



Physics Colloquium

Monday, 9 March 2020 | 11:30 – 12:30, Seminar Room, 3rd floor

Nonlinear couplings for quantum control of superconducting qubits photons and phonons

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ABSTRACT

Superconducting quantum circuits offer an alternative platform for studying light-matter interaction and manipulating quantum information using microwave photons. This field, known as circuit quantum electrodynamics (cQED), holds great promise for quantum technologies such as building fault-tolerant quantum computers [1] as well as exploring other less accessible systems by means of quantum simulations [2] or by contributing to hybrid quantum systems [3]. I will discuss my work on realizing a tuneable coupler for superconducting qubits with the aim of exploring novel many-body interaction regimes [4], as well as a theoretical proposal for controlling mechanical resonators based on this coupling scheme [5]. Finally, if time allows I will go through a recent experimental scheme where we extended cQED into the radiofrequency regime by means of dissipation-engineering techniques [6].

[1] Schoelkopf & Girvin, *Nature* **451**, 664 (2008)

[2] Houck et al., *Nature Physics* **8**, 292 (2012)

[3] Kurizki et al., *PNAS* **112**, 3866 (2015).

[4] Kounalakis et al., *npj Quantum Information* **4**, 38 (2018)

[5] Kounalakis et al., *npj Quantum Information* **5**, 100 (2019)

[6] Gely et al., *Science* **363**, 1072 (2019)