

Contents

1. Introduction. By M. Cardona and G. Güntherodt	1
References	2
2. Light Scattering in Graphite Intercalation Compounds By M. S. Dresselhaus and G. Dresselhaus (With 26 Figures)	3
2.1 Background	3
2.1.1 Introductory Comments	3
2.1.2 General Properties of Graphite Intercalation Compounds	5
2.1.3 Raman Scattering and Lattice Modes in Pristine Graphite	8
2.2 Lattice Dynamics of Intercalated Graphite	13
2.2.1 Introductory Comments	13
2.2.2 Model Calculations for Phonon Dispersion Relations	14
2.2.3 Phonon Density of States	20
2.3 Raman Spectra of Graphite Intercalation Compounds	23
2.3.1 Introductory Comments	23
2.3.2 Raman Scattering from Graphitic Modes in Donor and Acceptor Intercalation Compounds for Stages $n \geq 2$	24
2.3.3 Raman Scattering in Stage 1 Compounds	31
2.3.4 Raman Scattering by Intercalate Modes	38
2.3.5 Second-Order Raman Spectra in Graphite Intercalation Compounds	43
2.3.6 Raman Scattering from Intercalated Graphite Fibers	48
2.3.7 Raman Scattering of Molecules on Graphite Surfaces	51
2.3.8 Raman Scattering from Ion-Implanted Graphite	53
2.4 Summary	53
References	54
3. Light Scattering from Electronic and Magnetic Excitations in Transition- Metal Halides. By D. J. Lockwood (With 15 Figures)	59
3.1 One- and Two-Magnon Scattering in Pure Antiferromagnets	60
3.1.1 Cubic AMF_3 Compounds	60
3.1.2 Tetragonal MF_2 Compounds	66
3.1.3 Trigonal MX_2 Compounds	69
3.2 Magnon Scattering in Mixed Antiferromagnets	72
3.2.1 Low Impurity Concentrations	72
3.2.2 High Impurity Concentrations	72

3.3	Scattering from Electronic Excitations of Fe^{2+} , Co^{2+} , and Ni^{2+}	78
3.3.1	Diamagnetic Hosts	78
3.3.2	Paramagnetic and Antiferromagnetic Hosts	80
3.4	Scattering from Electron-Phonon Coupled Modes	84
3.5	Conclusion	88
	References	89
4.	Light Scattering by Superionic Conductors	
	By W. Hayes (With 19 Figures)	93
4.1	Some General Aspects of Light Scattering by Superionics	96
4.2	Light Scattering by Silver and Copper Compounds	98
4.2.1	Silver Compounds	98
	a) Silver Iodide	98
	b) Rubidium Silver Iodide	101
4.2.2	Cuprous Halides	102
4.3	β -Alumina Compounds	103
4.3.1	General Background	103
4.3.2	Sodium β -Alumina	105
4.3.3	Silver β -Alumina	107
4.3.4	Other Isomorphs of β -Alumina	111
4.4	Crystals with Fluorite Structure	112
4.5	Conclusion	117
	References	118
5.	Raman Studies of Phonon Anomalies in Transition-Metal Compounds	
	By M. V. Klein (With 21 Figures)	121
5.1	Examples of Raman Spectra in Transition Metals	121
5.1.1	Two-Phonon Spectra of Cubic Metals	121
5.1.2	Layered Compounds	124
5.2	Microscopic Theories of Phonon Softening	127
5.3	The Anomalous E_g Optical Phonon in A15 Compounds	129
5.4	Microscopic Theory of Raman Scattering in Metals	131
5.4.1	Interband Electronic Raman Scattering	133
5.4.2	One-Phonon Scattering	136
5.4.3	Intraband Electronic Processes	140
5.4.4	Two-Phonon Raman Scattering	141
5.4.5	Symmetries, Simplifications, and Selection Rules for the Two-Phonon Case	146
5.5	Charge-Density-Wave State	150
5.5.1	Mean-Field Theory	151
5.5.2	Static Distortion	154
5.5.3	Theory of Raman Scattering from Weak CDW Phonons	156
5.5.4	Raman Scattering in the Strong CDW Case	163
5.6	The Superconducting Gap and Its Coupling to Charge-Density- Wave Phonons	166

5.7 Conclusions 169
 References. 169

6. Trends in Brillouin Scattering: Studies of Opaque Materials, Supported Films, and Central Modes. By J. R. Sandercock (With 14 Figures) . 173

6.1 Concept of Brillouin Scattering 174

6.1.1 Brillouin Scattering from Phonons in Transparent Isotropic Solids 174

6.1.2 Spin Waves 177

 a) Bulk Spin Waves 177

 b) Surface Spin Waves 178

 c) Light Scattering from Spin Waves 179

6.2 Experimental Techniques 180

6.2.1 Improving the Spectral Contrast 181

 a) High-Contrast Multipass Interferometer 181

 b) Rejection Filters 182

6.2.2 Stabilising the Fabry–Perot 183

6.2.3 Increasing the FSR 183

 a) Basic Interferometer Construction 185

 b) Tandem Interferometer 186

6.3 Light Scattering from Acoustic Phonons in Opaque Materials . 187

6.3.1 Effect of Optical Absorption 187

6.3.2 Allowance for Phonon Reflection 189

6.3.3 Phonon Modes in the Presence of Surfaces and Interfaces . 190

 a) Modes of a Plate 191

6.3.4 Ripple Scattering 193

6.3.5 Modes of a Plate on a Half Space 195

6.3.6 Scattering from Films on Substrates 196

6.4 Scattering from Magnons in Opaque Materials 197

6.4.1 Light Scattering in Highly Opaque Magnets 197

6.4.2 Light Scattering from Thin Magnetic Films 199

6.5 Scattering from Diffusive Excitations 200

6.6 Conclusions 203

References. 204

7. Resonant Light Scattering Mediated by Excitonic Polaritons in Semiconductors. By C. Weisbuch and R. G. Ulbrich (With 32 Figures) . 207

7.1 Outline 209

7.2 Basic Properties of Excitonic Polaritons 210

7.2.1 Static Properties of Excitons 210

7.2.2 Dynamical Properties of Excitons 212

 a) Exciton–Photon Interaction 213

 b) Exciton–Phonon Coupling 214

 c) Exciton–Carrier and Exciton–Impurity Interaction . . 216

7.2.3	Excitonic Polaritons–Static Properties	217
7.2.4	Optical Properties of Polaritons	221
7.3	Light Scattering in the Polariton Framework	225
7.3.1	Kinematic Properties	227
	a) Dispersion Effects	228
	b) Stokes Versus Anti-Stokes Scattering	228
	c) Multimode Scattering	229
7.3.2	Scattering Efficiencies	229
7.4	Resonant Brillouin Scattering (RBS)	231
7.4.1	Polariton Dispersion Curves	232
7.4.2	Phonon Coupling	235
	a) LA Phonon Scattering	235
	b) TA Piezoelectric Scattering	236
7.4.3	Damping and Opacity Broadening	238
7.4.4	RBS and the Problem of the Determination of Additional Boundary Conditions (ABC's)	239
7.5	LO Phonon Raman Scattering (RRS)	241
7.5.1	Polariton-Mediated RRS Cross Sections	242
7.5.2	Resonant Raman Scattering and Hot Luminescence (HL)	243
7.6	Multiphonon Scattering and Polarization Effects	246
7.6.1	Scattering by Two-Acoustic Phonons	246
7.6.2	Acoustic Phonon and LO Phonon	247
7.6.3	Two-LO Phonon and Multiphonons	247
7.6.4	Polarization Correlation in RRS	249
7.7	Nonlinear Spectroscopy	250
7.8	Electronic Raman Scattering (ERS)	251
7.9	Conclusion	257
	References	257
	Subject Index	265