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Emergent properties of digital superlattices of $LaMnO_3/SrMnO_3$[1]

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$LaMnO_3$ and $SrMnO_3$, both antiferromagnetic insulators, are end members of the $La_{1-x}Sr_xMnO_3$ phase diagram, which includes a highly spin-polarized ferromagnetic metal and a variety of orbital-ordered antiferromagnets. Interfaces between $LaMnO_3$ and $SrMnO_3$ provide a unique environment where the spin, charge and orbital degrees of freedom of each of the constituents may 'reconstruct', giving rise to collective states at interfaces that are qualitatively distinct from those in either $LaMnO_3$ or $SrMnO_3$. We have synthesized superlattices of $(LaMnO_3)_p/(SrMnO_3)_q$, where $x = q/(p+q)$, using ozone-assisted molecular beam epitaxy. Here, p and $q$represent integer layers of the constituents. These superlattices can be realized with interfacial roughness/intermixing limited to a region less than one unit-cell in extent. We will explore the properties of these 'digital manganites' for a range of p/q, including enhanced ordering temperatures compared to randomly alloyed samples, and provide experimental evidence for the interfacial reconstruction that is responsible for their emergent properties.

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