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Unit-Cell-Thick Domains in Quasi-2D Ferroelectric Material

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Many electronic devices, like non-volatile high-density memories, ultra-fast switches, and thin film capacitors, rely on ferroelectric materials—a class of materials with spontaneous electrical polarization which can be reproducibly switched. In two-dimensional (2D) and quasi-2D ferroelectric materials the size of ferroelectric domains can be small which may enable the miniaturization of devices. Understanding of ferroelectric domain structure at the atomic scale is, however, limited, hindering the development of functional device units at the microscopic level.

Here, CBNO (cesium bismuth niobate $CsBiNb_2O_7$)—a layered oxide that has been predicted to be ferroelectric with a high Curie temperature and large in-plane polarization—is employed as a model system to study its ferroelectric domain structure at the atomic scale **in PARADIM's electron microscopy user facility**. By aberration-corrected scanning transmission electron microscopy, which allows precise tracking of atomic positions, the user from RPI revealed the existence of ferroelectric domains that are just one unit-cell-thick and 180° domain walls with an abrupt change in polarization direction in free-standing CBNO. The work might inspire new design concepts for ferroelectric devices demanding unit-cell-thick domain structures.

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