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Sketched ferroelectric single-electron transistor[1] GUANGLEI CHENG, U. of Pittsburgh, PABLO SILES, Laboratório Nacional de Luz Síncrotron, Brazil, FENG BI, CHENG CEN, DANIELA BOGORIN, U. of Pittsburgh, CHUNG WUNG BARK, CHAD FOLKMAN, JAE-WAN PARK, CHANG-BEOM EOM, U. of Wisconsin-madison, GILBERTO MEDEIROS-RIBEIRO, HP labs, JEREMY LEVY, U. of Pittsburgh — Oxide heterostructures formed from ultrathin layers of $LaAlO_3$ grown on TiO_2-terminated $SrTiO_3$, combined with a reversible nanoscale patterning technique, provide a versatile platform for nanoscale control at the single-electron limit. Here we demonstrate the creation and characterization of "sketched" single-electron transistors made from ultrasmall (1-2 nm) quantum dots. Shell filling from N=0 up to N=2 electrons by single-electron tunneling is observed. Resonant tunneling can be controlled in a deterministic and non-volatile fashion by altering the ferroelectric polarization within the $SrTiO_3$ tunnel barrier. These single-electron devices may find use as nanoscale hybrid piezoelectric/charge sensors, and as elemental building blocks for solid-state quantum computation and quantum simulation platforms.

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