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Phonon-Mediated Population Inversion in a Driven Double Quantum Dot[1] XANTHE CROOT, JAMES COLLESS, ANDREW DOHERTY, ARC Centre of Excellence for Engineered Quantum Systems, School of Physics, The University of Sydney, Sydney, NSW 2006, Australia, TOM STACE, ARC Centre of Excellence for Engineered Quantum Systems, School of Mathematics and Physics, University of Queensland, Brisbane, QLD 4072, Australia., SEAN BARRETT, Blackett Laboratory and Institute for Mathematical Sciences, Imperial College London, London SW7 2PG, United Kingdom, HONG LU, ART GOSSARD, Materials Department, University of California, Santa Barbara, California 93106, USA., DAVID REILLY, ARC Centre of Excellence for Engineered Quantum Systems, School of Physics, The University of Sydney, Sydney, NSW 2006, Australia
— We examine phonon emission processes in a double quantum dot, configured as either a single or two-electron charge qubit and driven with resonant microwave excitation. Fast readout using a proximal rf quantum point contact (rf-QPC) enables charge sensing with high resolution and allows fine phonon-related features to be observed in microwave spectroscopy data. Spontaneous phonon emission is observed to produce level broadening and population inversion of a two-level system, a phenomena predicted theoretically but previously unreported. For the two-electron configuration, microwave transitions are shown to be spin-dependent, consistent with the well-understood mechanism of Pauli-blockade in double quantum dots.

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