

Abstract Submitted
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Undoped Heterostructure Materials for SiGe Quantum Devices

R.S. ROSS, M.G. BORSELLI, B. HUANG, K.S. HOLABIRD, T.M. HAZARD, A.A. KISELEV, P.W. DEELMAN, I. ALVARADO-RODRIGUEZ, A.E. SCHMITZ, M. SOKOLICH, A.T. HUNTER, M.F. GYURE, HRL Laboratories LLC, 3011 Malibu Canyon Road, Malibu CA 90265 — Quantum well heterostructures, widely used for the fabrication of quantum dots and related devices, typically make use of modulation doping. Removal of the dopants, by use of globally “field-gated” and/or back-gated heterostructure designs, eliminates the dominant sources of scattering, charge noise and instability in devices intended for low-temperature operation. In this talk we present recent progress in designing and fabricating undoped quantum well heterostructures in sSi/SiGe. A combination of simulation based modeling and experimental work has enabled us to successfully engineer materials for stable and quiet quantum dot operation. Specific topics to be presented include the important role of substrate and buffer layer background doping, concurrent MOS accumulation, leakage to front and back gates via barrier tunneling, and the expected range of electric fields that determine valley mixing in quantum dots. Sponsored by United States Department of Defense. Approved for Public Release, Distribution Unlimited.

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