

CONTENTS

Editors' Foreword	v
Preface	vii
1. Introductory Survey	1
1-1 General considerations	1
1-2 Basic Hamiltonian	3
1-3 Elementary excitations	4
1-4 The measurement of the elementary excitation spectrum	9
1-5 Scope of the book	10
2. Phonons	13
2-1 Lattice dynamics in one dimension	13
2-2 Lattice dynamics in three dimensions	20
2-3 Lattice specific heat	30
2-4 Melting criterion	34
2-5 Neutron scattering in solids	38
26 Phonon-phonon interactions	49
Problems	55
3. Electrons and Plasmons	56
3-1 Sommerfeld noninteracting electron gas	56
3-2 Hartree and Hartree-Fock approximations	65
3-3 Correlation and correlation energy: an introductory survey	85

3-4	Dielectric response of an electron system	121
3-5	Properties of the electron gas in the RPA	138
3-6	Properties of the electron gas at metallic densities	156
	Problems	165
4.	Electrons, Plasmons, and Photons in Solids	168
4-1	Introductory considerations	168
4-2	Modification of $\epsilon(\mathbf{k}, \omega)$	172
4-3	Experimental observation of plasmons in solids: characteristic energy-loss experiments	182
4-4	Optical properties of solids	195
4-5	Optical studies of solids	207
	Problems	229
5.	Electron-Phonon Interaction in Metals	231
5-1	Basic Hamiltonian	231
5-2	New features associated with the electron-phonon interaction	237
5-3	General physical picture	241
5-4	Phonon frequencies and effective electron-electron interaction	244
5-5	The approach to equilibrium of a coupled electron-phonon system	257
5-6	High-temperature conductivity	265
5-7	More detailed calculations of the relaxation time	270
5-8	Low-temperature conductivity	273
5-9	Quasi-particle properties	278
	Problems	279
	Appendixes	279
	Appendix A Second quantization	281
	Appendix B Linear response functions; Kramers-Kronig relations	288
	Appendix C The RPA calculation of the ground-state energy	293