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Local-Moment Ferromagnets

Unique Properties for Modern Applications
For an understanding of the fascinating phenomenon of ferromagnetism, one needs a description of the mechanism that underlies the coupling of the magnetic moments. In some materials, the magnetic moments are caused by itinerant electrons of partially filled conduction bands: the band ferromagnets. In others, they are due to localized electrons of a partially filled atomic shell: the local-moment ferromagnets. The latter class comprises the classical local-moment systems like some rare-earth elements and compounds but also more complex materials like diluted magnetic semiconductors and half-metallic ferromagnets. These materials are a hot topic of current scientific research for two reasons. On the one hand, the exchange interaction between the localized magnetic moments and the quasi-free charge carriers in these materials is far from being fully understood. On the other hand, some of these materials are promising candidates for modern applications in magnetoelectronic as well as spintronic devices because of their unique magnetic properties. The present book provides a status report on our current knowledge about these interesting materials gained from experimental investigations as well as theoretical descriptions.

The various chapters in this book “Local-Moment Ferromagnets: Unique Properties for Modern Applications” are written in tutorial style by experts in the field. They were invited to an international specialists’ conference held under the same title in Wandlitz near Berlin (Germany) from 15 to 18 March 2004. It was the third seminar of this type in Wandlitz. The first seminar in 1998 dealt with magnetism and electronic correlations in classical local-moment systems: Magnetism and Electronic Correlations in Local-Moment Systems: Rare-Earth Elements and Compounds, ed. by M. Donath, P.A. Dowben, W. Nolting (World Scientific Publishing, Singapore, 1998). The second seminar in 2000 was dedicated to the microscopic understanding of band-ferromagnetism as an electron correlation effect: Band-Ferromagnetism: Ground-State and Finite-Temperature Phenomena, ed. by K. Baberschke, M. Donath, W. Nolting, Lecture Notes in Physics 580 (Springer, Berlin, 2001). The III. Wandlitz Days on Magnetism in 2004 came back to the phenomenon of local-moment ferromagnetism but with a special focus on particular materials with unique properties as described above. The presentations of twenty-seven invited speakers from thirteen different countries initiated in-
tense and fruitful discussions between the sixty participants of the conference. More results were presented in form of posters during the three days of the seminar. The organizers hope that the lively discussions in Wandlitz support actual and future collaborations between the various specialists in the field of local-moment ferromagnets. Of course, this book cannot give a complete account of these fascinating subjects, given the tremendous worldwide activity, but rather focuses on the authoritative work of the contributors to the conference.

Generous financial support by the Deutsche Forschungsgemeinschaft for this conference made it possible to bring together experimentalists and theoreticians, senior researchers and graduate students, to discuss the present state of affairs, to learn from each other, and to define joint projects for the future. Sincere thanks are due to the staff and associates of the Lehrstuhl Festkörperphysik of the Institute of Physics at the Humboldt-Universität zu Berlin for doing an excellent job with the organization of the seminar. We wish to thank Prof. Dr. Jürgen Braun for his time-consuming work in collecting and composing the contributions to this book. We enjoyed the always effective collaboration with the Springer Verlag.

Münster, Berlin
August 2005

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Contents

Introduction
M. Donath, W. Nolting ........................................ 1

Part I Concentrated Local-Moment Systems

Critical Behaviour of Heisenberg Ferromagnets
with Dipolar Interactions and Uniaxial Anisotropy
S.N. Kaul ...................................................... 11
1 Introduction ............................................. 11
2 Critical Exponents and Amplitudes ......................... 12
3 Scaling and Universality ................................ 14
4 Renormalization Group and Crossover Phenomena .... 15
5 The gadolinium Case .................................. 20
6 Summary and Future Scope ............................ 26
References .................................................. 28

Aspects of the FM Kondo Model: From Unbiased MC
Simulations to Back-of-an-Envelope Explanations
Maria Daghofer, Winfried Koller, Alexander Prüll, Hans Gerd Evertz,
Wolfgang von der Linden .................................... 31
1 Introduction ............................................. 31
2 Model Hamiltonian .................................... 32
3 Monte Carlo Algorithm ................................ 35
4 Results .................................................. 36
5 Summary .................................................. 44
References .................................................. 44

Carrier Induced Ferromagnetism
in Concentrated and Diluted Local-Moment Systems
Wolfgang Nolting, Tilmann Hickel, Carlos Santos .............. 47
1 Local Moment Magnetism ................................ 47
2 Kondo-Lattice (s-f) Model ................................ 49
3 Electronic Selfenergy of “Concentrated” Local-Moment Systems 52
2 Calculational Technique .......................................................... 117
3 Single Band in the Frozen-Magnon Field ................................. 118
4 Results for (GaMn)As,(GaCr)As,(GaFe)As .............................. 120
5 (ZnCr)Te .............................................................................. 123
6 Properties of the Holes and Magnetism ................................. 124
7 Comparative Study of (GaMn)As and (GaMn)N ........................ 127
8 Conclusions ........................................................................... 131
References .............................................................................. 131

Exchange Interactions and Magnetic Percolation
in Diluted Magnetic Semiconductors
J. Kudrnovský, L. Bergqvist, O. Eriksson, V. Drchal, I. Turek, G. Bouzerar ...................................................... 133
1 Introduction ........................................................................... 133
2 Formalism ............................................................................. 135
3 Curie Temperatures ............................................................... 141
4 Conclusions ........................................................................... 145
References .............................................................................. 146

The Role of Interstitial Mn
in GaAs-Based Dilute Magnetic Semiconductors
Perla Kacman, Izabela Kuryli{sz}-Kudelska .................................................. 149
1 Introduction ........................................................................... 149
2 High Resolution X-ray Diffraction (HRXRD) Measurements .... 152
3 Channeling Experiments (c-RBS and c-PIXE) ......................... 153
4 SQUID Measurements .......................................................... 156
5 Exchange Interactions of Mn Interstitials ............................... 158
References .............................................................................. 161

Magnetic Interactions in Granular Paramagnetic-Ferromagnetic GaAs: Mn/MnAs Hybrids
Wolfram Heimbrodt, Peter J. Klar .................................................. 165
1 Introduction ........................................................................... 165
2 Growth and Preparation of Hybrid structures .......................... 166
3 Magneto-Optical Properties of the GaAs:Mn Matrix ............. 168
4 Galvano-Magnetic Properties of Paramagnetic GaMn:As Epitaxial Layers .................................................. 171
5 Ferromagnetic Properties of MnAs Clusters in GaAs:Mn .......... 174
6 Galvano-Magnetic Properties of Hybrid structures ................. 176
7 Concluding Remarks ............................................................. 183
References .............................................................................. 183
Magnetization, Spin Polarization, and Electronic Structure of NiMnSb Surfaces
Markus Donath, Georgi Rangelov, Jürgen Braun, Wolfgang Grentz . . . 263
1  Introduction .......................................................... 263
2  Sample Preparation and Characterization ........................ 265
3  Spin-Resolved Appearance Potential Spectroscopy .......... 268
4  Spin-Resolved Inverse Photoemission ............................... 271
5  Conclusion ................................................................ 273
References ..................................................................... 274

Spin Injection Experiments from Half-Metallic Ferromagnets into Semiconductors: The Case of NiMnSb and (Ga,Mn)As
Willem Van Roy .................................................................. 277
1  Introduction ............................................................ 277
2  NiMnSb-Based Spin Injectors ........................................ 278
3  Ga$_{1-x}$Mn$_x$As-Based Spin Injectors ......................... 285
4  Conclusions ............................................................ 287
References ..................................................................... 288

Growth and Room Temperature Spin Polarization of Half-metallic Epitaxial CrO$_2$ and Fe$_3$O$_4$ Thin Films
1  Introduction ............................................................ 291
2  Half-Metallic Ferromagnets ......................................... 291
3  Magnetite ................................................................ 293
4  Chromium Dioxide ..................................................... 300
References ..................................................................... 308

On the Importance of Defects in Magnetic Tunnel Junctions
P.A. Dowben, B. Doudin ................................................... 311
1  Introduction ............................................................ 311
2  Chromium Oxide Interfaces and Surface Composition .... 314
3  Intermediate States in the Barrier ................................. 317
4  Polarizable Defects in Cr$_2$O$_3$? ................................. 321
5  Defect Mediated Coupling? ........................................... 323
6  Conclusion: Defects May Be Important ....................... 327
References ..................................................................... 328
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