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**Controlled lateral anisotropy in correlated manganite heterostructures by interface-engineered oxygen octahedral coupling**

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Ultimate miniaturization of magnetic random access memory (MRAM) devices is expected by the utilization of spin-transfer torques, because they present an efficient means to switch elements with a very high magnetic anisotropy. To overcome the low switching speed in current collinearly magnetized devices, new routes are being explored to realize magnetic tunnel junction stacks with non-collinear magnetization between two magnetic electrodes. Controlled in-plane rotation of the magnetic easy axis in manganite heterostructures by tailoring the interface oxygen network would provide a promising direction for non-collinear magnetization in correlated oxide magnetic tunneling junctions. Here, we demonstrate how to manipulate magnetic and electronic anisotropic properties in manganite heterostructures by engineering the oxygen network on the unit-cell level. The strong oxygen octahedral coupling is found to transfer the octahedral rotation, present in the NdGaO<sub>3</sub> (NGO) substrate, to the La<sub>2/3</sub>Sr<sub>1/3</sub>MnO<sub>3</sub> (LSMO) film in the interface region. This causes an unexpected realignment of the magnetic easy axis along the short axis of the LSMO unit cell as well as the presence of a giant anisotropic transport in these ultrathin LSMO films. As a result we possess control of the lateral magnetic and electronic anisotropies by atomic scale design of the oxygen octahedral rotation.

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