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The ORGAN Experiment: Progress and Future Directions in High-Mass Axion Searches

Tuesday 23 September 2025 09:00 (40 minutes)

The Oscillating Resonant Group Axion (ORGAN) experiment is a microwave cavity haloscope searching for axion dark matter in the high-mass region of 15–50 GHz. The recently completed Phase 1b successfully scanned the 107.42–111.93 μeV (26–27 GHz) mass range using a novel rectangular copper cavity, achieving leading sensitivity and excluding axionlike particle (ALP) cogenesis models over this range. The rectangular geometry mitigates critical challenges associated with conventional cylindrical designs at high frequencies, including mode crowding, thermalization, and mechanical instabilities.

Looking ahead, ORGAN Phase 2 will substantially improve sensitivity across much of the Phase 1a parameter space (15–16 GHz) by operating at millikelvin temperatures with beyond-quantum-limited amplification. Further development includes the integration of single-photon detectors to reach sensitivity sufficient to probe the theoretically motivated KSVZ and DFSZ axion models. Parallel work is advancing kinetic inductance parametric amplifiers as part of this effort. Together, these upgrades position ORGAN to explore new parameter space in the high-mass axion regime with sensitivity approaching fundamental quantum limits.

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