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Spin State Control using Oxide Interfaces in $LaCoO_3$-based Heterostructures SANGJAE LEE, ANKIT DISA, FREDERICK WALKER, CHARLES AHN, Yale Univ — The flexibility of the spin degree of freedom of the Co 3d orbitals in $LaCoO_3$ suggests that they can be changed through careful design of oxide heterostructures. Interfacial coupling and dimensional confinement can be used to control the magnetic exchange, crystal fields, and Hund's coupling, through orbital and charge reconstructions. These parameters control the balance between multiple spin configurations, thereby modifying the magnetic ordering of $LaCoO_3$. We study $(LaCoO_3)_m/(LaTiO_3)_2$ heterostructures grown by molecular beam epitaxy, which allow interfacial charge transfer from Ti to Co, in addition to structural and dimensional constraints. The electronic polarization at the interface and consequent structural distortions suppress the ferromagnetism in the $LaCoO_3$ layers. This effect extends well beyond the interface, with ferromagnetic order absent up to $LaCoO_3$ layer thickness of m=10. We compare the properties of the $LaCoO_3/LaTiO_3$ heterostructures with $LaCoO_3/SrTiO_3$, to untangle how charge transfer and structural modifications control the spin and magnetic configuration in cobaltates.

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