

Abstract Submitted
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Improving the search for axion dark matter with cavity arrays and squeezed vacuum for ADMX¹ PATRICK HARRINGTON, Washington University in St. Louis, ADMX COLLABORATION — The search for QCD axion dark matter with the Axion Dark Matter Experiment (ADMX) requires quantum-limited microwave detectors. Unfortunately, microwave signal power and noise scales unfavorably for detection of higher mass axion signals. Above 1 GHz, detection sensitivity is limited by intrinsic properties of resonant modes: signal power weakens for small-volume high frequency modes while vacuum shot noise increases with frequency. We approach these interrelated challenges by coherently adding signals from multiple resonant cavities, thereby increasing the overall detector volume. Furthermore, we develop Josephson parametric amplifiers to improve signal-to-noise beyond the standard quantum limit by driving multiple cavity systems with squeezed vacuum. These microwave engineering and quantum optics techniques address frequency scaling limitations of resonant detectors and will advance higher mass axion searches at accelerated scan rates.

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