Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information for

Interlayer coupling and thus induced distinct spin texture for the $[LaCoO_3/LaMnO_3]_5$ superlattices

*Jing Zhang, Hongrui Zhang, Xuejing Zhang, Xiangxiang Guan, Xi Shen, Deshun Hong, Hui Zhang, Banggui Liu, Richeng Yu, Baogen Shen, and Jirong Sun**

Beijing National Laboratory for Condensed Matter & Institute of Physics, Chinese Academy of Sciences, Beijing 100190, Peoples' Republic of China

E-mail: jrsun@iphy.ac.cn

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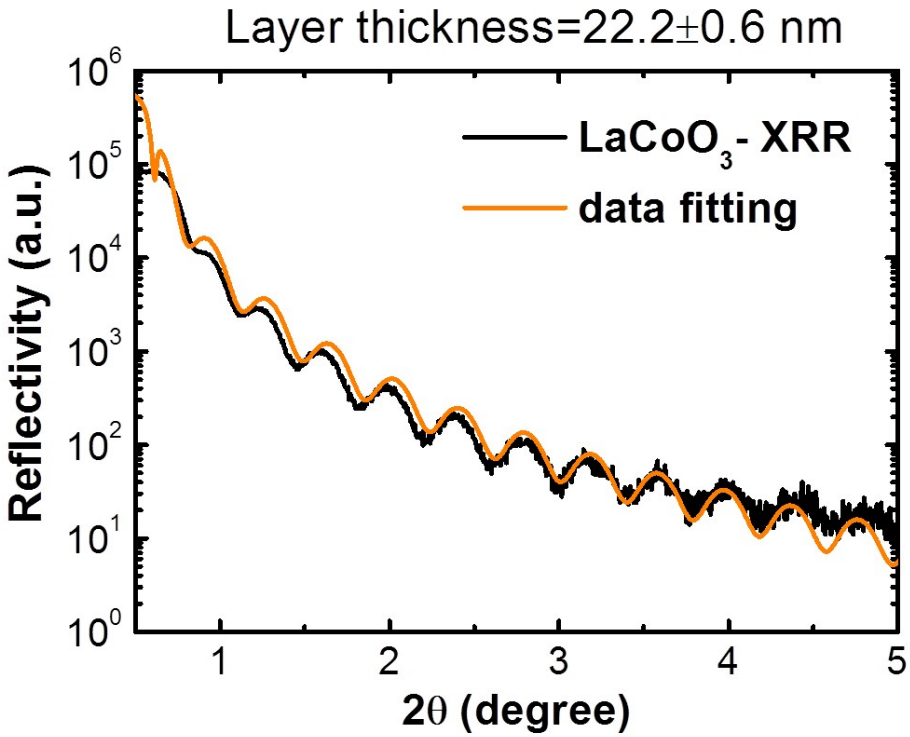

Figure S1 Small angle x-ray reflectivity of the LCO single layer and the corresponding results of data fitting that gives layer thickness.

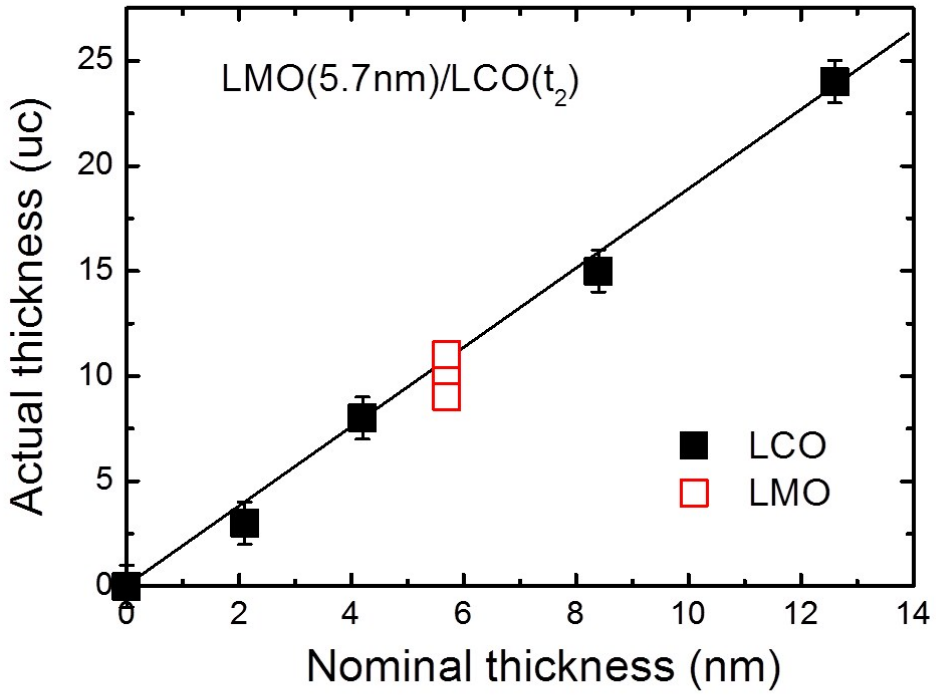

Figure S2 A conversion relationship between nominal and actual layer thickness obtained by directly counting cell numbers in HAADF images of the SLs on STO. Solid lines are guides for the eye.

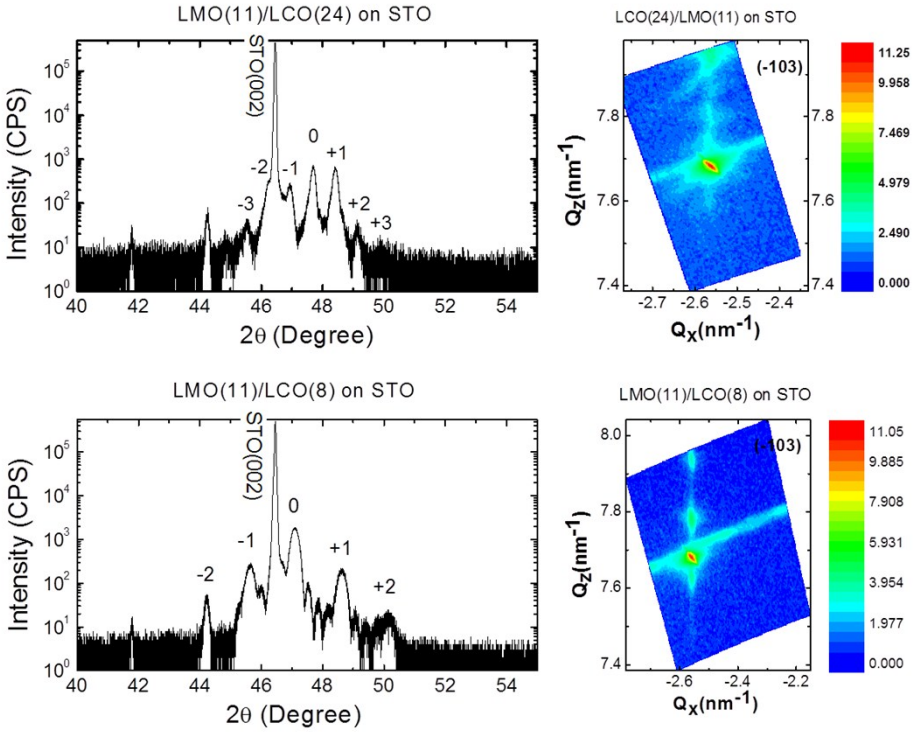

Figure S3 (Left panel) X-ray diffraction spectra (left panel) for superlattice samples marked in the figure. Satellite peaks corresponding to superlattice structure (marked by numbers) can be clearly seen. (Right panel) The reciprocal space mapping (RSM) for the (-103) reflection.

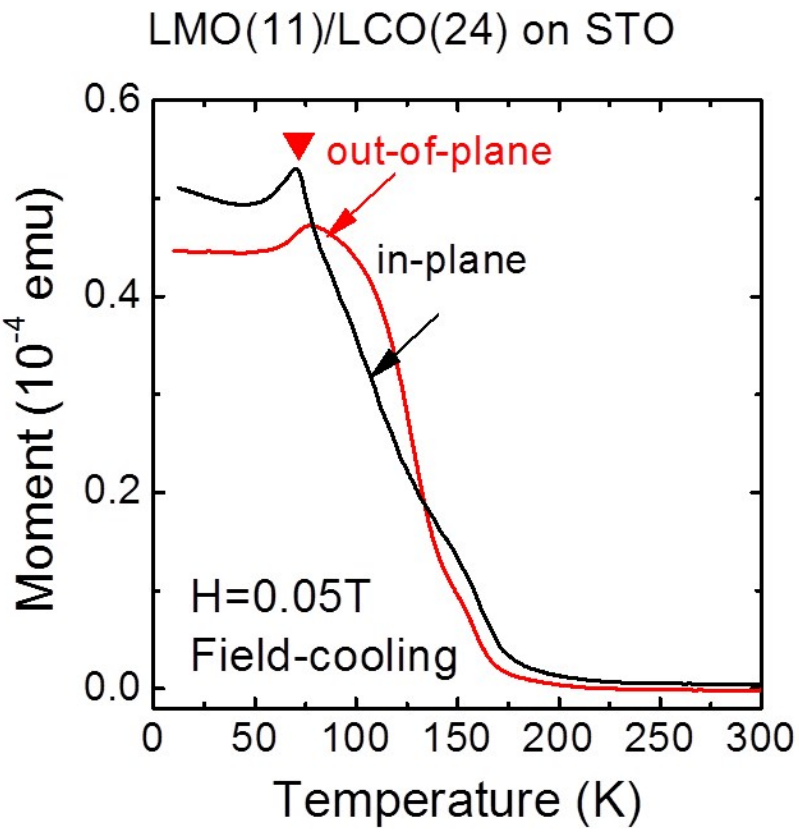

Figure S4 Temperature dependence of the magnetization of $[LMO(11)/LCO(24)]_5/STO$, measured with an in-plane (black curve) or out-of-plane (red curve) field of 0.05 T. Antiferromagnetic phase transition was observed in both cases, as marked by a triangle.

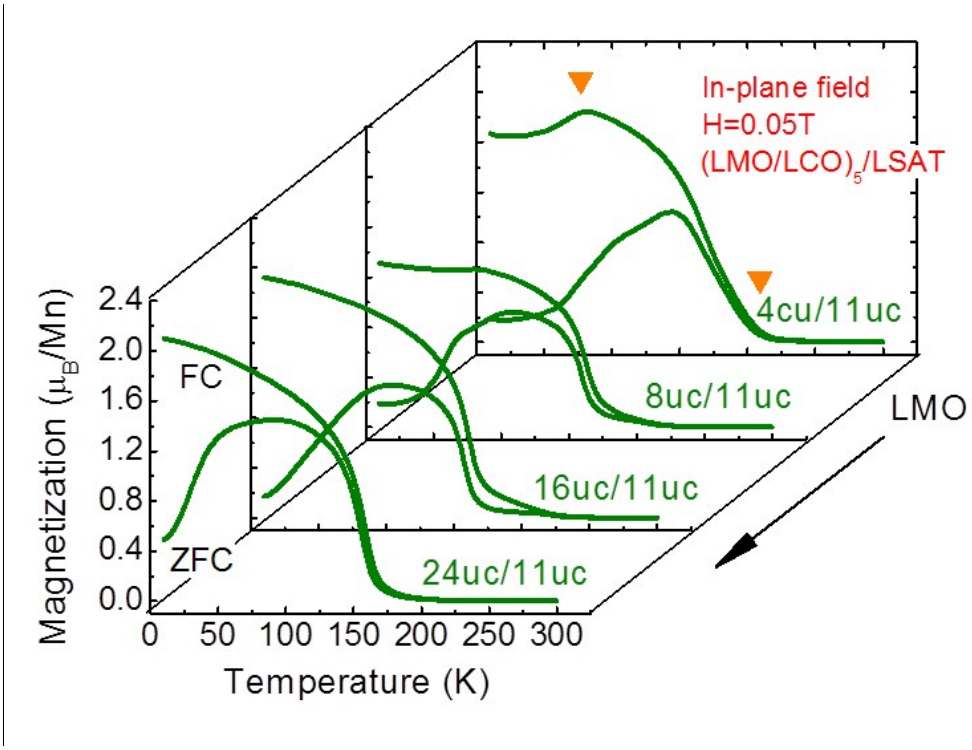

Figure S5 Temperature dependence of the magnetization of [LMO(t_1)/LCO(11)]$_5$/LSAT for the t_1 varying from 4 to 24 uc, measured under an in-plane field of 0.05 T. Magnetic transitions were marked by red triangles. With the increase of the layer thickness of LMO, the low temperature phase transition disappears. Orange triangles here mark the temperatures for magnetic transitions. Here the layer thickness similar to that on STO was adopted without affecting the general relation between magnetization and layer thickness.

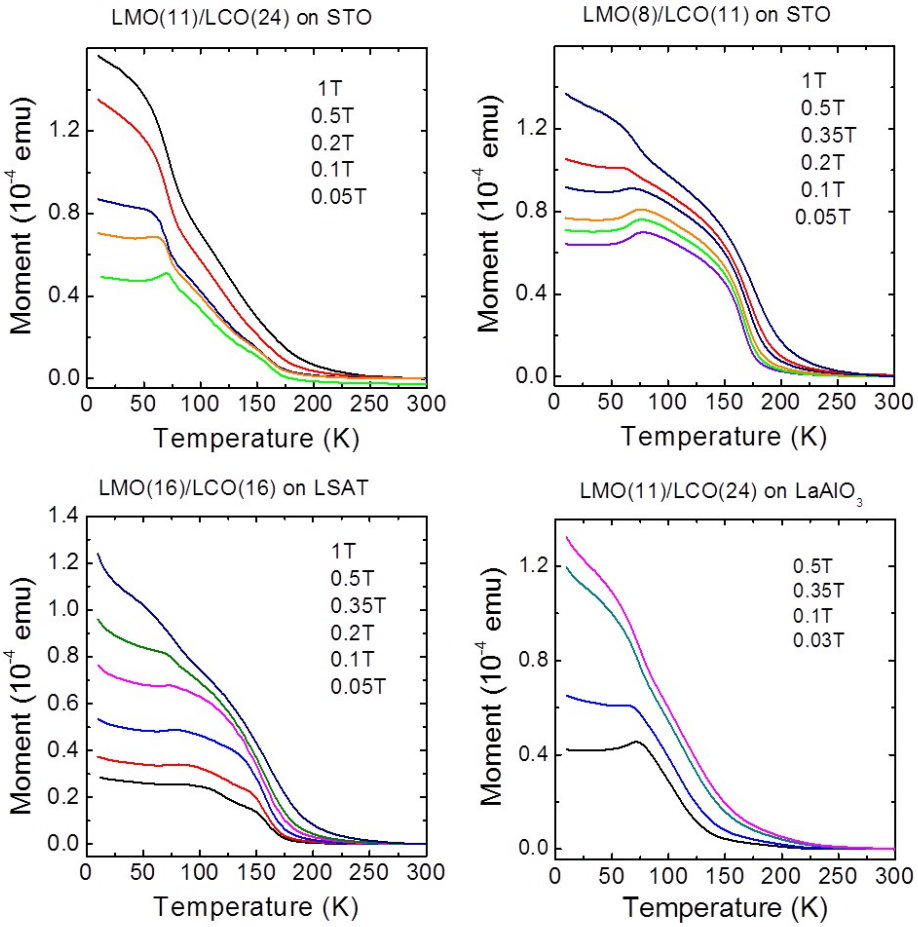

Figure S6 Thermomagnetic curves of the superlattices marked in the figures, measured under different in-plane fields in the field-cooling mode. The magnetic reversion from decrease to increase with increased field can be clearly seen corresponding to the low temperature transitions for the SLs not only on STO but also on LSAT. Data for the SLs grown on $LaAlO_3$ were also presented, showing essentially the same behaviors as those of the former two kinds of SLs. This result indicates that lattice strains are not necessary for the anomalous magnetic behaviors observed here. Here the layer thickness similar to that on STO was adopted without affecting the general relation between magnetization and layer thickness.

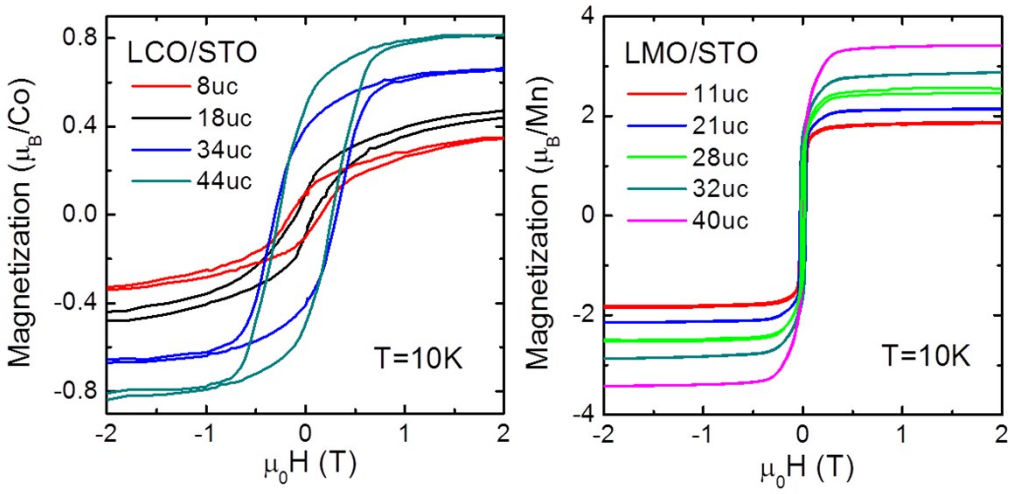

Figure S7 Magnetizations of the LCO and LMO single layers on STO, measured at 10 K as functions of magnetic field.