
Contents

1 Introduction

<i>S. Hüfner</i>	1
References	9

Part I Many-Body Effects

2 Photoemission Spectroscopy with Very High Energy Resolution: Studying the Influence of Electronic Correlations on the Millielectronvolt Scale

<i>F. Reinert, S. Hüfner</i>	13
2.1 Introduction	13
2.2 Experimental Considerations	15
2.3 Theory of the Photoemission Spectrum	22
2.4 Scattering at Phonons, Electrons, and Impurities	25
2.5 Surface Modification and the Influence on Shockley States	41
2.6 Another High-resolution Paradigm: The Kondo Resonance	44
2.7 Summary and Conclusions	48
References	49

3 Photoemission as a Probe of the Collective Excitations in Condensed Matter Systems

<i>P. D. Johnson, T. Valla</i>	55
3.1 Introduction	55
3.2 The Photoemission Process	56
3.3 Electron-Phonon Coupling in Metallic Systems	59
3.4 Studies of the Dichalcogenides	63
3.5 Magnetic Systems	71
3.6 Studies of the High- T_C Superconductors	75
3.7 Summary and Outlook	81
References	82

4 High-resolution Photoemission Spectroscopy of Solids Using Synchrotron Radiation

<i>K. Shimada</i>	85
4.1 Introduction	85
4.2 Inelastic Mean Free Path, Energy and Angular Resolution	86
4.3 High-Resolution Photoemission Spectroscopy in the VUV and SX Regions	88
4.4 High Energy Resolution Photoemission Spectroscopy with HX Combined with VUV and SX	104
4.5 Summary	107
References	109

Part II Low-Dimensional Systems

5 Photoemission on Quasi-One-Dimensional Solids: Peierls, Luttinger & Co.

<i>R. Claessen, J. Schäfer, and M. Sing</i>	115
5.1 Introduction	115
5.2 Electronic Instabilities in One Dimension	116
5.3 Photoemission of Quasi-1D CDW Systems	121
5.4 Electronic Correlation Effects in 1D	130
5.5 Conclusions and Open Questions	142
References	143

6 Atomic Chains at Surfaces

<i>J. E. Ortega, F. J. Himpsel</i>	147
6.1 Introduction to One-Dimensional Systems	147
6.2 One-Dimensional Quantum Wells at Metal Surfaces	151
6.3 Atomic Chains on Semiconductor Surfaces: The Ultimate Nanowires	163
6.4 Summary and Future Avenues	179
References	182

Part III Ultimate Resolution

7 High-Resolution Photoemission Spectroscopy of Low- T_c Superconductors

<i>T. Yokoya, A. Chainani, and S. Shin</i>	187
7.1 Introduction	187
7.2 High-Resolution and Low-Temperature Photoemission Spectroscopy	190
7.3 Superconducting DOS	191

7.4	Photoemission Results of Superconducting Gap and Strong-coupling Line Shape	193
7.5	Anomalous SC Gap Form	201
7.6	Fermi Surface Sheet Dependence	205
7.7	Summary and Future Prospects	208
	References	211

Part IV Molecules

8 Very-High-Resolution Laser Photoelectron Spectroscopy of Molecules

	<i>K. Kimura</i>	215
8.1	Introduction	215
8.2	REMPI Photoelectron Spectroscopy	217
8.3	Compact cm^{-1} -Resolution ZEKE Photoelectron Analyzers	222
8.4	Application	230
8.5	Concluding Remarks	236
	References	237

Part V High-Temperature Superconductors and Transition-Metal Oxides

9 Doping Evolution of the Cuprate Superconductors from High-Resolution ARPES

	<i>K. M. Shen, Z.-X. Shen</i>	243
9.1	Introduction	243
9.2	High-Temperature Superconductivity	244
9.3	Photoemission Studies of the Lightly Doped Cuprates	247
9.4	Conclusions	267
	References	268

10 Many-Body Interaction in Hole- and Electron-Doped High- T_c Cuprate Superconductors

	<i>T. Takahashi, T. Sato, and H. Matsui</i>	271
10.1	Introduction	271
10.2	Experiments	273
10.3	Results and Discussion	273
	References	292

11 Dressing of the Charge Carriers in High- T_c Superconductors

	<i>J. Fink, S. Borisenko, A. Kordyuk, A. Koitzsch, J. Geck, V. Zabolotnyy, M. Knupfer, B. Büchner, and H. Berger</i>	295
11.1	Introduction	295

11.2 High- T_c Superconductors 297
 11.3 Angle-resolved Photoemission Spectroscopy 300
 11.4 The Bare-particle Dispersion 308
 11.5 The Dressing of the Charge Carriers at the Nodal Point 311
 11.6 The Dressing of the Charge Carriers at the Antinodal Point 315
 11.7 Conclusions 322
 References 323

12 High-Resolution Photoemission Spectroscopy of Perovskite-Type Transition-Metal Oxides

H. Wadati, T. Yoshida, and A. Fujimori 327
 12.1 Introduction 327
 12.2 Electronic Structure 328
 12.3 Samples 329
 12.4 Case Studies 331
 References 346

Part VI High Energy and High Resolution

13 High-Resolution High-Energy Photoemission Study of Rare-Earth Heavy Fermion Systems

A. Sekiyama, S. Imada, A. Yamasaki, and S. Suga 351
 13.1 Introduction 351
 13.2 Experimental 352
 13.3 High-Resolution Soft X-ray Photoemission Study of Ce Compounds 352
 13.4 High-Energy Photoemission Study of Pr Compounds 361
 References 371

14 Hard X-Ray Photoemission Spectroscopy

Y. Takata 373
 14.1 Introduction 373
 14.2 Experimental Aspects 374
 14.3 Performance and Characteristics 376
 14.4 Applications 380
 14.5 Summary 395
 References 396

Index 399