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The ORGAN Experiment: Results, Status, and Future Plans

Tuesday 9 August 2022 14:00 (30 minutes)

We present the current status and future plans of the various experiments within The Oscillating Resonant Group AxioN (ORGAN) Collaboration, which develops microwave cavity axion haloscopes. ORGAN is a collaboration of various nodes of the ARC Centres of Excellence for Engineered Quantum Systems, and Dark Matter Particle Physics, and is primarily hosted at the University of Western Australia.

The ORGAN Experiment is a high mass haloscope (~60-200 micro-eV) broken down into various phases, having commenced in 2021, and running until 2026 [1]. Phase 1a recently concluded, excluding ALP Cogenesis models of dark matter in the mass range of 63 –67 micro-eV [2]. Phase 1b is currently in commissioning, with Phase 2 in research and development. Active avenues of research and development for ORGAN include novel high frequency cavity design [3,4], superconducting materials, and single photon counting.

ORGAN-Q is a pathfinder experiment (~25 micro-eV), designed as a testbed for various techniques to be integrated into the main ORGAN Experiment in future phases, such as quantum-limited amplification, and other improvements.

ORGAN-Low Frequency is a lower-mass experiment (~1 micro-eV), designed to utilise an MRI magnet, and novel re-entrant cavities to push into the low frequency axion regime, and search for different models of dark matter.

We will summarize each experiment in terms of the relevant experimental details, current status, run plans, and projected reach.

1. Ben T. McAllister, Graeme Flower, Eugene N. Ivanov, Maxim Goryachev, Jeremy Bourhill, Michael E. Tobar, 'The ORGAN experiment: An axion haloscope above 15 GHz', Physics of the Dark Universe 18, 67-72
2. Aaron P. Quiskamp, Ben T. McAllister, Paul Altin, Eugene N. Ivanov, Maxim Goryachev, Michael E. Tobar, 'Direct Search for Dark Matter Axions Excluding ALP Cogenesis in the 63-67 micro-eV Range, with The ORGAN Experiment', Science Advances (accepted, in production), arXiv:2203.12152
3. Ben T. McAllister, Graeme Flower, Lucas E. Tobar, and Michael E. Tobar, 'Tunable Supermode Dielectric Resonators for Axion Dark-Matter Haloscopes, Phys. Rev. Applied 9, 014028
4. Aaron P. Quiskamp, Ben T. McAllister, Gray Rybka, and Michael E. Tobar, 'Dielectric-Boosted Sensitivity to Cylindrical Azimuthally Varying Transverse-Magnetic Resonant Modes in an Axion Haloscope' , Phys. Rev. Applied 14, 044051

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