Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Spectroscopic measurement of impurity ions in crystals using Whispering Gallery Modes and application to hybrid qantum systems[1]
MICHAEL TOBAR, DANIEL CREEDON, WARRICK FARR, NATALIA CARVALHO, The University of Western Australia, PAVEL BUSHEV, Karlsruhe Institute of Technology, MAXIM GORYACHEV, JEAN-MICHEL LE FLOCH, The University of Western Australia — Crystal resonators with paramagnetic ion impurities are promising devices for hybrid quantum systems. However, a trade-off exists between cavity coherence time and ion concentration. As a result, it is important to characterize crystals with varying levels of concentration and in the experimental regime where quantum effects occur (millikelvin temperature at microwave frequencies). Here, we describe recent progress in sensitive spectroscopic measurements of paramagnetic impurity ions in crystals. Using hybrid Whispering Gallery Mode and Electron Spin Resonance techniques, interactions between photons and impurity ions in crystalline microwave cavities are studied. Rigorous spectroscopy of single-crystal sapphire and rare earth doped YAG and YSO was performed over the frequency range 8-19 GHz, and external DC magnetic fields of up to 0.9 T. Measurements of a high purity sapphire reveal the presence of Fe3+, Cr3+, and V2+ impurities, with quadrupole and hyperfine structure, as well as coupling between spins and photons of up to 6MHz. Also, new transitions in Erbium doped YSO crystals are observed in the strong coupling regime and will be presented at the conference.

[1]This work has been supported by the Australian Research Council Grants FL0992016 and CE110001013.

Michael Tobar
The University of Western Australia

Date submitted: 15 Nov 2013 Electronic form version 1.4