

Interplay between superconductivity and magnetism in $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ / $\text{La}_{0.67}\text{Ca}_{0.33}\text{MnO}_3$ heterostructures

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We studied the interplay between superconductivity and magnetism in $\text{La}_{2-x}\text{Sr}_x\text{CuO}_4$ (LSCO)/ $\text{La}_{0.67}\text{Ca}_{0.33}\text{MnO}_3$ (LCMO) superlattices (SLs). By varying the Sr content and thus the hole doping in the cuprate layers, three SLs ($x=0.0, 0.15, 0.30$) have been prepared using pulsed laser deposition. Upon Sr doping, the cuprate layers evolve from the insulating parent compound with an AF order of the Cu moments at $x=0$, over the high temperature superconducting state at $x=0.15$, to a metallic state where superconductivity is suppressed again at $x=0.3$. The quality of the samples has been characterized by in-situ Reflection high-energy electron diffraction and X-ray diffraction techniques. The polarized neutron reflectometry on these SLs reveals the existence of a so-called depleted layer with a strongly suppressed ferromagnetic Mn moment on the LCMO side of the interface with a thickness of about 10 Å. On the other hand, with X-ray magnetic circular dichroism measurements we observed an induced Cu moment on the LSCO side of the interface. With X-ray magnetic linear dichroism measurements we also observed the signature of an orbital reconstruction effect of the Cu states at the interfaces of these superlattices.

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