CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE

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Phase transition of spin-crossover material

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Recently, the photomagnetism of the spin-crossover materials has been studied extensively. We have studied thermodynamic properties of the ordering process of this type of material. In spin-crossover materials, the volume of a molecule changes depending on whether it is in the high-spin (HS) or low-spin (LS) state. This change causes distortion of the lattice. Elastic interactions among these distortions play an important role for the cooperative properties of spin-transition phenomena. We study pressure dependence of the ordering processes using the model of elastic interaction. We also find that the critical behavior caused by this elastic interaction belongs to the mean-field universality class, in which the critical exponents for the spontaneous magnetization and the susceptibility are $\beta = 1/2$ and $\gamma = 1$, respectively. Furthermore, the spin-spin correlation function is a constant at long distances, and it does not show an exponential decay in contrast to short-range models. The value of the correlation function at long distances shows different size-dependences: $O(1/N)$, $O(1/\sqrt{N})$, and constant for temperatures above, at, and below the critical temperature, respectively. The model does not exhibit clusters, even near the critical point. We also found that cluster growth is suppressed in the present model and that there is no critical opalescence in the coexistence region. During the relaxation process from a metastable state at the end of a hysteresis loop, nucleation phenomena are not observed, and spatially uniform configurations are maintained during the change of the fraction of HS and LS. These characteristics of the mean-field model are expected to be found not only in spin-crossover materials, but also generally in systems where elastic distortion mediates the interaction among local states.

References:
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