UCLA College | Physical Sciences Physics & Astronomy

Physics and Astrophysics Special Seminar

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Quantum Sensors for Direct Detection of Light Dark Matter

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The identification of dark matter (DM) is a central question for high-energy physics and one of the strongest motivations for physics beyond the standard model. In light of the lack of evidence for supersymmetry at the LHC, theoretical models for particle DM have veered towards ideas like a 'dark sector', where there may be many different light DM particles, including some that mediate the interaction with normal matter. All of these light DM candidates would deposit meV-scale to eV-scale energies in an earth-bound detector. The challenge for experiments is to develop detectors that can measure the sub-eV energy deposits produced by such potential DM interactions. In this talk, I will discuss the roadmap for detector R&D down to meV energy thresholds for background-free, gram-day exposures, in the context of the experiments I am currently involved in. This work also has broad synergies with understanding qubit decoherence times for superconducting quantum computing, which is the current limitation on complexity of modern quantum computers. I will touch upon some new work which combines R&D for low-threshold particle detection and radiation hardened qubits, which aims to better understand the coupling of environmental radioactivity into a broad class of superconducting sensors.

Noah Kurinsky is a Lederman Postdoctoral Fellow at Fermilab, where he works on detector R&D for dark matter searches and on superconducting devices for fault-tolerant quantum computing. He obtained his PhD in Physics in 2018 from Stanford University. He obtained a dual degree in Astrophysics and Engineering Physics from Tufts University in 2014, working as part of both the Planck and ATLAS collaborations and studying galaxy evolution using data from infrared surveys. His scientific interests span condensed matter physics and particle astrophysics. In particular, his work focuses broadly on understanding the coupling of excitations in cryogenic crystals to superconducting sensors, with applications to phonon and photon sensing, as well as understanding quasiparticle decay in superconductors. He is currently the R&D coordinator for the SuperCDMS experiment, and leads underground qubit testing at Fermilab as part of the Quantum Science Center.