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A Tunable Photonic Band Gap Resonator for HAYSTAC[1]
SAMANTHA LEWIS, MIRELYS CARCANA BARBOSA, KARL VAN BIBBER, University of California, Berkeley, HAYSTAC COLLABORATION — Haloscopes search for dark matter axions via their conversion to photons in an applied magnetic field. The Haloscope at Yale Sensitive to Axion CDM (HAYSTAC) uses a copper cylindrical cavity with an off-axis tuning rod to resonantly enhance the converted photon signal. The lowest order transverse magnetic mode (the TM_{010}) is tuned to search over a range of potential axion masses. This process is complicated by other fundamental cavity modes which interfere with the TM_{010} mode, reducing the achievable signal power and sensitivity. Current experiments tolerate these mode crossings, but the problem worsens at higher frequencies. Photonic Band Gap (PBG)-based resonators allow for the confinement of TM modes while eliminating unwanted modes. We have developed a tunable PBG resonator which eliminates transverse electric (TE) modes and tunes the TM_{010} from 7.3 to 9.3 GHz. This work will present results from an improved prototype aluminum structure and will discuss ongoing research on future designs.

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