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Sketched Oxide Single-Electron Transistor[1] JEREMY LEVY, GUANGLEI CHENG, JOSH VEAZEY, PATRICK IRVIN, MENGCHEN HUANG, Department of Physics and Astronomy, University of Pittsburgh, CHUNG-WUNG BARK, SANGWOO RYU, CHANG-BEOM EOM, Department of Materials Science and Engineering, University of Wisconsin-Madison — Devices that confine and process single electrons represent an important scaling limit of electronics. Such devices have been realized in a variety of materials and exhibit remarkable electronic, optical and spintronic properties. Here, we use an atomic force microscope tip to reversibly "sketch" single-electron transistors by controlling a metal-insulator transition at the interface of two oxides.[2] In these devices, single electrons tunnel resonantly between source and drain electrodes through a conducting oxide island with a diameter of ∼1.5 nm. We demonstrate control over the number of electrons on the island using bottom- and side-gate electrodes, and observe hysteresis in electron occupation that is attributed to ferroelectricity within the oxide heterostructure. These single-electron devices may find use as ultradense non-volatile memories, nanoscale hybrid piezoelectric and charge sensors, as well as building blocks in quantum information processing and simulation platforms.

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[2]Cheng *et al.*, Nature Nanotechnology **6**, 343 (2011).

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