Abstract Submitted
for the APR14 Meeting of
The American Physical Society

A tunable microstrip SQUID amplifier for the Axion Dark Matter eXperiment (ADMX)[1] SEAN O'KELLEY, UC Berkeley, JORN HANSEN, Technical University of Denmark, ELAN WEINGARTEN, UC Berkeley, MICHAEL MUECK, ez SQUID, GENE HILTON, NIST, JOHN CLARKE, UC Berkeley, ADMX COLLABORATION, ADMX-HF COLLABORATION — We describe a microstrip SQUID (Superconducting QUantum Interference Device) amplifier (MSA) used as the photon detector in the Axion Dark Matter eXperiment (ADMX). Cooled to 100 mK or lower, an optimized MSA approaches the quantum limit of detection. The axion dark matter is detected via Primakoff conversion to a microwave photon in a high-Q ($\approx 10^5$) tunable microwave cavity, currently cooled to about 1.6 K, in the presence of a 7-tesla magnetic field. The MSA consists of a square loop of thin Nb film, incorporating two Josephson tunnel junctions with resistive shunts to prevent hysteresis in the current-voltage characteristic. The microstrip is a square Nb coil deposited over an intervening insulating layer. Since the photon frequency is determined by the unknown axion mass, the cavity and amplifier must be tunable over a broad frequency range. Tunability is achieved by terminating the microstrip with a GaAs varactor diode with a voltage-controlled capacitance that enables us to vary the resonance from nearly 1/2 to 1/4 of a wavelength. With the SQUID current-biased in the voltage state, we demonstrate a gain of typically 20 dB over nearly one octave, 415 MHz to 800 MHz.

[1]Supported by DOE Grants DE-FG02-97ER41029, DE-FG02-96ER40956, DE-AC52-07NA27344, DE-AC03-76SF00098, NSF grants PHY-1067242 and PHY-1306729, and the Livermore LDRD program.

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Date submitted: 09 Jan 2014 Electronic form version 1.4