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Control of magnetism by tuning interfacial octahedral rotations in atomic-layer superlattices XIAOFANG ZHAI, LONG CHENG, University of Science and Technology of China, YANG LIU, CHRISTIAN SCHLEPUTZ, Argonne National Lab, HUI LI, XIAOQIANG ZHANG, University of Science and Technology of China, SHENGQI CHU, LIRONG ZHENG, JING ZHANG, Beijing Synchrotron Radiation Facility, AIDI ZHAO, University of Science and Technology of China, HAWOONG HONG, ANAND BHATTACHARYA, Argonne National Lab, JAMES ECKSTEIN, University of Illinois at Urbana-Champaign, CHANGGAN ZENG, University of Science and Technology of China — It was recently predicted that structural reconstructions caused by discontinuities in the oxygen octahedral rotation (OOR) patterns at complex oxides interfaces are capable of shaping interface magnetic properties. However, experimental evidences for this interrelation are scarce. By combining state-of-the-art laser molecular-beam-epitaxy and synchrotron X-ray diffraction techniques, we demonstrate that interfacial OOR are closely linked to the strongly modified ferromagnetism (FM) in (LaMnO3plusd)N/(SrTiO3)N superlattices. The maximized FM moment in the N=6 superlattice is accompanied by charge-transfer and a metastable structure (Imcm) featuring minimal octahedral rotations. Quenched FM for N smaller than 4 superlattices is attributed to a substantially enhanced c-axis octahedral rotation (about 8 deg), a phenomenon that has been predicted theoretically but never observed experimentally. Our study demonstrates that engineering superlattices with controllable interfacial structures may be a new route in realizing functional magnetic materials.

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