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Anisotropic conductance at improper ferroelectric domain walls JAN SEIDEL, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA, DENNIS MEIER, Department of Physics, University of California, Berkeley, CA 94720, USA, ANDRES CANO, European Synchrotron Radiation Facility, 6 Rue Jules Horowitz, 38043 Grenoble, France, KRIS DELANEY, Materials Research Laboratory, University of California, Santa Barbara, CA 93106, USA, YU KUMAGAI, Department of Materials, ETH Zurich, Wolfgang-Pauli-Strasse, 8093 Zurich, Switzerland, MAXIM MOSTOVOY, Zernike Institute for Advanced Materials, University of Groningen, 9747 AG Groningen, The Netherlands, NICOLA SPALDIN, MANFRED FIEBIG, Department of Materials, ETH Zurich, Wolfgang-Pauli-Strasse, 8093 Zurich, Switzerland, RAMAMOORTHY RAMESH, Department of Materials Science and Engineering, University of California, Berkeley, CA 94720, USA —
Domain walls in ferroelectric oxides hold great potential for the development of new device paradigms in oxide nanoelectronics due to their field-tunable functionality. They are also of fundamental interest for studies of ferroic and low-dimensional systems physics. We investigate the electronic conductance of ferroelectric domain walls in the improper ferroelectric ErMnO3. We show that the conductance is a continuously tunable function of the domain wall orientation, with a range of an order of magnitude. We explain the observed behavior using first-principles density functional and phenomenological theories, and relate it to the extraordinary stability of the inherent head-to-head and tail-to-tail domain walls in hexagonal manganites, which is a direct consequence of the improper ferroelectric character of these materials.

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