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Searches for Ultralight Dark Matter and New Forces with MAGIS-100

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Searches for dark matter (DM), using a vast array of different technologies that cover a wide range of DM masses, have consistently returned null results. While most experiments have probed WIMP-like dark matter above a few GeV in mass, models of light (< 1 meV) bosonic dark matter are compelling and large swaths of parameter space remain unexplored. One such model, an ultralight scalar particle that couples to fundamental constants (e.g. electron mass, fine structure constant) will induce time-dependent fluctuations in the energy levels of atoms, which can be detected using precision quantum-mechanical sensors. The Matter-wave Atomic Gradiometer Interferometric Sensor (MAGIS-100), soon to be constructed at Fermilab, will search for various ultralight DM models and new forces using three coupled light-pulsed atom interferometers across a 100-meter baseline. The experiment offers sensitivity to bosonic DM candidates in the mass range of $10^{-22} - 10^{-15}$ eV, a region of parameter space that is relatively unconstrained. This detector builds on expertise from the 10-meter prototype at Stanford and capitalizes on the latest advancement in atomic clock technology, and will serve as a pathfinder for a future kilometer-scale sensor. In this talk, I summarize the planned scientific program for the experiment and present projected sensitivities of searches for dark matter and new forces.

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