

**A Monte Carlo study of the Falicov-Kimball model in the
perturbative regime: preliminary results**

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Finite-temperature properties of the Falicov-Kimball model on the square lattice have been studied in the perturbative regime, i.e. in the case: $t/U \ll 1$, where t is the hopping constant and U denotes the Coulomb interaction strength. For such a range of t and U parameters, it is possible to develop perturbation theory in the parameter t/U . As a result, the Ising-like model emerges. In the second order of the perturbation theory it is the antiferromagnetic Ising model in the magnetic field, whereas in the fourth order it constitutes the Ising model with more complicated frustrated antiferromagnetic interactions. The main observables examined were order parameters and their temperature (T) dependences for different values of the magnetic field (h). In our study, we have determined the phase diagram of the model in the second-order of the perturbation theory and partially in the fourth-order. We have employed the Monte Carlo method, that proved its accuracy in analysis of other spin models like Ashkin-Teller model, which we have recently investigated. To determine the type of ordering and phase boundaries, we have analysed the behavior of Binder cumulants based on the order parameters under consideration.

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