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Ultralight Axion Dark Matter Search using Optical Quantum Sensors

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An optical quantum sensor (OQS) based on lasers and alkali-metal atoms is currently the most sensitive ambient-temperature magnetometer. Because of high sensitivity and operation in a broad frequency range, the OQS can be used in axion dark matter search with an inductor-capacitor (LC) circuit at kHz and MHz frequencies. In this talk, we will present our recent activities on OQS-based axion dark matter search at Los Alamos National Laboratory. Our search targets an extremely weak axion-induced oscillating magnetic field in the presence of a static magnetic field. We investigate the sensitivity of an LC circuit-OQS axion detector to ultralight axion dark matter that could be potentially reached by an OQS performing close to the fundamental quantum noise levels of 10 aT. We anticipate that such an experiment could probe benchmark quantum chromodynamics (QCD) axion models in an unexplored mass range near 10 neV.

Early Career

No

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