Editorial

Spin models have appeared since early days of quantum mechanics and are connected with such famous researchers as Wilhelm Lenz, Paul Dirac, Werner Heisenberg or Hans Bethe. Although originally these models were aimed at explaining magnetic properties of solids, very soon it became clear that they arise not only in many other fields of solid state physics, but also provide an excellent playground for various statistical mechanics calculations. Many rigorous calculations were performed just for lattice spin models (recall, e. g., the Bethe ansatz for the antiferromagnetic Heisenberg chain or the Onsager's solution of the two-dimensional Ising model), as well as many widely used approximations in an interacting many-body system theory were elaborated just for lattice spin models (recall, e. g., the mean-field theory which is usually explained for an extremely simple case of the Ising model). Furthermore, with the appearance of computers, lattice spin models found application among those systems the various properties of which are most intensively simulated. The simple reason for a wide popularity of spin models is their relative simplicity accompanied by highly nontrivial properties reflecting generic features of many-particle interacting systems.

Nowadays spin model theory is a very broad field in condensed physics and statistical physics. The Condensed Matter Physics special issue on spin systems touches only upon a small part of the existing studies and by no means exhausts numerous investigations on spin systems. Nevertheless, the collected papers were written by the leading researchers in the field of strongly correlated systems who are active experts in this field and, therefore, this special issue may be indeed considered a representative collection in this area. The papers concern several particular subjects which are known as hot topics in the prime of 21st century. Namely, the papers deal with theoretical studies on magnetic molecules and one- and two-dimensional spin models for which quantum fluctuations are known to be extremely important. The considered spin models are defined not only on simple lattices but also on some exotic frustrated lattices. Moreover, in addition to pure spin models, disordered spin models are discussed as well. Interplay of quantum fluctuations, geometrical frustration, and disorder may lead to unusual and counterintuitive behavior of many-body interacting systems. The papers constituting the present special issue also demonstrate various techniques of modern condensed matter theory. Thus, among the analytical approaches used in these papers one can find such popular tools as Bethe ansatz, fermionization, Grassmann integrals, spin-wave theory, decoration-iteration transformation, transfer-matrix method etc., whereas among numerical techniques – exact diagonalization, quantum Monte Carlo, coupled cluster method, density-matrix renormalization group method etc. The performed calculations permit to discuss static and dynamic properties in the ground state and at finite temperatures. Along with conventional order parameters characterizing different phases and phase transitions between them, some exotic order parameters (exotic phases) being discussed as well. This special issue seems to be useful both for experts (since there are a number of brilliant brief reviews on current achievements in the field) and for beginners (since the papers contain pedagogically excellent introductions to complicated problems in this area).

It is my great pleasure to thank the authors of the papers who supported this project. Obviously, only due to their responsiveness an idea of such a publication has become true and their kind agreement to submit their papers, both original ones and surveys on their recent studies, is gratefully appreciated. I wish to thank the anonymous referees for careful reading the papers and presenting the reports. Finally, a lot of thanks go to the staff of Condensed Matter Physics, who took care about the special issue on the final stage.

Oleg Derzhko