

CONTENTS

Editor's Foreword	xiii
Preface	xv
Chapter I Nuclear Phenomena in Heavy-Ion Collisions	1
1 Coulomb Excitation and Low-Frequency Surface Modes.....	3
2 Quasielastic Reactions.....	13
(a) Elastic Scattering.....	13
(b) Inelastic Scattering and High-Frequency Modes	16
(c) Transfer Reactions and Pairing Modes	19
(d) Combined Reactions and Yrast Spectroscopy	21
3 Fusion Reactions and Compound States	26
4 Deep-Inelastic Reactions.....	31
5 Nuclear Phenomena in Higher-Energy Collisions.....	35
Chapter II Coulomb Excitation	37
1 Classical Description	37
2 Adiabaticity.....	41
(a) Adiabaticity Parameter.....	42
(b) Polarization by Coulomb Field.....	46
3 Strength of Coulomb Excitation.....	48
4 Excitation of Low-Lying Vibrational States.....	56
(a) Surface Modes.....	56
(b) Coulomb Excitation	61
5 Coherent Excitation of Surface Modes.....	66
6 Excitation of Rotational States.....	72
7 Coherent Excitation of Rotational States.....	78
8 Excitation of Vibrational States in Deformed Nuclei.....	83

9	Coulomb Excitation as an Absorption	87
	Appendix A: Coulomb Excitation for Small-Angle Scattering	92
	Appendix B: Semiclassical S-Matrix	93
	Appendix C: Coulomb Excitation of Rotational States by Classical-Limit Quantum Mechanics	96
Chapter III	Elastic Scattering	103
1	Ion-Ion Potential	104
	(a) Folding Potentials	104
	(b) Proximity Potentials	108
2	General Features of Elastic Scattering	115
3	Deflection Function	122
	(a) Rainbow Scattering	123
	(b) Grazing Angular Momentum	127
	(c) Nuclear Rainbow	129
4	Partial Waves, Phase Shifts and Cross-Sections ...	131
5	Solution of Radial Equation	138
6	WKB Approximation	144
	(a) Single Turning Point	144
	(b) Generalization of Simple Prescription	150
7	Rainbow Scattering	158
8	Comparison with Experiment	163
9	Total Reaction Cross-Sections	165
	Appendix A: Folding with Yukawa Functions	171
	Appendix B: Classical Description of Trajectories ...	174
	Appendix C: Classical Perturbation of Coulomb Trajectory	181
	Appendix D: Stokes Constants	185
	Appendix E: Uniform Approximation	188
	Appendix F: Determination of Empirical Potential. ...	191
Chapter IV	Inelastic Scattering	193
1	General Features of Inelastic Scattering	194
2	Microscopic Form Factors	198
	(a) Evaluation of Single-Particle Form Factor ...	201
	(b) Excitation of Two-Particle Configurations ...	203
	(c) Phonon Excitation	207
	(d) Excitation through the Isovector Interaction ...	211

3	Macroscopic Form Factors for Vibrations	216
4	Form Factors for Deformed Nuclei.	224
5	Form Factors for Compression Modes	233
6	Sum Rules	238
7	Oscillator Model and Absorption.	248
	(a) Classical Treatment.	248
	(b) Quantal Treatment	254
8	Cross-Sections for Inelastic Scattering	258
9	Coulomb-Nuclear Interference	262
	Appendix A: General Definition of Radial Form Factors and Sum Rules	277
	Appendix B: Interaction between Two Deformed Nuclei by Yukawa Folding	281
	References.	285
	Index	289