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Tunable microstrip SQUID amplifiers for the Gen 2 Axion Dark Matter eXperiment (ADMX) SEAN O'KELLEY, UC Berkeley, GENE HILTON, NIST Boulder, JOHN CLARKE, UC Berkeley — We present a series of tunable microstrip SQUID 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 the presence of 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 superconducting, resonant microstrip flux-coupled to a resistively-shunted dc SQUID biased into the voltage state. Tunability is achieved by terminating the microstrip with low inductance GaAs varactor diodes that operate below 100 mK. By varying the bias voltage of the varactors we vary their capacitance, allowing a reflected phase varying from nearly 0 to π, thus achieving a tunability close 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, that exhibit gains exceeding 20 dB. The associated noise temperatures, measured with a hot/cold load, approach the standard quantum limit ($h\nu/\mathrm{k_B}$) for a linear phase-preserving amplifier.

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