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**Large Tunable Valley Splitting in a Si/SiGe Quantum Point Contact**[1] LISA MCGUIRE, K.A. SLINKER, MARK FRIESEN, SRIJIT GOSWAMI, O.J. CHU, ROBERT JOYNT, S.N. COPPERSMITH, MARK A. ERIKSSON, University of Wisconsin-Madison — Quantum dots formed in Si/SiGe two-dimensional electron gases are of interest for use in semiconductor quantum computing due to their potentially long spin lifetimes. However, silicon has a near degeneracy in orbital states due to the presence of multiple valley minima. If the splitting between valley states is smaller than the spin splitting, decoherence rates will be enhanced, complicating qubit operation. Here we present measurements of the valley spitting in a quantum point contact (QPC). The valley splitting is shown to be large, of order 0.5 - 2 meV, over the entire measured range in gate voltage and magnetic field. These results are in contrast with numerous past measurements of valley splitting in laterally unconfined Si/SiGe systems, such as Hall bars. We discuss a physical mechanism, based on interference between states on neighboring atomic steps at the quantum well interface, that explains the discrepancy between the experiments on laterally confined and laterally unconfined systems. We find, in all cases, the magnitude of the valley splitting is suppressed due to atomic steps, but this suppression is substantially lifted in laterally confined nanostructures like QPCs. Work supported by ARO, NSA, and NSF.

[1] S. Goswami et al., to appear in Nature Physics, cond-mat/0611221

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