

View Abstract

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TITLE: 3D Double Post Re-entrant Microwave Cavities as a Powerful Tool for Strong Photon-Magnon Coupling
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INSTITUTIONS (ALL): 1. IMT-Atlantique, Brest, France. 2. University of Western Australia, Perth, WA, Australia.
ABSTRACT BODY: <p>Abstract Body: 3D re-entrant cavities offer a unique platform for microwave photon-magnon coupling in magnetic materials. A double post architecture (see Fig. 1) allows RF magnetic field focusing over a magnetic sample placed between the posts, generating orders of magnitude improvements in coupling strength compared to standard TM microwave cavities. These systems have successfully demonstrated achieving the strong coupling regime with coupling strengths equal to a sizeable percentage of the system's total energy [1,2] (see Fig. 2). Furthermore, the spatial separation of E and B fields within the cavity permit the presence of conductive layers, allowing utilisation of Spin-Hall devices [3]. Finally, the possibility of broad in-situ tuneability of the resonant frequency of these cavities results in an extremely versatile device, which will have important ramifications for microwave filtering applications and cavity quantum electrodynamics experiments. A range of experimental and simulation results are presented demonstrating the adaptability of these cavities towards the goals of achieving large coupling parameters, low microwave losses or high field uniformity, the latter being important for the suppression of coupling to higher order magnetic modes [4] for the purposes of clean filtering protocols. Successful manufacturing of these cavities has been demonstrated via 3D printing [5], further adding to their list of benefits through reduced cost and weight, and improved reproducibility, allowing mass production of such systems from a commercial standpoint, but also scalability of experimental tests of fundamental physics such as dark matter detection [6].</p>
References: [1] M. Goryachev, W.G. Farr and D.L. Creedon, Phys. Rev. Applied, Vol. 2(5), pp. 054002, (2014) [2] M. Goryachev, S. Watt and J. Bourhill, Phys. Rev. B, Vol. 97(15), pp. 155129, (2018) [3] V. Castel, R. Jeunehomme and J.B. Youssef, Phys. Rev. B, Vol. 96, pp. 064407, (2017) [4] J. Bourhill, N. Kostylev and M. Goryachev, Phys. Rev. B, Vol. 93(14), pp. 144420, (2016) [5] V. Castel, S.B. Ammar and A. Manhec, IEEE Mag. Lett., Vol. 10, pp. 1-5, (2019) [6] G. Flower, J. Bourhill and M. Goryachev, Physics of the Dark Universe, Vol. 25, pp. 100306, (2019)

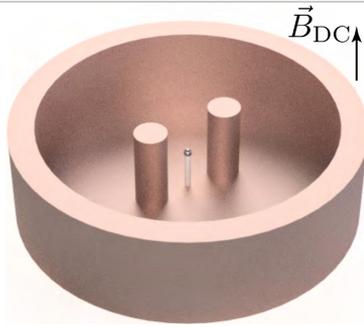


Fig. 1. 3D double post re-entrant cavity architecture with magnetic sphere positioned between the posts.

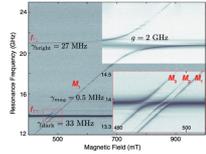


Fig. 2. Magnetic spectroscopy of cavity system with YIG sphere, demonstrating photon-magnon coupling strength of 2 GHz (~ 10% of system energy).

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Manuscript?: Undecided

Previous Presentation: No – I didn't present a paper at ICM2018, Intermag 2018 or MMM 2017

Attendance at Conference: I acknowledge that I have read the above statement regarding the requirement that an author of this presentation must attend the conference to present the paper.