

Contents

Synchrotron Radiation as a Light Source R. P. GODWIN	1
Electron-Phonon Interaction and Boltzmann Equation in Narrow-Band Semiconductors J. SCHNAKENBERG	74

Synchrotron Radiation as a Light Source

R. P. GODWIN

Contents

1.	Introduction	2
2.	Properties of Synchrotron Radiation	3
2.1	Qualitative Discussion	3
2.2	Exact Results for Monoenergetic Electrons	7
2.3	Properties of Synchrotron Radiation from Accelerators	11
3.	Synchrotron Radiation as a Practical xuv Source	14
3.1	Intensity	15
3.2	Continuity	16
3.3	Polarization	16
3.4	Vacuum	16
3.5	Properties can be Calculated	17
3.6	Angular Distribution	17
3.7	Associated with Accelerators	17
4.	Special Techniques for xuv Spectroscopy with Synchrotron Radiation	18
4.1	Beam Access	19
4.2	Spectrometers	20
4.2.1	NBS Spectrograph and Spectrometer	21
4.2.2	DESY Grazing-incidence Spectrometer	22
4.2.3	DESY-München Normal-incidence Monochromator and Ultrahigh-vacuum Reflectometer	23
4.2.4	Collimating Monochromator	28
4.2.5	Grazing-incidence Monochromator with Fixed Exit Slit	29
4.3	Overcoming the Problem of Higher Spectral Orders	30
5.	Experiments	32
5.1	Introduction	32
5.1.1	Autoionization in Gases	35
5.1.2	Soft x-ray Absorption	37
5.1.3	Excitons. The Structure Rich Absorption Spectra of Alkali Halides	41
5.1.4	Plasmons and the Optical Properties of Al Films for Incident Light Near the Plasma Frequency	45
5.1.5	Photoemission. The Vectorial Photoeffect of Aluminum Films in the xuv	52
5.1.6	Surface Physics	55
5.1.7	Reflection Measurement of the Optical Constants of Germanium in the xuv	57
5.1.8	Reflectance Measurements of Anisotropic Crystals. Graphite Example	60
5.2	Synchrotron Radiation as an Intensity Standard	63
5.3	Other Experiments	65
	Acknowledgements	67
	References	68

Electron-Phonon Interaction and Boltzmann Equation in Narrow-Band Semiconductors

J. SCHNAKENBERG

Contents

Summary	74
1. Introduction	74
2. Model Hamiltonian: Interaction with Acoustic Phonons	77
3. Green's Function Perturbation Theory; Self-Energy	81
4. Derivation of the Transport Equation	86
5. Boltzmann Equation and the Variational Principle	92
6. One-Dimensional Model	95
a) One-Phonon Scattering; $f_k = \text{const} = n\Omega/N$	95
b) One-Phonon Scattering; Variable f_k	97
c) Two-Phonon Scattering; $f_k = \text{const}$	99
d) The Condition $\Delta E > \hbar/\tau_i$	102
7. Some Remarks on the 3-dimensional Case	103
8. Interaction with Polar or Intramolecular Lattice Vibrations: Weak Coupling Case	104
9. Interaction with Polar Phonons, Strong Coupling Case: Small Polaron Bands	108
Appendix A: Non-Simultaneous Two-Phonon Processes	116
Appendix B: Higher-Order Vertex Corrections	119
References	120

