Contribution ID: **18** Type: **Talk (UK-APP one-day meeting)**

Searching for Ultralight Dark Matter with MOLeQuTE: a Massive Optically Levitated Quantum Tabletop Experiment

Monday, 19 January 2026 11:30 (30 minutes)

Many well theoretically motivated models of ultralight dark matter are expected to give rise to feeble oscillatory forces on macroscopic objects. Optically trapped sensors have high force sensitivies but have remained relatively unexplored in this context. In this talk we propose a new, tunable, optically trapped sensor specifically designed to detect such forces. Our design features a high-mass (˜mg) plate whose weight is supported by a vertical beam. We present the first systematic analysis and optimisation of quantum noises in optically trapped systems and show that our setup has the potential to operate at the standard quantum limit with current off-the-shelf technologies. We demonstrate that our sensor could offer unique access to large regions of uncharted parameter space of vector B-L and scalar dark matter, with projected sensitivities that could advance existing limits by several orders of magnitude over a broad range of frequencies.

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