Magnetoelectric coupling and switching in layered perovskites

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The rational discovery of new materials displaying novel properties is a fundamental challenge. Due to their highly tunable ground states, structurally and chemically complex oxides are a promising class of materials in which to realize new emergent phenomena that could not only defy our current understanding of condensed matter but also provide real solutions for technological advances. In this talk I will discuss examples of our work on the first-principles based rational design of novel ferroic complex oxide materials. In particular I will present our recent work on tuning the behavior of layered perovskites. In one case I will focus on the role played by strain and dimensionality to the emergence of ferroelectricity. In a second system, I will discuss the interplay between functional rotation/tilt modes and magnetism in a magnetic ferroelectric and how – by controlling their behavior with epitaxial strain – one can realize a crossover from an magnetoeletric ground state to one where a ferroelectric distortion induces weak ferromagnetism, opening the possibility of electric-field switching of magnetism.