

CONTENTS

CHAPTER 1. QUANTUM MECHANICS OF ATOMS	1
1.1 Review of Quantum Theory	1
1.2 Symmetry Properties	10
1.3 Quantum Mechanics of Atoms	19
References	26
CHAPTER 2. MAGNETIZATION AND SUSCEPTIBILITY MEASUREMENTS	27
2.1 Description of a Magnetization Measurement Experiment by Axial Extraction in a Continuous Intense Magnetic Field	27
2.2 Magnetic Susceptibility Measurements: A Translation Balance	31
CHAPTER 3. THE MOLECULAR FIELD MODEL AND MAGNETIC ORDERING	35
3.1 Magnetic Coupling and the Molecular Field Approximation	35
3.2 Molecular Field Model of Ordered Magnetic Solids	37
3.3 The Method of Villain and Yoshimori	53
References	54
CHAPTER 4. THE PARAMAGNETIC STATE	55
4.1 Localized Magnetic Moments Without Interactions	55
4.2 Localized Magnetic Moments with Exchange Interactions	58
4.3 Crystal Field Effects on Localized Magnetic Moments: Van Vleck Susceptibility	63
4.4 Itinerant Electron Magnetism: Pauli Paramagnetism.....	68
CHAPTER 5. DETERMINATION OF MAGNETIC STRUCTURES	70
5.1 Magnetic Scattering of Neutrons	70
5.2 Investigation of Possible Magnetic Structures	78
5.3 Examples of Structure Determination	83
References	89
CHAPTER 6. MAGNETIC EXCITATIONS	90
6.1 Electron Energy Levels	90
6.2 Collective Excitations — Spin Waves.....	97
6.3 Inelastic Neutron Scattering By Spin Waves in a Ferromagnet	102
References	105
CHAPTER 7. 4f MAGNETISM	106
7.1 Introduction	106
7.2 Magnetic Interactions	106
7.3 Interaction of the Magnetic Moments with the Crystal Lattice: The Crystal Electric Field	110
References	120
Appendix	120
CHAPTER 8. IONIC 3d COMPOUNDS	121
8.1 Crystal Field Effects—Anisotropy	121
8.2 Exchange Interactions in Ionic Compounds	133
8.3 FeCl ₃ : A Highly Anisotropic Antiferromagnetic Compound	136
References	140

CHAPTER 9. 3d METALLIC MAGNETISM	141
9.1 The <i>d</i> Band	141
9.2 Origin of Magnetism: Electron-Electron Correlation	145
References	148
CHAPTER 10. STONER MODEL—ONSET OF 3<i>d</i> MAGNETISM	149
10.1 The Stoner Model	149
10.2 Very Weak Itinerant Ferromagnetism	150
10.3 Collective Electron Metamagnetism	155
10.4 Onset of 3 <i>d</i> Co Magnetism in RCo ₂ Compounds (R = Rare Earth)...	158
References	160
CHAPTER 11. MAGNETIC DOMAINS AND DOMAIN WALLS	
MAGNETIC BUBBLES	161
11.1 Weiss Domains and Bloch Walls.....	161
11.2 Magnetic Bubbles	169
References	176
CHAPTER 12. COERCIVITY	177
12.1 Energy of a Ferromagnetic System	178
12.2 Origin of the Coercive Field	180
12.3 Influence of Metallurgical Transformations on the Coercive Field...	183
References	199
CHAPTER 13. INTERMEDIATE VALENCY IN 4<i>f</i> SYSTEMS	200
13.1 Review of the Properties of Normal Rare-Earth Metals	200
13.2 Phase Transitions in Intermediate Valency Systems	203
13.3 Static and Dynamic Mixtures	205
13.4 Different Types of Classical Mixed Valence Systems	208
References	210
CHAPTER 14. MAGNETIC PHASE TRANSITIONS	211
14.1 Landau Theory of Second-Order Transitions	211
14.2 Multicritical Points	221
14.3 Critical Effects	226
References	231