Two-state lattice for one-state field coupled elastic and electric

SEED

Multiferroic materials combine multiple electric, elastic and magnetic properties within the same material, often a complex oxide. These ambidextrous materials can show novel couplings between electric polarization, elastic distortion, and magnet domains: for example, electric fields could modulate magnetic properties or elastic distortions could control both magnetism and electric fields.

In ferroelectrics, the electric polarization is coupled to the lattice strain, and a stable distortion of the crystal lattice can create electric fields. MRSEC researchers have shown that SrTiO$_3$, which is not a ferroelectric in bulk form, can be made ferroelectric by stretching the lattice through growth as a thin film. Not only does this strain generate ferroelectricity, it also induces multiferricity: the material is not only ferroelectric, but also ferroelastic, meaning that the lattice and the electric polarization can form independent distortions. Unlike in other ferroelectrics, the ferroelectric polarization and the antiferroelastic rotation of oxygen cages are independent, with two independent phase transitions and a coupled domain structure dynamics.