Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

First-order phase transition induced by disorder in a model for manganites EDUARDO CASTRO, JOÃO SANTOS, CFP and Departamento de Física, Faculdade de Ciências Universidade do Porto — The role of disorder in the physics of manganese oxides has been unveiled by a series of experiments in half-doped ordered and disordered manganites. For the ordered family a multicritical behaviour was found in the temperature vs bandwidth phase diagram, where a charge-order insulator (COI) competes with a ferromagnetic metal (FM). Chemical disorder induces a strong suppression of the transition to the COI state, effectively turning an insulator into a FM and enhancing the colossal magnetoresistive effect above the Curie temperature. Recently, a one orbital double-exchange model with cooperative phonons and quenched disorder was proposed to explain this metal-insulator transition induced by disorder. Treating the electronic degrees of freedom exactly, and the local spins and lattice distortions classically, in a variational mean-field approach, we have investigated the thermodynamic behaviour of the model in 2D systems larger by one order of magnitude than in previous works. Not only the suppression of the COI state by disorder was obtained, but we have also found that the second-order charge-order phase transition turns into first-order in the presence of intermediate disorder. This picture is consistent with experiments: first-order phase transitions are known to be present in half-doped disordered manganites which show the spectacular phenomena of the collapse of a charge-ordered state under a magnetic field.

Eduardo Castro
CFP and Departamento de Física
Faculdade de Ciências Universidade do Porto

Date submitted: 04 Dec 2005 Electronic form version 1.4