Abstract Submitted
for the APR21 Meeting of
The American Physical Society

Studies of a Wire Array Metamaterials for a Tunable Plasmonic Haloscope[1] SAAD AL KENANY, ALEXANDER DROSTER, SAMANTHA LEWIS, DAJIE SUN, KARL VAN BIBBER, University of California, Berkeley — The microwave cavity experiment based on the resonant conversion of axions to photons in a magnetic field proposed by Sikivie in 1983 has provided the strongest limits to date on the QCD axion. Current searches are extendable up to the range of 10 GHz (˜40 eV), but concepts for practical resonators for higher frequencies that possess both large volume and good form factor are lacking. A concept has recently been published however, based on a metamaterial comprised of a 2D array of thin wires, whereby in a magnetic field the axion couples directly to its plasmonic modes [1]. With wire arrays similar to those used in high energy physics detectors (tens of microns diameter, few millimeter spacing), the plasma frequency can be adjusted to be >10 GHz and importantly, the volume can be arbitrarily large. We have carried out experimental studies of 2D wire array metamaterials built up of individual wire planes extending earlier measurements [2,3], and finding excellent agreement with theoretical models [2,4]. Furthermore, we have explored new configurations to find a practical mechanism for tuning the array over a wide dynamic range in frequency, with promising results.

[1]This work was performed under NSF Grant 1914199.

Saad Al Kenany
University of California, Berkeley

Date submitted: 08 Jan 2021 Electronic form version 1.4