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Epitaxial strain induced atomic ordering in stoichiometric $LaCoO_3$ thin films WOO SEOK CHOI, Sungkyunkwan University, JI-HWAN KWON, Seoul National University, HYOUNGJEEN JEEN, Oak Ridge National Laboratory, GEORGE A. SAWATZKY, University of British Columbia, VLADIMIR HINKOV, Max Planck-UBC Centre for Quantum Materials, MIYOUNG KIM, Seoul National University, HO NYUNG LEE, Oak Ridge National Laboratory — Heteroepitaxial strain imposed in complex transition metal oxide thin films is recognized as an effective tool for identifying and controlling emergent physical phenomena. Stoichiometric $LaCoO_3$ is particularly interesting, since the thin film form of the material exhibits a robust macroscopic ferromagnetic ordering, while the bulk form of the material is a zero spin, nonmagnetic insulator. In this work, we show that the ferromagnetic ordering observed in $LaCoO_3$ thin films is related to a lattice modulation in the atomic scale, originating from the epitaxial strain. The possibility of oxygen vacancies have been carefully ruled out using various macroscopic and microscopic spectroscopic techniques, and an unconventional strain relaxation behavior identified by strip-like lattice modulation pattern was responsible for the non-zero spin ground state of Co^{3+} ions [1,2]. We further note that the unconventional strain relaxation did not involve any uncontrolled misfit dislocations.

[1] W. S. Choi *et al.*, *Nano Lett.* **12**, 4966 (2012).
[2] J.-H. Kwon *et al.*, *Chem. Mater.* **26**, 2496 (2014).

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