Microwave Cavity R&D for ADMX-HF

MARIASIMANOVSKAIA, KELLY BACKES, University of California, Berkeley, GIANPAOLOCAROSI, Lawrence Livermore National Laboratory, SAAD KENANY, SAMANTHA LEWIS, JABEN ROOT, KARL VAN BIBBER, University of California, Berkeley, ADMX-HF COLLABORATION — Dark matter axions may be detected by their resonant conversion to photons in a tunable microwave cavity permeated by a strong magnetic field. The Axion Dark Matter eXperiment - High Frequency is both a test-bed for innovative cavity and amplifier concepts and a data pathfinder for the 5-25 GHz range. We are focusing on two major issues in the microwave cavity axion search. The first is increasing the cavity quality factor, $Q$, which enters linearly into the signal power and thus mass scan rate. Toward this end, we are developing a RF plasma deposition technique for making and characterizing superconducting NbTiN thin films. Multilayers of these thin films deposited on cylindrical surfaces of the microwave cavity may improve the $Q$ by an order of magnitude. The second is applying Photonic Band Gap structures to make resonators of higher frequency and isolate the desired TM$_{010}$ mode. The density of mode crossings between the axion-coupling TM$_{010}$ mode and axion-noncoupling TE and TEM modes is the greatest limitation to the experiment’s mass scan rate through loss of continuous frequency coverage.

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