

Contents

List of Symbols and Abbreviations	XIII
1 Introduction: Historical Remarks	1
2 Basic Concepts	7
2.1 Charge Transfer	7
2.2 Molecular Orbitals and Transfer Integrals.....	8
3 Structural Aspects	13
3.1 Molecular Building Blocks	13
3.2 Crystal Structures	16
3.2.1 Quasi-One-Dimensional Compounds	16
3.2.2 Quasi-Two-Dimensional Compounds	19
3.2.3 Three-dimensional Compounds	25
3.3 Anion Ordering and Glassy Phenomena	29
4 Normal-State Properties	37
4.1 Tight-Binding Model.....	37
4.2 Fermi Surfaces and Low Dimensionality	42
4.3 Electronic Properties.....	45
4.3.1 Transport and Optical Properties.....	45
4.3.2 Thermal and Magnetic Properties	63
4.4 Instabilities Involving Spin- and Charge-Degrees of Freedom	75
4.4.1 Charge- and Spin-Density-Waves	75
4.4.2 Spin-Peierls State	81
4.4.3 Charge-Ordering Phenomena	83
4.5 Many-Body Effects	87
4.6 Phase Diagrams	91
5 Magnetic-Field Effects	99
5.1 Electron Motion in Magnetic Fields	100
5.1.1 Semi-Classical Description in \mathbf{k} -Space	100
5.1.2 Angular-Dependent Magnetoresistance Oscillations ...	101
5.1.3 Magneto-Optic Resonances	106
5.2 Magnetic Quantum Oscillations	109
5.2.1 Landau Levels and Lifshitz-Kosevich Theory	109
5.2.2 Magnetic Breakdown and Quantum Interference.....	117

5.2.3	Two-Dimensionality Effect	120
5.2.4	Superconducting Vortex States	123
5.2.5	Magnetic Exchange-Interaction	126
5.3	High-Magnetic Field States	128
5.3.1	Field-Induced Cascade Transitions to SDWs and Anomalous High-Field States	128
5.3.2	Field-Induced Destruction of CDW and Anomalous High-Field States	133
5.3.3	Approaching the Quantum Limit	138
6	Superconductivity	141
6.1	Occurrence of Superconductivity in Molecular Metals	141
6.2	Ginzburg-Landau Theory	143
6.3	The Superconducting Phase Transition	147
6.3.1	Anisotropy and Superconducting Fluctuations	148
6.3.2	Pressure Dependence of T_c	153
6.3.3	Disorder	157
6.4	Superconducting Parameters	164
6.4.1	(TMTSF) $_2$ X	165
6.4.2	(BEDT-TTF) $_2$ X and (BEDT-TSF) $_2$ X	166
6.5	The Superconducting Mixed State	170
6.5.1	Overview	170
6.5.2	Basic Concepts of Vortex Matter in Quasi-Two-Dimensional Systems	172
6.5.3	Experimental Findings for κ -(BEDT-TTF) $_2$ X	175
6.6	Superconducting Order-Parameter	188
6.7	On the Pairing Mechanism	210
7	Phenomena of Interacting π- and d-Electrons	219
7.1	(DCNQI) $_2$ Cu	219
7.1.1	Crystal Structure and Electrical Conductivity	219
7.1.2	Reentrant Metal-Insulator Transition	221
7.2	(BEDT-TSF) $_2$ FeX $_4$ (X=Cl,Br)	224
7.2.1	Crystal Structures and Transfer Integrals	225
7.2.2	Conductivity and Magnetism	227
7.2.3	Magnetic Interactions and Mean-Field Theories	229
7.2.4	Anomalous Metallic States	232
7.2.5	Antiferromagnetic Insulating States	236
7.2.6	Magnetic Field-Induced Transitions	241
8	Epilogue	247
	References	249
	Index	291