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The Microstrip SQUID Amplifier: Upgrading the Axion Dark Matter Experiment (ADMX) JOHN CLARKE, University of California, Berkeley, DARIN KINION, Lawrence Livermore National Laboratory, ADMX COLLABORATION — The axion detector, now at the University of Washington, Seattle. requires a very low noise amplifier in the 1-GHz frequency range. In the first generation detector, the cavity was cooled to 1.5 K and used a HEMT (High Electron Mobility Transistor) amplifier with a noise temperature T_N of 1.7 K. Thus, the system noise temperature T_S was 3.2 K. To achieve significantly lower noise temperatures, we developed the Microstrip SQUID Amplifier (MSA) in which the input coil forms a microstrip with the SQUID washer. When the length of the coil corresponds to a half-wavelength of the signal, the gain is typically 20 dB. We measured the gain and noise of an MSA at 0.62 GHz, and achieved a minimum noise temperature $T_N = 48 \pm 5$ mK for a bath temperature of 50 mK and at a frequency slightly below resonance, as predicted. The quantum limit is 30 mK. Since the time for the axion detector to scan a given frequency range scales as T_S^2, replacing the HEMT with a SQUID and cooling the cavity to 50 mK potentially reduces the scan time by three orders of magnitude. In a proof-of-principle run, the system was operated at 1.7 K with an MSA readout, and performed as predicted. A total of 88,370, 80-second data sets were acquired, corresponding to 82 days of data acquisition.

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