



Physical Sciences Seminar

Hybrid Quantum Systems: Coupling Diamond Color Centers to Superconducting Cavities

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Hybrid quantum systems based on spin-ensembles coupled to superconducting microwave cavities are promising candidates for robust experiments in cavity quantum electrodynamics (QED) and for future technologies employing quantum mechanical effects. In particular the electron spins hosted by nitrogen-vacancy centers in diamond [1]. The main source of decoherence in this systems is inhomogeneous dipolar spin broadening and a full understanding of the complex dynamics is essential and has not been addressed in recent studies yet. We investigate the influence of a non-Lorentzian spectral spin distribution in the strong coupling regime of cavity QED. We show experimentally how the so-called cavity protection effect influences the decay rate of coherent Rabi oscillation by varying the coupling strength in our experiment [2]. We then demonstrate how the Rabi oscillation amplitude can be enhanced by two orders of magnitude by pulsing the strongly coupled system matching a special resonance condition.

Furthermore, we show that by burning narrow spectral holes into a spin ensemble we create long-lived collective dark states [3]. We observe long-lived Rabi oscillations with high visibility and a decay rate that is a factor of forty smaller than the spin ensemble linewidth and thereby more than a factor of three below the pure cavity dissipation rate. Additionally, I will discuss the possibility of coupling spin ensembles over large distances using the cavity as a quantum bus[4].

[1] R. Amsüss, Ch. Koller, T. Nöbauer, S. Putz, S. Rotter, K. Sandner, S. Schneider, M. Schramböck, G. Steinhauser, H. Ritsch, J. Schmiedmayer, and J. Majer, Phys. Rev. Lett. 107, 060502 (2011) [2] S. Putz, D. O. Krimer, R. Amsuss, A. Valookaran, T. Nobauer, J. Schmiedmayer, S. Rotter, and J. Majer, Nature Physics 10, 720-724 (2014) [3] S. Putz, A. Angerer, D.O. Krimer, R. Glattauer, W.J. Munro, S. Rotter, J. Schmiedmayer, and J. Majer, Nature Photonics 11, 36-39 (2017) [4] T. Astner, S. Nevlacsil, N. Peterschofsky, A. Angerer, S. Rotter, S. Putz, J. Schmiedmayer, and J. Majer, Phys. Rev. Lett. 118, 140502 (2017)

Thursday, September 7, 2017 11:15am - 12:15pm

Mondi Seminar Room 2, Central Building



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