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Re-entrant Negative Coulomb Drag in a 1D Quantum Circuit

DOMINIQUE LAROCHE, GUILLAUME GERVAIS, McGill University, MIKE P. LILLY, JOHN L. RENO, Sandia National Laboratories — We report Coulomb drag measurements between tunable vertically- coupled quantum wires. The wires are fabricated in a GaAs/AlGaAs double quantum well heterostructure with a 15 nm barrier separating the quantum wells and are non-ballistic. The Coulomb drag signal is mapped out versus the number of subbands occupied in each wire, and regions of both positive and negative drag are observed. Negative Coulomb drag signals are measured in two regimes: one at low electronic density when the drag wire is close to or beyond depletion, and one at higher electronic density when the drag wire has more than a single 1D subband occupied. A discussion of the negative drag signal in terms of electron-hole asymmetry and localization is presented. Sandia National Laboratories is a multi-program laboratory managed and operated by Sandia Corporation, a wholly owned subsidiary of Lockheed Martin Corporation, for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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