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Transport studies and potential fluctuations in mesoscopic-scale $SmTiO_3/SrTiO_3/SmTiO_3$ quantum wells WILL HARDY, Applied Physics Graduate Program, Smalley-Curl Institute, Rice University, PANPAN ZHOU, Department of Physics and Astronomy, Rice University, BRANDON ISAAC, PATRICK MARSHALL, EVGENY MIKHEEV, SUSANNE STEMMER, Materials Department, University of California, Santa Barbara, DOUGLAS NATELSON, Department of Physics and Astronomy, Rice University — Heterointerfaces of rare earth titanates comprise an intriguing family of systems with coexisting and competing physical orders. Some examples, such as $LaAlO_3/SrTiO_3$, support high carrier density quantum wells whose electronic properties are determined by lattice distortions, spin-orbit coupling, defects, and various regimes of magnetic and charge ordering. Here, we study electronic transport in mesoscale heterostructure devices of $SrTiO_3$ sandwiched between layers of $SmTiO_3$, in which the transport properties can be tuned from a regime of Fermi-liquid like resistivity ($\rho \propto T^2$) to a non-Fermi liquid ($\rho \propto T^{5/3}$) by controlling the STO thickness. Unexpected, large, time-dependent surface potential fluctuations ramp up below 10 K, and are apparently independent of the drive current and contact spacing distance but suppressed with increasing contact size. Magnetoresistance fluctuations are also observed, which are reminiscent of universal conductance fluctuations but not entirely in agreement with their conventional form. Candidate interpretations of the underlying mechanism are discussed in terms of a fluctuating Seebeck coefficient, and in the context of a material system that has a low-T pseudogap and is not necessarily a Fermi liquid.

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