# Mapping the Phase Diagram of Multiferroic BiFeO3-LaFeO3 Superlattices

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Interfaces in oxides, like those introduced in epitaxial superlattices, provide pathways to novel functional behaviour such as electronic transport properties or coupling between different order parameters, all at a very localized scale. Here we report on such interfaces, focusing in particular on the role of electrostatic and strain boundary conditions.

We explore the complex phase diagram of epitaxial BiFeO3/LaFeO3 superlattices [1] grown on (001) SrTiO3 and (110) DyScO3 substrates, presenting three distinct regions as a function of BiFeO3 fraction, with a BiFeO3-like ferroelectric phase and a LaFeO3-like paraelectric phase at its extremities, and a complex intermediate region, as supported by first principles calculations. The intermediate region shows unusual, mixed functional behaviour, most likely due to competing phases driven by substitution with a same-size central ion and the specific boundary conditions imposed by the superlattice structure, with much more diffuse transitions observed for the samples grown on SrTiO3. With high resolution synchrotron diffraction measurements, we show the coexistence/competition of three different superstructures in this region, a possible structural bridge between the BiFeO3 and LaFeO3 structures at the extrema of the phase diagram.

1. Rispens et al, Phys. Rev. B. 90, 104106 (2014)