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Nanomechanical Shuttling of Electrons E. M. WEIG, D. R. KOENIG, J. P. KOTTHAUS, Center for NanoScience & Department of Physics, Ludwig-Maximilians University Munich, Germany — A nanoscale metal island that is oscillating between two opposing electrodes on a vibrating string can be used to mechanically actuate an electic current. We have realized such an electron shuttle on a doubly clamped high Q silicon nitride beam subject to high tensile strain. The shuttle is operated acoustically which guarantees complete decoupling of the measured signal from the drive at arbitrary source drain voltages. We have investigated the shuttling current across the island as a function of the applied voltage bias under resonant actuation. Since the tunnel resistance increases exponentially with distance, charge transfer between the island and an electrode only occurs at the turning points of the shuttle motion. Therefore transport across the island is strictly sequential, so that the shuttle can be theoretically described using a single electron box model during contact time. We have observed excellent agreement between our measured data and theoretical calculations which suggests that a crossover to the Coulomb blockade regime should be observed for smaller sample dimensions and lower temperatures.

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