Preface

Recently, in the field of magnetism, various new types of phenomena have been discovered, and from their investigation many novel concepts have come out. The new types of magnetic structures, entirely different from the well-known conventional ones, arise from quantum fluctuations and have been observed, up to now, in a wide class of materials ranging from strongly correlated bulk systems to nanostructured materials. Also, the recent researches have revealed the new dynamical aspects of some peculiar magnetic materials: the resonant tunneling phenomena in nanostructured materials and the slow dynamics due to the randomness and frustration in glassy materials such as spin glasses. This volume is to review the present status of such *Frontiers in Magnetism*, and to further contribute to the field. It comprises the following three subjects: *Metallic magnetism*, *Glassy magnetism* and *Quantum magnetism*.

(1) *Metallic magnetism*: A central thema of this subject is 'strong correlation of electrons', and various topics related to it are discussed. They are the novel magnetic structures such as those in the Kondo lattice systems, the relationship between magnetism and superconductivity, the magnetic and quadrupolar ordering in the rare-earth and uranium compounds, and so on. Another key-word here is a 'quantum phase transition', and the spin fluctuation effect near a quantum critical point is comprehensively explored.

(2) *Glassy magnetism*: Spin glasses are the most typical glassy system. Aging phenomena in their spin-glass phase, as well as in other glassy systems such as amorphous silica, are extensively discussed. Also presented are the recent works on the specification of the spin-glass phase and its phase transition, the chiral-glass ordering in ceramic cuprates, the novel dynamical aspects such as the colossal magnetoresistance in other glassy materials, and so on.

(3) *Quantum magnetism*: Various types of ground state phases have been found in low dimensional quantum spin systems reflecting the spatial structure of the lattice. These new spin-gapped states were previously simply considered as non-magnetic states, but they have brought a new concept of magnetism. There the spin does not behave as an arrow, but arrangements of the singlet pairs (valence bonds) characterize various phases which have no corresponding classical states. The dynamical properties of quantum spin systems have been studied extensively. In particular, various phenomena which are inherent to quantum mechanical dynamics have been found in nanoscale magnets.

We would like to express our sincere thanks to all the authors who wrote the excellent article for this volume. Due to their efforts this volume is, we believe, very useful to grasp the present forefront, and the prospect for future developments as well, in the field of magnetism.

The present volume also plays a role of the summary of the international cooperative research projects on magnetism between Japan, Germany, France, Netherlands and USA, which we have organized in these six years. Our thanks are obviously due to our partners, Profs. I. A. Campbell, J. Hammann, R. Orbach, A. P. Young, and E. F. Wassermann, for their fruitful co-organization. We also express our thanks for the financial support from the Ministry of Education, Science, Culture and Sports (*Monbusho*), Japanese Society for Promotion of Science, Deutsche Forschungsgemeinschaft (DFG), Service de Physique de l'Etat Condensé CEA/Saclay, Université Paris Sud (Orsay) and University of California (River Side and Santa Cruz).

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