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Single electron tunneling in a controllable electromagnetic environment Z. JI, Rice University, W. XUE, A.J. RIMBERG, Dartmouth College, L.N. PFEIFFER, K.W. WEST, Bell Laboratories — Real-time counting of single electrons is the most fundamental means of measuring current [1]. Direct observation of single electron tunneling oscillations requires embedding a tunnel barrier in a high-impedance electromagnetic environment. Beginning with a two dimensional electron gas in a GaAs heterostructure we first etch a narrow mesa to serve as a conducting channel. We fabricate two staggered arrays of quantum point contacts (QPCs) across the mesa to serve as ballistic resistors controlled by tuning the QPC gate voltage. An additional QPC placed between the arrays serves as the tunnel barrier and a nearby radio-frequency single electron transistor (RF-SET) serves as an electrometer. We have fabricated several such samples. Typically the conductance G versus gate voltage of such an array of 10 QPCs shows plateau-like structures at fractions of the conductance quantum, $G_0 = 2e^2/h$. The first plateau, below which the conductance drops rapidly to zero, is the preferred working point corresponding to one open channel in each QPC. When the arrays are at their working points and the central barrier is formed, the samples show a large gap in their I-V characteristics corresponding to dynamical Coulomb blockade. Recent measurements of such samples will be presented, and the use of the RF-SET to directly observe single electron tunneling will be discussed. [1] J. Bylander, T. Duty and P. Delsing, Nature **434**, 361 (2005).

Z. Ji
Department of Physics and Astronomy, Rice University

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