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Electron Correlation and Charge Transfer in $(Ba_{0.9}Nd_{0.1})CuO_{2+\delta}/(CaCuO_2)_2$ Superconducting Superlattices Observed with Resonant Inelastic X-ray Scattering BYRON FREELON, LBL — In-plane CuO_2 physics of the 2×2 high-Tc superlattice $(Ba_{0.9}Nd_{0.1}CuO_{2+x})_2/(CaCuO_2)_2$ was investigated by applying x-ray emission/absorption spectroscopy. The superlattices are fabricated by pulsed-laser molecular beam epitaxy (MBE) in a layer-by-layer fashion.[1] Thesuperlattices consist of two layers; an infinite layer (IL) and the charge reservoir (CR). Each insulating layer is alternately deposited to produce superlattices exhibiting a Tc of 80K.[2] We measure the O 1s density of states to be insulating for the component layers and metallic for the superlattice. Using resonant inelastic scattering (RIXS) we make the first direct observation of Zhang-Rice singlets in artificial high-temperature superconducting heteroepitaxial structures. Zhang-Rice singlet polarization dependent studies are performed, and the absorption and emission results are compared to local-density approximation theory. X-ray emission spectra of the superlattice and its component layers gives evidence of charge transport from the charge reservoir to the infinite layer. Cu-edge resonant x-ray emission is performed to probe *dd* excitations in the component layers and superlattice.

[1]G. Balestrino, S. Lavanga, P. G. Medaglia, P. Origiani, A. Paoletti, G. Pasquini, A. Tebano, and A. Tucciarone, Appl. Phys. Lett. **79**, 99 (2001).
[2]G. Balestrino, P. G. Medaglia, P. Origiana, A. Tebano, C. Aruta, S. Lavanga, and A. A. Varlamov, Phys. Rev. Lett. **89,** 156402 (2002).

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