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Detecting Axions with Superconducting Qubits

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The Axion Dark Matter eXperiment (ADMX) aims to detect dark matter axions converting to single photons in a resonant cavity bathed in a uniform magnetic field. A qubit (two level system) operating as a single microwave photon detector is a viable readout system for ADMX and may offer advantages over the quantum limited amplifiers currently used ADMX. When weakly coupled to the detection cavity, the qubit transition frequency is shifted by an amount proportional to the cavity photon number. Through spectroscopy of the qubit, the frequency shift is measured and the cavity occupation number is extracted. At low enough temperatures, this system would allow sensitivities exceeding that of the standard quantum limit.

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