

Search for dark-matter axions beyond the quantum limit: the Cosmological Axion Sarov Haloscope (CASH) proposal and status

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Firmly established in astrophysical observations, dark matter evades direct detection in experiments. Axions and axion-like particles are among the leading dark-matter candidates, and numerous attempts to detect them in laboratories have been performed. Here, we propose to advance these efforts substantially, extending the sensitivity for dark-matter axions in the mass range $38\text{--}54\text{ }\mu\text{eV}$ down to the axion-photon couplings $g_{\text{agg}} \sim 10^{-14}\text{--}10^{-15}\text{ GeV}^{-1}$, motivated by generic models of Quantum Chromodynamics axion. Single-photon detectors based on Josephson junctions operating at ultra-low temperatures are key elements of the experiment. The projected sensitivity will be reached in one year of data taking with magnetic field of 7 T, making Cosmological Axion Sarov Haloscope (CASH) the most sensitive haloscope in this mass range (based on arXiv:2506.18595 [hep-ph]). In addition, we discuss the sensitivity of proposed CASH experiment to relativistic axion flux. We report the current status of the first pathfinder run of CASH experiment.

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