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Doping evolution and polar surface reconstruction of the infinite-layer cuprate $Sr_{1-x}La_xCuO_2$ JOHN HARTER, Department of Physics, Cornell University, LUIGI MARITATO, DARRELL SCHLOM, Department of Materials Science and Engineering, Cornell University, KYLE SHEN, Department of Physics, Cornell University — We use angle-resolved photoemission spectroscopy to study the doping evolution of infinite-layer $Sr_{1-x}La_xCuO_2$ thin films grown by molecular-beam epitaxy. At low doping, the material exhibits a dispersive lower Hubbard band typical of the superconducting cuprate parent compounds. Electron diffraction probes reveal a $p(2 \times 2)$ reconstruction of the surface. Using a number of simple assumptions, we develop a model of this reconstruction based on the polar nature of the infinite-layer material. As carriers are added to the system, a continuous evolution from Mott insulator to superconducting metal is observed as a coherent low-energy band develops with a concomitant remnant lower Hubbard band, gradually filling in the Mott gap. This two-component spectral function emphasizes the important role that strong local electron correlations play in the electronic structure of $Sr_{1-x}La_xCuO_2$ even at relatively high doping levels. Finally, we confirm the theoretical prediction of a thickness-controlled transition in ultrathin films of $SrCuO_2$ grown on nonpolar $SrTiO_3$, highlighting the diverse structural changes that can occur in polar complex oxide thin films.

John Harter
Department of Physics, Cornell University

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