Contribution ID: **51** Type: **Invited Talk**

High-Q and Novel Cavity Structures for Photon-Spin Strong Coupling

Thursday 23 February 2017 11:24 (36 minutes)

Strong coupling between microwave photons and spins at millikelvin temperatures is necessary to realise quantum information processing. We will present our most recent results in coupling strongly to a variety of cavity and spin systems. Novel cavity systems include whispering gallery modes, 3D lumped element meta-structures based on the reentrant cavity and dielectric TE modes. Spin systems include paramagnetic iron group and rare-earth impurities doped in low-loss crystalline materials (such as YSO, YAP and Silicon), P1 centers in diamond and magnons in ferrimagnetic YIG.

In particular we will focus on new cavities, which couple photons and magnons in YIG spheres in a super- and ultra-strong way at around 20 mK in temperature. Few/Single photon couplings (or normal mode splitting, 2g) of more than 7 GHz at microwave frequencies are obtained for a 15.5 GHz mode. Types of cavities include multiple post reentrant cavities, which co-couple photons at different frequencies with a coupling greater that the free spectral range, as well as spherical loaded dielectric cavity resonators. In such cavities we show that the bare dielectric properties can be obtained by polarizing all ferromagnetic effects and magnon spin wave modes to high energy using a 7 Tesla magnet. We also show that at zero-field, collective effects of the spins significantly perturb the photon modes. Other effects like time-reversal symmetry breaking are observed.

Author: Prof. TOBAR, Michael (ARC Centre of Excellence for Engineered Quantum Systems, University of Western Australia)

Presenter: Prof. TOBAR, Michael (ARC Centre of Excellence for Engineered Quantum Systems, University of Western Australia)