

Department of Physics

Condensed Matter Physics
Clarendon Laboratory, Parks Road, Oxford OX1 3PU



CONDENSED MATTER SEMINAR

Thursday 19 October 2017 at 2.15pm

“Controlling the Collective Coupling in Spin-Photon Hybrids”

Dr Hans Hübl

Walther-Meissner-Institut, Bayerische Akademie der Wissenschaften, Garching

Solid-state based quantum systems (e.g. single spin systems like NV centers in diamond or phosphor donors in silicon, superconducting qubits, nanomagnets, and nanomechanical elements) are building blocks for devices exploiting quantum physics phenomena. With different quantum systems available, schemes allowing to couple them move into focus. In particular, coupling enables information transfer between the sub systems.

We will focus on the magnon-photon interaction between spin ensembles and microwave resonators and aspects of controlling the interaction. Hereby we will explore the different coupling regimes from weak to strong coupling. We will discuss various material systems ranging from paramagnetic spin ensembles to exchange coupled magnetic insulators including the ferrimagnetic insulator Yttrium Iron Garnet as well as the compensated ferrimagnet Gadolinium Iron Garnet. As the collective magnon-photon interaction is directly related to magnetization of the system, it can be straightforwardly controlled in paramagnetic ensembles using thermal polarization. In contrast, thermal polarization is typically not an efficient tuning mechanism in ordered magnetic systems. Nevertheless, in compensating magnetic systems the net-magnetization becomes tunable via the polarization and compensation of their sub-lattice magnetizations. We will show that the net magnetization of Gadolinium Iron Garnet can be tuned drastically around its compensation temperature and discuss its impact on the collective magnon-photon coupling rate. Complementary to the microwave spectroscopy, I will present data using optical readout of the coupled system.

Host: Dr Alexy Karenowska

Audrey Wood Seminar Room, Clarendon Laboratory