPS, Center for Astrophysics, Harvard & Smithsonian, ALEX SUSHKOV, Department of Physics, Boston University, RONALD WALSWORTH, Center for Astrophysics, Harvard & Smithsonian — We propose a method to identify weakly interacting massive particle (WIMP) dark matter via induced nuclear recoil in diamond. This 100 nm damage cluster induces stress in the crystal, shifting the energy levels of nearby quantum defects. Crucially, the direction of the track left by the recoil allows us to determine the incoming direction of the particle enabling the possibility of distinguishing between dark matter particles and backgrounds such as solar neutrinos. To measure these damage tracks we will use spectroscopic interrogation of quantum defects such as NV centers in diamond along with other nanoscale imaging techniques. Here we present the proposed technique along with measurements of the pre-existing stress variations in diamond. This method could allow for directional detection of WIMP-induced nuclear recoils at solid-state densities, enabling probes of WIMP parameter space below the solar neutrino floor.

David Phillips  
Harvard - Smithsonian Center for Astrophysics

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