Emergent dimensional reduction in a model for manganites

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We present the results of unbiased Monte-Carlo simulations for a realistic model treating itinerant electrons coupled to localized spins in narrow-band manganites. We find that for doping fractions $x = 1/N$ ($N = 3, 4, 5\ldots$) and small Jahn-Teller coupling, the system supports 'striped' phases, where the spins in each stripe can be flipped without a physically relevant energy penalty. Consequently, the spins order only along one direction and remain disordered along the other, implying 'dimensional reduction' similar to the compass model discussed in quantum computing. The quasi-degeneracy of many states with different spin order is not related to any symmetry of the Hamiltonian, but is instead an emergent property of the low-energy states and appears to be linked to dispersionless states of the itinerant electron system. Various stripe patterns can be distinguished by their ferroelectric properties.
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9.7 cm

13.4 cm

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