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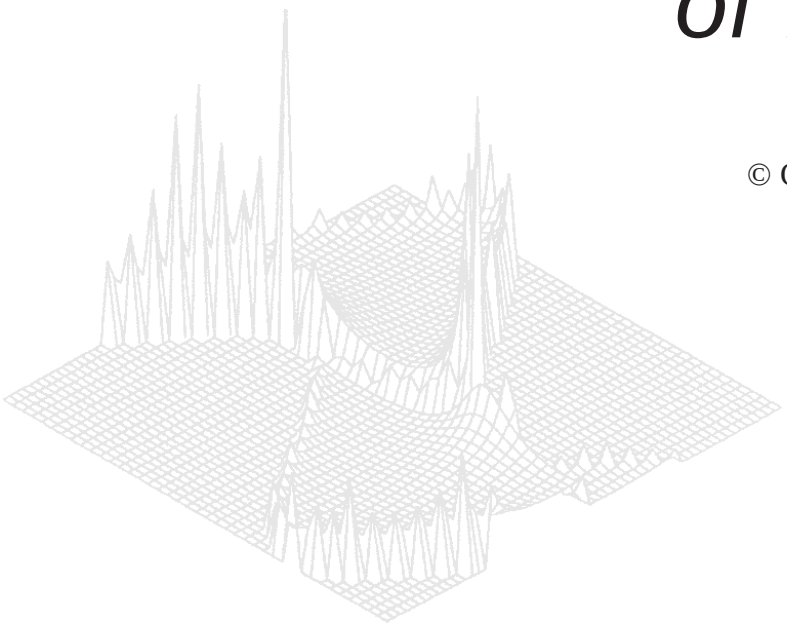

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Foreword

A renaissance in the study of the cross-over from localised to itinerant electronic behaviour in the transition-metal oxides with perovskite-related structures is in full swing despite a long history going back to the 1950s. The resurgence of interest was triggered by the discovery of high-temperature superconductivity in the copper oxides in 1986 and has been refuelled by the additional discovery of a large—'colossal'—magnetoresistance in the manganites. At the cross-over, neither the crystal-field theory with interatomic superexchange interactions applicable to localised electrons, nor the broad-band picture of itinerant electrons interacting weakly with one another and with the lattice is appropriate, and a rich variety of physical phenomena are encountered. These phenomena reflect interlocking dependencies of the charge, spin, orbital, and lattice degrees of freedom. Where these interlocking dependencies are manifest in static charge-density/spin-density waves, they are detectable by conventional diffraction experiments. Undetected until recently is evidence for phase segregations with dynamic short-range or long-range ordering of the two-phase volumes. In the copper-oxide superconductors, long-range dynamic ordering within the CuO_2 sheets gives rise to a distinguishable thermodynamic state; in the manganites discussed in this special issue, the volume of an electron-poor phase varies with an applied magnetic field as well as with temperature, but any ordering of the phases remains short-range above a ferromagnetic Curie temperature T_c and/or a charge-orbital ordering temperature T_{co}. It is remarkable that a response property such as the resistivity or the magnetisation, which is normally a derivative quantity with respect to the thermodynamic state, should be so intimately linked to the stabilisation of a particular thermodynamic phase. How close an analogy can be drawn between the superconductive phenomenon in the copper oxides and the *isotropic intrinsic* colossal magnetoresistance (CMR) of the manganites remains to be seen. However, a more complete understanding of the complex interplay between cooperative dynamic and static Jahn–Teller deformations, magnetic order, charge order, phase segregation, and transport properties in the manganites promises to shed light on at least some aspects of the normal state of the copper oxides from which the superconductive pairs are condensed.

In addition, there is an emerging field of spin electronics in which transfer of electronic charge between half-metallic ferromagnets is modulated by changing the magnetisation direction of the acceptor ferromagnet relative to the direction of the spin of the electrons flowing from the donor ferromagnet. This modulation can give an *extrinsic* giant magnetoresistance (GMR) at room temperature in small applied magnetic fields. Related to this problem is the question of whether layered manganites can give an *anisotropic intrinsic* GMR associated with their anisotropic magnetic-exchange and transport properties.

With this appreciation of the issues involved and of the extra experimental dimension that the magnetisation and strong Jahn–Teller orbital–lattice coupling

Workshop participants (*left to right*): Masashi Tokunaga, Yutaka Moritomo, Tony Ersaz, Jose Alarco, Oleg Gorbenko, Nick Witte, J. Zhang, James Riches, Peter Talbot, Rajapan Mahesh, Ian Grey, Graeme Russell, John Barry, Roger Lewis, Peter Goodman, Dimitri Argyriou, Rhonda Stroud, Eduard Nagaev, Hiroshi Watakatsu, Frank Lincoln, John Goodenough, Alan Bishop, Michihoto Muroi, Mark Blackford, Peter Robertson.

introduces into the cross-over from localised to itinerant electronic behaviour in the manganites, a small group in Melbourne undertook to organise an international meeting on the CMR phenomenon in the manganese oxides with perovskite-related structures. An attempt was made to bring together an international group of theorists and experimentalists who were making significant contributions to several key aspects of the problem. While it was not possible to bring to Melbourne everyone who was invited, an excellent representation was assembled. The workshop size was modest by international standards which, as it turned out, enabled a lively participation of the attendees in discussion of the presentations. Several different viewpoints were presented, which led to a lively debate that was always conducted in a patient and constructive manner. The discussions permitted the common concepts as well as essential distinctions of the different points of view to be fully understood. Although these discussions are not included in this special issue, they have helped to sharpen the written contributions. Unfortunately, not every speaker was able to provide a written paper to be included in this volume. The most notable omissions are the papers on 'Phenomenology of Manganites' by Bernard Raveau and 'Multiscale Complexity in Complex Oxides' by Alan Bishop.

Special thanks are due to Peter Goodman, who persevered with the organisation of the workshop in the face of considerable skepticism regarding the feasibility of the effort, and to Inna Priymak for her tireless skill and gracious style in the execution of the meeting and its associated social events, as well as for her attention to the varied needs of the foreign visitors. Finally, thanks must also be given to the participants for their lively involvement in all the sessions and for the spirit of open discussion and commitment to their work that enlightened everyone who attended.

Nicholas Witte, University of Melbourne
John B. Goodenough, University of Texas at Austin

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Vale Peter Goodman (1928–99)

Just as this issue was about to be sent to the printers we learnt of the death of Peter Goodman, and so we would like to dedicate this special workshop issue to his memory. Certainly his appreciation of the significance of this meeting and its subject to contemporary condensed matter physics is a testament to his vision and energy. All those who had contact with him would have been well aware of his breadth of interests, and of his belief in the fundamental indivisibility of the many facets of physics. We think this has been well reflected in the workshop and this special issue. It stands then as a most suitable tribute to him.

Nicholas Witte