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Superconducting Clusters and Colossal Effects in Underdoped Cuprates GONZALO ALVAREZ, Computer Science and Mathematics Division, Oak Ridge National Laboratory, MATTHIAS MAYR, Max-Planck-Institut für Festkörperforschung, ADRIANA MOREO, ELBIO DAGOTTO, University of Tennessee and ORNL — Phenomenological models for the antiferromagnetic vs. d-wave superconductivity competition in cuprates are studied[1] using conventional Monte Carlo techniques. The analysis suggests that cuprates may show a variety of different behaviors in the very underdoped regime: local coexistence, stripes, or, if disorder is present, states with nanoscale superconducting clusters. The transition from an antiferromagnetic to a superconducting state does not seem universal. In particular, inhomogeneous states lead to the possibility of colossal effects in some cuprates, analogous of those in manganites. Under suitable conditions, non-superconducting Cu-oxides could rapidly[2] become superconducting by the influence of weak perturbations that align the randomly oriented phases of the superconducting clusters in the mixed state. Consequences of these ideas for angle resolved photoemission and scanning tunneling microscopy experiments[3] will also discussed. [1] Alvarez et al., cond-mat/0401474, to appear in PRB. [2] I. Bozovic et al., PRL 93, 157002, (2004) [3] A. Ino et al., PRB 62, 4127 (2000); K. Lang et al, Nature 415, 412 (2002). Research performed in part at the Oak Ridge National Laboratory, managed by UT-Battelle, LLC, for the U.S. Department of Energy under Contract DE-AC05-00OR22725.

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