

Magnetism in the Solid State

An Introduction

Bearbeitet von
Peter Mohn

überarbeitet 2005. Taschenbuch. xi, 229 S. Paperback

ISBN 978 3 540 29384 2

Format (B x L): 15,5 x 23,5 cm

Gewicht: 385 g

[Weitere Fachgebiete > Physik, Astronomie > Elektrodynamik, Optik > Magnetismus](#)

schnell und portofrei erhältlich bei

The logo for beck-shop.de features the text 'beck-shop.de' in a bold, red, sans-serif font. Above the 'i' in 'shop' are three red dots of increasing size. Below the main text, 'DIE FACHBUCHHANDLUNG' is written in a smaller, red, all-caps, sans-serif font.

beck-shop.de
DIE FACHBUCHHANDLUNG

Die Online-Fachbuchhandlung beck-shop.de ist spezialisiert auf Fachbücher, insbesondere Recht, Steuern und Wirtschaft. Im Sortiment finden Sie alle Medien (Bücher, Zeitschriften, CDs, eBooks, etc.) aller Verlage. Ergänzt wird das Programm durch Services wie Neuerscheinungsdienst oder Zusammenstellungen von Büchern zu Sonderpreisen. Der Shop führt mehr als 8 Millionen Produkte.

Contents

1. A Historical Introduction	1
2. Consequences of Fermi Statistics	13
2.1 Quantum Statistics of Fermions	13
2.2 Free Energy of the Fermi Gas	16
3. Paramagnetism	25
4. Energy Bands in the Crystal	31
5. Experimental Basis of Ferromagnetism	37
5.1 Nickel Alloys	42
5.2 Iron Alloys	43
5.3 Palladium Alloys	44
5.4 Iron–Nickel Alloys	44
5.5 Effects of Strong Magnetic Fields	44
5.6 Effects of High Pressure	46
5.7 Effects of Finite Temperature	47
5.8 Susceptibility above T_c	47
5.8.1 Susceptibility of “Classical Spins”	48
5.9 Critical Exponents	50
5.10 Neutron Diffraction	51
5.11 Further Experimental Methods	52
6. Weiss Molecular Field Model	53
6.1 Rhodes–Wohlfarth Plot	59
7. Heisenberg Model	63
7.1 Magnon Operators	63
7.2 Heisenberg Hamiltonian in Magnon Variables	66
7.3 Magnon Dispersion Relation	67
7.3.1 Specific Heat of Magnons	69
7.3.2 Ordering Temperature	70
7.4 Approximations for the Heisenberg Model	71
7.4.1 Ising Model	71

7.4.2	XY Model	72
7.4.3	Mean Field Solutions of the Heisenberg Model	73
8.	Itinerant Electrons at 0 K	75
8.1	Pauli Susceptibility of the Itinerant Electrons	80
8.2	Susceptibility of the Interacting Itinerant Electrons	80
8.3	Non-linear Effects	83
8.4	Effects of High Fields at 0 K	83
8.4.1	Non-magnetic Limit	84
8.4.2	Strong Ferromagnets	85
8.4.3	Weak Ferromagnets	85
8.4.4	bcc Iron and hcp Cobalt	85
8.4.5	Extremely High Fields	87
8.4.6	Metamagnetism	87
8.5	Susceptibility of Paramagnetic Alloys	89
9.	Band Gap Theory of Strong Ferromagnetism	93
9.1	Magnetism of Alloys	97
10.	Magnetism and the Crystal Structure –	
	Covalent Magnetism	101
10.1	Crystal Structure of Mn, Fe, Co, and Ni	103
10.2	Covalent Magnetism	105
10.3	Covalent Polarization	111
11.	Magnetic Impurities in an Electron Gas	117
11.1	Impurity Potential in the Jellium	117
11.2	Strong Perturbations in the Jellium	119
11.3	Layer and Line Defects	119
11.4	Magnetic Impurities and Oscillations of the Magnetization	120
12.	Itinerant Electrons at $T > 0$: A Historical Survey	123
12.1	Excitations at Low Temperatures	127
12.1.1	Strongly Ferromagnetic Systems	127
12.1.2	Weakly Ferromagnetic Systems	129
12.2	Stoner Theory for a Rectangular Band	130
12.3	Weak Excitations with $\zeta < 1$	132
13.	Hubbard Model	135
13.1	Beyond Hartree–Fock	137
14.	Landau Theory for the Stoner Model	139
14.1	General Considerations	139
14.2	Application to the Stoner Model	141
15.	Coupling Between Itinerant and Localized Moments	147

16. Origin of the Molecular Field	151
16.1 Heitler–London Theory for the Exchange Field	151
16.1.1 Magnetism of a Spin Cluster	156
16.1.2 Spinwaves for Localized Electrons	158
17. Exchange and Correlation in Metals	161
17.1 Free Electron Gas	161
17.2 Tightly Bound Electrons	163
18. Spin Fluctuations	169
18.1 Fluctuations of a Thermodynamical Variable	170
18.2 Fluctuations of the Magnetic Moment	171
18.3 Specific Heat of the Spin Fluctuations	177
18.4 Magneto–Volume Coupling	177
18.5 Applications of the Spin Fluctuation Model	179
18.6 Comparing the Spin-Fluctuation and the Stoner-Model	182
19. Single Particle Excitations Versus Spin Waves	185
20. Landau–Ginzburg Model for Spin Fluctuations	191
21. Conclusion and Lookout	199
A. Appendices	203
A. Convexity Property of the Free Energy	203
B. Derivation of the Coefficient a in (3.17)	203
C. Quenching of the Orbital Momentum	206
D. Properties of “Classical” Spins	208
E. Derivation of the Constant c in (8.24)	210
F. Ornstein–Zernicke Extension	211
G. Bogoliubov–Peierls–Feynman Inequality	213
H. The Factor 2 in Equation (7.27)	214
I. Hund’s Rules	216
J. Polynomial Coefficients in (18.12)	218
K. Conversion Between Magnetic Units	219
References	221
Index	227