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Reduced dimensionality and pseudogap formation in $(LaMnO_3)_{2n}(SrMnO_3)_n$ superlattices ERIC MONKMAN, CAROLINA ADAMO, DANIEL SHAI, JOHN HARTER, DAWEI SHEN, BULAT BURGANOV, DARRELL SCHLOM, KYLE SHEN, Cornell University — $(LaMnO_3)_{2n}(SrMnO_3)_n$ superlattices, composed of the antiferromagnetic insulators $LaMnO_3$ (LMO) and $SrMnO_3$ (SMO), are ferromagnetic and metallic for n $<$ 3. By increasing the separation between LMO/SMO interfaces for n $\geq$ 3, the system goes through a transition from a metallic to insulating ground state whose origin remains unresolved. We present ARPES measurements of $LMO_{2n}SMO_n$ superlattices grown by MBE. The electronic structure of states near the Fermi level is similar to the random alloy $La_{2/3}Sr_{1/3}MnO_3$ for small n, but as n is increased we observe the formation of a more 2D state with a preferential occupation of $x^2 - y^2$ orbitals. As the system passes into the insulating state at n = 3, a pseudogap forms at the Fermi level: charge carriers are suppressed over a scale of hundreds of meV but without substantial changes to the overall bandstructure. This pseudogap begins to fill as the temperature is increased, but a large suppression in spectral weight at the Fermi level remains at room temperature. Our observations indicate that the insulating state for large-n superlattices is related to strong many-body effects within this system, enhanced by the reduced dimensionality of an interfacial two-dimensional electron liquid.

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