Complexity in Transition Metal Oxide

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Recent developments in the context of theory and experiments for transition metal oxides -- including the high-Tc cuprates and the colossal magnetoresistance manganites -- will be discussed. It will be argued that intrinsic inhomogeneities -- nanoscale phase separation -- is at the heart of the colossal magnetoresistance phenomenon. Inhomogeneities are also very important in the cuprates, and it will be argued that `colossal' effects can potentially occur in the glassy underdoped regime. Clustered or mixed-phase states could form a new paradigm for the understanding of compounds in condensed matter physics.

Some references by our group:
A. Moreo et al., Science **283**, 2034 (1999)
Elbio Dagotto, T. Hotta and A. Moreo, Physics Reports **344**,1 (2001);
Elbio Dagotto, *Nanoscale Phase Separation and Colossal Magnetoresistance*, Springer-Verlag, 2002
G. Alvarez et al., cond-mat/0401474.