

CONTENTS

PREFACE	v
CONTENTS	vii

CHAPTER I

NANOSECOND EXPERIMENTATION WITH PULSED MACHINES

by STEWART D. BLOOM

1. INTRODUCTION	1
2. PULSED ELECTROSTATIC ACCELERATORS	3
2.1 Example of the unstored method	4
2.2 Example of a stored method	10
2.3 Example of a combination of stored and unstored pulsing methods	13
3. PULSED RF ACCELERATORS	14
3.1 Cyclotron phase grouping	15
3.2 Cyclotron time-of-flight techniques	17
3.3 Pulsed linear accelerators	20
4. TECHNIQUES OF DETECTION AND MEASUREMENT	22
5. RESULTS, PAST AND FUTURE	30
REFERENCES	40

CHAPTER II

NUCLEAR FISSION

by J. R. HUIZENGA and R. VANDENBOSCH

1. INTRODUCTION	42
2. COMPETITION BETWEEN FISSION AND NEUTRON EMISSION	43
2.1 Introduction	43
2.2 Dependence of Γ_n/Γ_t on excitation-energy theory	43
2.2a Fission and neutron widths with Fermi gas level density	45
2.2b Effect of energy gap on fission and neutron widths	49
2.3 Dependence of Γ_n/Γ_t on angular momentum-theory	55
2.4 Experimental results of Γ_n/Γ_t at low excitation energies ($Z \geq 90$)	60
2.5 Experimental results of Γ_n/Γ_t at moderate excitation energies ($Z \geq 90$)	66
2.6 Experimental results of Γ_n/Γ_t for target nuclei $Z < 90$	71

3. ANGULAR DISTRIBUTION OF FISSION FRAGMENTS	77
3.1 General considerations	77
3.2 Photofission of even-even targets by dipole absorption	78
3.3 Photofission of even-even targets by quadrupole absorption	80
3.4 Photofission of odd-even and even-odd targets	81
3.5 Particle-induced fission at moderate energies	82
3.6 Neutron-induced fission	85
3.7 Charged-particle induced fission	88
3.8 Anisotropy of selected fission fragments	91
3.9 Angular distributions from aligned nuclei	92
3.10 Direct fission	94
4. ENERGETICS OF FISSION	96
4.1 Energy available for fission	96
4.2 Fission fragment kinetic energies	97
4.3 Excitation energies of the fission fragments	100
5. ISOMERIC RATIOS FOR SHIELDED FISSION PRODUCTS	104
6. MASS DISTRIBUTION IN FISSION WITH RESONANCE NEUTRONS	105
REFERENCES	108

CHAPTER III

THE GIANT RESONANCE OF THE NUCLEAR PHOTOEFFECT

by E. G. FULLER and EVANS HAYWARD

1. INTRODUCTION	113
2. GENERAL BACKGROUND	114
2.1 The idealized nucleus	114
2.2 The interaction hamiltonian	117
2.3 The sum rule	120
3. ABSORPTION AND SCATTERING OF PHOTONS	123
3.1 Dispersion relations	124
3.2 Classical oscillator	124
3.3 Scattering and absorption of photons by nuclei	131
3.4 Scattering and absorption by deformed nuclei	139
4. EXPERIMENTAL DATA	142
4.1 Cross section determinations	143
4.2 The integrated absorption cross section	147
4.3 The light nuclei	153

4.4 Photon absorption below the photodisintegration thresholds	157
4.5 The nuclear polarizability and the energy of the giant resonance	160
4.6 The giant resonance width and the deformed nuclei	166
4.7 The absorption cross section for specific nuclei	173
4.7.1 The deuteron	173
4.7.2 Helium	175
4.7.3 Carbon	177
4.7.4 The photodisintegration of oxygen	180
4.7.5 Lead and bismuth	187
REFERENCES	190

CHAPTER IV VIBRATIONS OF SPHERICAL NUCLEI

by J. M. ARAÚJO

1. INTRODUCTION	195
2. GENERAL QUALITATIVE CONSIDERATIONS	196
3. SPHERICAL NUCLEI	199
3.1 Classification of vibrations; the harmonic approximation	199
3.2 Discussion of experimental data	203
3.2.1 Quadrupole vibrations	203
3.2.2 Octupole vibrations	210
3.3 Models for quadrupole vibrations	211
3.3.1 Weak and intermediate coupling calculations	211
3.3.2 Gamma-unstable vibrations	215
3.4 Calculations of the collective parameters	220
3.4.1 The method of Inglis	220
3.4.2 The method of generator coordinates	237
3.5 Generalized shell model calculations of nuclear vibrations	240
REFERENCES	246

CHAPTER V COEFFICIENTS FOR THE ANALYSIS OF ANGULAR CORRELATION MEASUREMENTS OF THE RADIATIVE DECAY OF ALIGNED NUCLEI

by PHILIP B. SMITH

1. INTRODUCTION	248
2. THE VALUE OF TRIPLE CORRELATION EXPERIMENTS	249
3. MATHEMATICAL FORMULATION	252

4. ANALYSIS OF THE DATA	256
4.1 Analysis in terms of Legendre polynomials	256
4.2 Analysis in terms of the X_{KM}^N functions	258
4.3 Calculation of the formation parameters	260
4.3.1 Reactions in which the incoming particle or initial nucleus has zero spin	260
4.3.2 The channel-spin representation	262
4.3.3 The j_p representation	263
4.4 Summary of the discussion concerning analysis	263
5. DESCRIPTION OF THE TABLES	264
5.1 The calculation of the coefficients	264
5.2 Organization of the tables	266
5.3 Range of the tables	267
ACKNOWLEDGEMENTS	268
REFERENCES	268
6. TABLES OF C_{KM}^N COEFFICIENTS	271
AUTHOR INDEX	536