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Development of Low-Temperature Scanning Capacitance Microscopy for Measurement of Single Quantum Dots[1] GUANGLEI CHENG, Department of Physics and Astronomy, University of Pittsburgh, JEREMY LEVY, Department of Physics and Astronomy, University of Pittsburgh, GILBERTO MEDEIROS-RIBEIRO, Laboratorio Nacional de Luz Sincrotron, COSMQC COLLABORATION[2] — Self-assembled single quantum dots are widely considered to be leading candidates for spin-based quantum bits. The characterization of such systems requires local information about both charge and spin degrees of freedom as a function of temperature and magnetic field. We describe an extension of a working low-temperature AFM/optical microscope to enable scanning capacitance measurements of quantum dots. Our system relies on the sensitivity of a microwave resonator to perturbations from the scanning probe (similar to RCA's CED technology), using a quartz tuning fork with an etched tungsten tip. The expected sensitivity of the instrument (10^{-21} F) is much below the capacitance of a single self-assembled quantum dot (10^{-18} F). To measure the capacitance, we first use the AFM to locate a single quantum dot, and then collect local C-V information using the measured frequency shift of the resonator.

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[2]Center for Oxide Semiconductor Materials for Quantum Computation

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