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Circuit Quantum Electrodynamics with Semiconductor Quantum Dots ANDREAS WALLRAFF, TOBIAS FREY, PETER J. LEEK, MATTHIAS BECK, ETH Zurich, ALEXANDRE BLAIS, Université de Sherbrooke, THOMAS IHN, KLAUS ENSSLIN, ETH Zurich — Research on semiconductor quantum dots has tremendously contributed to the understanding of the physics of individual charges and spins in a solid state environment. Typically, quantum dots are investigated by direct current transport measurements or using quantum point contacts for charge sensing. Instead, we have realized a novel device in which a semiconductor double quantum dot is dipole coupled to a GHz-frequency high-quality tranmission line resonator. This approach allows us to characterize the properties of the double dot by measuring both its dispersive and dissipative interaction with the resonator [1]. In addition to providing a new readout mechanism, this architecture has the potential to isolate the dots from the environment and to provide long distance coupling between spatially separated dots. These features are expected to improve the potential for realizing a quantum information processor with quantum dots as previously demonstrated for superconducting circuits making use of circuit quantum electrodynamics.
[1] T. Frey et al., arXiv:1108.5378v1 (2011)

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