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Improper ferroelectricity in perovskite oxide artificial superlattices MATTHEW DAWBER[1], NICOLAS STUCKI, CELINE LICHTENSTEIGER, JEAN-MARC TRISCONE, DPMC, University of Geneva, Switzerland, ERIC BOUSQUET, PATRICK HERMET, PHILIPPE GHOSEZ, Physique Theorique des Materiaux, Universite de Liege, Belgium — In paraelectric/ferroelectric heterostructures with thick constituent layers electrostatics is the dominant interaction between layers and we have previously demonstrated that the key ferroelectric parameters, polarization and critical temperature can be tuned over a very large range in $PbTiO_3/SrTiO_3$ superlattices by varying the ratio of the layer thicknesses [1]. However, as the layers become thinner, a departure from the electrostatic model is observed, which manifests itself as an unusually high ferroelectric polarization and transition temperature and a high, but temperature independent, dielectric constant. Detailed examination of the phase transitions with temperature reveal that along with these enhanced characteristics there is a fundamental change in the nature of the ferroelectricity. The microscopic origin of this change, a form of improper ferroelectricity, is revealed by first principles calculations to occur through a coupling of oxygen rotations and the polarization mode at the interfaces in the material.
[1] M. Dawber et al., Adv. Mat. (2007)

[1]Now at: Physics and Astronomy, SUNY Stony Brook, USA

Matthew Dawber
DPMC, University of Geneva, 24 Quai E.-Ansermet 1211 Geneva 4, Switzerland

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