Physical Sciences Seminar

Microwave up-conversion with magneto-optic and electro-optic non-linearities.

Nicholas Lambert
University of Otago

Host: Johannes Fink

Many proposed quantum information technologies rely on coherent communication between two or more locations. Typical natural frequencies for superconducting and spin qubits are of order 1-10 GHz, but communication at microwave frequencies is subject to both loss and thermal noise. A better option is to communicate over optical channels, and exploit fiber-based telecommunications technologies to do so. A key component in such a communication chain is high efficiency, high fidelity coherent conversion between the microwave and optical domains. Converting signals between frequencies requires the presence of a non-linearity. In this talk I will describe conversion from microwaves to optical frequencies via magneto-optic non-linearities. Strong coupling between cavity photons and magnons is desirable for high efficiencies, and we demonstrate this using yttrium iron garnet (YIG) spheres and transmission line microwave cavities. We also use this architecture to couple magnetostatic modes in two spatially separated ferromagnets. YIG spheres also support optical frequency whispering gallery modes, and we demonstrate coupling between the two, leading to microwave to optical up-conversion. I will discuss some possibilities for improving the efficiency of the conversion chain. Other non-linearities are available. Electro-optic non-linearities can offer up-conversion with relatively simple device architectures and well-understood materials. I will show results for triple-resonant enhanced up-conversion, and describe our plans for increased efficiency and fidelity devices.

Friday, October 18, 2019 11:00am - 12:00pm
Heinzel Seminar Room / Office Bldg West (I21.EG.101)

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