Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Novel techniques for strong coupling between spin ensembles and cavity resonators DANIEL CREEDON, MAXIM GORYACHEV, WARRICK FARR, JEAN-MICHEL LE FLOCH, YAOHUI FAN, NATÁLIA CARVALHO, MICHAEL TOBAR, ARC Centre of Excellence for Engineered Quantum Systems, University of Western Australia, MIKHAIL KOSTYLEV, Magnetisation Dynamics and Spintronics Group, School of Physics, University of Western Australia, STEFANIA CASTELLETTO, ARC Centre of Excellence for Engineered Quantum Systems, RMIT University, Melbourne, PAVEL BUSHEV, Universität des Saarlandes, Saarbrücken, Germany — Spins in solids are a promising physical subsystem for the realization of hybrid quantum systems. We focus on experiments coupling spins to three dimensional cavities, a system where it is critical to achieve operation in the strong coupling regime. This has been achieved using two approaches: coupling to impurity ions in single-crystal Whispering Gallery photonic resonators, and by using a novel field focusing re-entrant cavity. The first approach has allowed us to investigate various impurities in sapphire, quartz, and YAG, as well as iron group ions in YSO. This method is characterised by relatively narrow photon linewidths, higher filling factors and lower impurity concentration. The second approach allowed strong coupling to P1 impurities in diamond and operation in the ultra-strong coupling regime with magnons in YIG. This method is designed to achieve spatial separation of the cavity magnetic and electric fields, relatively high filling factors with sub-mm crystals of any shape and a high concentration of magnetic ions, as well as arbitrary engineering of the cavity spectrum and field distribution.

Daniel Creedon
ARC Centre of Excellence for Engineered Quantum Systems,
University of Western Australia

Date submitted: 09 Nov 2014 Electronic form version 1.4