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Improved tunable microstrip SQUID amplifiers for the Axion Dark Matter eXperiment[1] SEAN O'KELLEY, Univ of California - Berkeley, JØRN HANSEN, Technical University of Denmark, GENE HILTON, NIST Boulder, JAN-MICHAEL MOL, RWTH Aachen, JOHN CLARKE, Univ of California - Berkeley, ADMX COLLABORATION — We describe a series of tunable microstrip SQUID (Superconducting QUantum Interference Device) amplifiers (MSAs) used as the photon detector in the Axion Dark Matter eXperiment (ADMX). Cooled to 100mK or lower, an optimized MSA approaches the quantum limit of detection. The axion dark matter candidate would be detected via Primakoff conversion to a microwave photon in a high-Q ($\approx 10^5$) tunable microwave cavity, cooled to 1.6 K or lower, in the presence of a 7-tesla magnetic field. The MSA consists of a square loop of thin Nb film, incorporating two resistively shunted Josephson tunnel junctions biased to the voltage state, flux-coupled to a resonant microstrip. The photon frequency is determined by the unknown axion mass, so the cavity and amplifier must be tunable over a broad frequency range. MSA tunability is achieved by terminating the microstrip with a GaAs varactor diode that operates at cryogenic temperatures. This voltage-controlled capacitance enables us to vary the resonant microstrip mode from nearly $\lambda/2$ to $\lambda/4$. We demonstrate gains exceeding 20 dB, at frequencies above 900 MHz. With proper design of the microwave environment, a noise temperature of 1/2 to 1/4 of the physical temperature is demonstrated.

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