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Modulation-doped ferromagnetism in digitally synthesized manganite superlattices T.S. SANTOS, CNM, Argonne National Lab, B. KIRBY, NCNR, NIST, S.J. MAY, MSD, ANL & Drexel U., B. MARANVILLE, NCNR, NIST, S. TE VELTHUIS, MSD, ANL, J. ZARESTKY, HFIR, ORNL, A. BHATTACHARYA, MSD & CNM, ANL — We have digitally synthesized ordered analogs of $La_{1-x}Sr_xMnO_3$ by interleaving single unit cell layers of $LaMnO_3$ and $SrMnO_3$ with atomic layer precision using ozone-assisted molecular beam epitaxy. In our neutron diffraction experiments on these epitaxial superlattices near $x = 0.5$, we confirmed the A-type antiferromagnetic spin structure with an enhanced ordering temperature. We found that in superlattices with composition at the ferromagnetic/antiferromagnetic phase boundary, inserting an additional single unit cell layer of $LaMnO_3$ causes a significant increase of the net magnetic moment while still retaining the A-type spin structure. Our polarized neutron reflectometry experiments revealed a highly modulated moment commensurate with the structural periodicity of the superlattice, with higher moment in the region of the extra $LaMnO_3$ layer. Thus, introducing a single La dopant layer results in a localized enhancement of double exchange along the c-axis and a canted moment in an otherwise antiferromagnetic structure. PNR analysis reveals the length scale over which these modulation-doped charges extend normal to the interfaces. Supported by DOE, Basic Energy Sciences, contract No. DE-AC02-06CH11357.

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