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# Novel Resonant Cavity Designs and Applications to Axion Haloscopes

*Wednesday, 11 January 2017 11:50 (35 minutes)*

At the University of Western Australia we are investigating novel resonant cavity structures for a variety of applications ranging from tests of fundamental physics, quantum information techniques and applied technologies. After a short introduction, this presentation will focus on our work in designing novel cavities geometries for axion detection. First we will discuss our work on using 3D lumped "re-entrant" cavities, which offer high tuning ranges at cryogenic temperatures [1], for the potential application for detection of low mass axions between the range of 50 neV to 1 μev [2]. Secondly, we will discuss work on using multiple post cavities [3-5] and how they may aid in designing high frequency haloscopes. Thirdly, we will present our experimental and theoretical work on higher order reentrant post modes, and discuss their sensitivity to axions as well as implications for cavities with tuning posts and gaps between the post and cavity end wall [6]. Finally we will discuss our work on dielectric cavities, 3D printed superconducting cavities [7] and some new designs for high frequency axion haloscopes.

[1] NC Carvalho, Y Fan, ME Tobar, "Piezoelectric tunable microwave superconducting cavity", Rev. Sci. Instrum., vol. 87, 094702, 2016.
[2] BT McAllister, SR Parker, ME Tobar, "3D lumped LC resonators as low mass axion haloscopes", Phys. Rev. D 94, 042001, 2016.
[3] M Goryachev, ME Tobar, "Reconfigurable microwave photonic topological insulator," accepted to be published in Phys. Rev. Applied, Nov. 2016. arXiv:1606.02001[physics.ins-det].
[4] M Goryachev, ME Tobar, Creating Tuneable Microwave Media from a 2D Lattice of Re-entrant Posts, Journal of Applied Physics, vol. 118, 204504, 2015.
[5] M Goryachev, ME Tobar, "The 3D split-ring cavity lattice: a new metastructure for engineering arrays of coupled microwave harmonic oscillators," New J. Phys. 17, 023003, 2015.
[6] BT McAllister, Y Shen, SR Parker, ME. Tobar, "Higher Order Reentrant Post Modes in Cylindrical Cavities," arXiv:1611.08939[physics.ins-det].
[7] DL Creedon, M Goryachev, N Kostylev, T Sercombe, ME Tobar, A 3D Printed Superconducting Aluminium Microwave Cavity, Appl. Phys. Lett. vol. 109 , 032601, 2016.

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