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Electric field effects in graphene-complex-oxide heterostructures[1]
GIRIRAJ JNAWALI, MENGCHEN HUANG, JEN-FENG HSU, FENG BI, LU CHEN, RONGPU ZHOU, Department of Physics and Astronomy, University of Pittsburgh, HYUNGWOO LEE, SANGWOO RYU, CHANG-BEOM EOM, Materials Science and Engineering, University of Wisconsin-Madison, PATRICK IRVIN, BRIAN D'URSO, JEREMY LEVY, Department of Physics and Astronomy, University of Pittsburgh — Graphene has excellent electrical, chemical, and mechanical properties, which makes it a promising material for developing nanoscale electronic devices, while complex-oxide heterostructure provide sharply confined multifunctional interfaces that can be tailored at nanoscale dimensions. The combination–graphene-complex oxide heterostructures–merge the multifunctional properties of oxide interfaces such as high dielectric constant, metal-insulator-transition, magnetism, and superconductivity, with the unique electronic properties of graphene. Here we demonstrate some simple three-terminal field-effect devices that combine the electronic properties of these two systems. Nanoscale devices are fabricated from graphene/$LaAlO_3$/$SrTiO_3$ heterostructures using c-AFM lithography. We demonstrate field effects in both the graphene and $LaAlO_3$/$SrTiO_3$ interface. These novel heterostructures open new avenues for creating devices that combine the most interesting and unique properties of the coupled two-dimensional electron system.

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