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Tunable microstrip SQUID amplifiers for the Gen 2 Axion Dark Matter eXperiment (ADMX)[1] SEAN O'KELLEY, UC Berkeley, GENE HILTON, NIST Boulder, JOHN CLARKE, UC Berkeley, ADMX COLLABORATION — We present a series of tunable microstrip SQUID (Superconducting Quantum Interference Device) amplifiers (MSAs) for installation in ADMX. The axion dark matter candidate is detected via Primakoff conversion to a microwave photon in a high-Q (≈100,000) tunable microwave cavity cooled with a dilution refrigerator in a 7-tesla magnetic field. The microwave photon frequency ν is a function of the unknown axion mass, so both the cavity and amplifier must be scanned over a wide frequency range. An MSA is a linear, phase-preserving amplifier consisting of a square washer loop, fabricated from a thin Nb film, incorporating two Josephson tunnel junctions with resistive shunts to prevent hysteresis. The input is coupled via a microstrip made from a square Nb coil deposited over the washer with an intervening insulating layer. Tunability is achieved by terminating the microstrip with GaAs varactors that operate below 100 mK. By varying the varactor capacitance with a bias voltage, the resonant frequency is varied by up to a factor of 2. We demonstrate several devices operating below 100 mK, matched to the discrete operating bands of ADMX at frequencies ranging from 560 MHz to 1 GHz. The MSAs exhibit gains exceeding 20 dB and the associated noise temperatures, measured with a hot/cold load, approach the standard quantum limit ($h\nu/\mathrm{k_B}$).

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