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Tunable Percolative Transport in Manganite Thin Films using Strain and Exchange Fields[1]

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Strongly correlated electronic systems are often sensitively dependent on spin-charge-orbital-lattice interactions. We will discuss recent work on manganites that have led to some fascinating new discoveries on the role of these interactions in driving electronic phase separation in strongly correlated systems. We demonstrate that substrate induced anisotropic strain effects and surface exchange coupled magnetic nanodots can be used to preferentially seed electronic domains. These effects have led to a new understanding of how order parameter tuning can lead to highly controllable electronic and magnetic properties. We find that even strain frustrated ultrathin manganite films—where no metal-insulator transition is present—can be selectively tuned with the application of magnetic nanodots at the film surface. Both the magnetoresistance and the metal-insulator transition temperature can be tuned through dot density and dimension. The strain frustrated film's metal-insulator transition and magnetoresistivity can be driven to bulk levels. We expect these results to be applicable in many other systems in which order parameters are tightly correlated.

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