Contribution ID: **169** Type: **Parallel talk**

High Frequency Microwave Cavity Design Innovations for Axion Dark Matter Searches

Monday, 8 July 2024 14:17 (17 minutes)

The most sensitive searches for axion halo dark matter are based on the resonant conversion of axions to photons in a microwave cavity permeated by a strong magnetic field. Current and future experiments such as HAYSTAC and ALPHA seeking to reach recent predictions of the post-inflation axion of masses of 40-180 μeV (~10-45 GHz) are challenged both by the rapidly diminishing volume of conventional microwave cavities with frequency (thus loss of signal power) and by the proliferation of other modes which hybridize with the mode of interest (thus loss of frequency coverage). We will present the design and first experimental results of metamaterial-inspired resonators which can simultaneously have the requisite high frequency and large volume, and on photonic band gap structures which can trap the mode of interest (TM010) while radiating away most of the interfering modes (TElmn). These results informed design choices for both HAYSTAC run III and ALPHA run I. HAYSTAC will employ a symmetric multi rod resonator covering a frequency range of 6.3-8.6 GHz. ALPHA run Ia will apply a similar approach to create a resonator aimed at the 10-20 GHz range, and ALPHA run Ib will use a more optimized though mechanically complex design.

Primary author: JACKSON, Heather (UC Berkeley)

Presenter: JACKSON, Heather (UC Berkeley)

Session Classification: Parallel 3

Track Classification: Parallel session: Axion/Sterile