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Mesoscale spin domain formation and their correlations in quasi-1D $La_{0.67}Sr_{0.33}MnO_3$ nanowires[1] XIAOQIAN M. CHEN, NICK BRONN, NADYA MASON, PETER ABBAMONTE, Frederick Seitz Materials Research Laboratory, University of Illinois at Urbana-Champaign, JASON HOFFMAN, ANAND BHATTACHARYA, Argonne National Laboratory — Creating materials with nanoscale dimensions can introduce finite size and boundary effects, where the scale of the system boundaries near criticality becomes comparable to the correlation of competing orders in the material. To study these effects, we have fabricated arrays of quasi-1D nanowires from epitaxially grown $La_{0.67}Sr_{0.33}MnO_3$ (LSMO) thin films on $SrTiO_3$(STO) substrates. Our studies with resonant soft x-ray scattering (RSXS) reveal a non-trivial magnetic domain formation along different momentum directions in these wires. In addition, a new magnetic order was observed below 110K, likely induced by the STO structural transition. Below the Curie temperature we also observed a series of magnetic superlattice reflections, indicating collective mesoscale ordering of the magnetic moments into a pattern with a spatial period of five wires. Our calculations using dielectric susceptibility and Ising model simulations provide us an interpretation for the mechanism of domain formation and their long-range interaction through dipole coupling.

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