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Characterization of nonlinear dielectric films for the tuning of microwave cavities for axion searches CHIARA SALEMI, University of North Carolina at Chapel Hill, DANIEL BOWRING, ANDREW SONNENSCHEIN, Fermilab — The axion is a hypothetical particle that can solve the strong CP problem and that may be the primary component of dark matter in the universe. Experiments such as the Axion Dark Matter eXperiment (ADMX) hope to find the axion through its coupling to photons in the presence of a strong magnetic field. This coupling can be detected using a microwave cavity whose fundamental resonance frequency is matched to that of the photons. By tuning the cavity resonance frequency, the corresponding axion mass range can be scanned. For axion searches above 1GHz, future generations of ADMX may use an array of small cavities locked to the same frequency. These cavities will be coarsely tuned using a tuning rod as is done in the current generation of ADMX, but fine tuning of individual resonators will be necessary for multi-cavity arrays. A candidate fine tuning method uses nonlinear dielectric films inside the cavities. DC-biasing the films changes their dielectric constant, affecting the frequencies of the cavity modes. This method makes frequency-matched resonator arrays more practical by saving space and minimizing heat load inside the cryostat. This poster presents RF design and simulation and preliminary measurements on the coplanar waveguide resonators used to test the films.

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