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Electron Correlation and Charge Transfer in $(Ba_{0.9}Nd_{0.1})CuO_{2+\delta}/(CaCuO_2)_2$ Superconducting Superlattices BYRON FREELON, LBNL, ANDREAS AUGUSTSSON, JINGHUA GUO, PIER GIANNI MEDAGLIA, ANTONIO TEBANO, GIUSSEPPE BALSESTRINO — The mechanism of cuprate high-temperature superconductivity is still controversial. It is widely accepted that HTSC occurs primarily within CuO planes of cuprates, yet there is contention concerning the in-plane low-energy physics. Using 2×2 high-Tc superlattices (SL) $(Ba_{0.9}Nd_{0.1}CuO_{2+x})_2/(CaCuO_2)_2$, we probe the CuO_2 planes by applying x-ray emission/absorption spectroscopy. The pulsed-laser deposited SL consist of two separately insulating layers and exhibit a Tc of 80K. Superconductivity occurs exclusively within the infinite layer (IL) and not the charge reservoir (CR) of the SL. We demonstrate resonant x-ray emission and absorption to be insightful tools for studying the IL, CR and superlattice structures. We measure the O 1s density of state 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-Tc superconducting heteroepitaxial structures. A comparison of the x-ray emission spectra of the SL and its component layers gives evidence of charge transport from the so-called charge reservoir layer to the infinite layer.

Byron Freelon
LBNL

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