

CONTENTS

	PAGE
EDITOR'S FOREWORD	vii
1 THE DETERMINATION OF NUCLEAR REACTION ENERGIES BY DEFLECTION MEASUREMENTS	1
<i>W. W. Buechner</i> M.I.T., Department of Physics, Cambridge, Mass.	
2 THE INELASTIC SCATTERING OF FAST NEUTRONS	37
<i>Joan M. Freeman</i> Atomic Energy Research Establishment, Harwell	
3 NEW ELECTRONIC TECHNIQUES FOR THE NUCLEAR PHYSICIST	89
<i>K. Kandiah and G. B. C. Chaplin</i> Atomic Energy Research Establishment, Harwell	
4 THE BUBBLE CHAMBER	142
<i>C. Dodd</i> University College, London	
5 THE RADIUS OF A NUCLEUS	157
<i>J. M. C. Scott</i> Cavendish Laboratory, Cambridge	
6 THE NEUTRINO	188
<i>B. W. Ridley</i> Atomic Energy Research Establishment, Harwell	
7 ORGANIC SCINTILLATORS	252
<i>F. D. Brooks</i> Atomic Energy Research Establishment, Harwell	
NAME INDEX	315
SUBJECT INDEX	324

CONTENTS

	PAGE
1. INTRODUCTION	1
2. METHODS FOR THE DETERMINATION OF NUCLEAR REACTION ENERGIES	2
3. ENERGY SELECTORS FOR ION BEAMS	6
3.1. Electrostatic energy selectors	8
3.2. Magnetic energy selectors	12
3.3. Calibration of energy selectors	16
4. ANALYSERS FOR REACTION PRODUCTS	18
4.1. Electrostatic analysers	20
4.2. Magnetic analysers for reaction products	22
4.3. Calibration and use of reaction-product analysers	30
REFERENCES	33

CONTENTS

	PAGE
1. INTRODUCTION	38
2. CLASSIFICATION OF NEUTRON-INDUCED REACTIONS	39
3. EARLY WORK ON INELASTIC NEUTRON SCATTERING	41
4. NEUTRON SOURCES AND FLUX MEASUREMENTS	42
4.1. Fast-neutron sources	42
4.2. Flux measurements	43
5. EXPERIMENTAL METHODS AND RESULTS	44
5.1. Transmission experiments	44
5.2. Differential elastic scattering cross-sections	47
5.3. Measurements of the neutron spectra	48
5.4. Measurements of the gamma-ray spectra	58
5.5. Metastable states	65
6. THEORETICAL DISCUSSION	67
6.1. Individual levels in both compound and residual nuclei	67
6.2. Statistical theory applied to the compound nucleus	70
6.3. Statistical theory applied to both compound and residual nuclei.	73
6.4. The complex potential model	76
APPENDIX: TABLE OF CROSS-SECTION DATA	81
REFERENCES	84

3

NEW ELECTRONIC TECHNIQUES FOR THE NUCLEAR PHYSICIST

K. Kandiah and G. B. B. Chaplin

CONTENTS

	PAGE
1. INTRODUCTION	90
2. SOME CIRCUIT TECHNIQUES	91
2.1. General comments	91
2.2. A low-level pulse amplitude discriminator	92
2.3. Pulse amplifiers	95
2.4. A logarithmic d.c. amplifier	96
2.5. Fast trigger circuits	98
2.6. Fast coincidence circuits	100
3. COLD CATHODE TRIGGER TUBES	103
3.1. General principles	103
3.2. Operating characteristics	104
3.3. Applications	106
4. DECIMAL COUNTING TUBES	108
4.1. A general survey	108
4.2. Gas-filled counting tubes	108
4.3. The ribbon-beam tube	110
4.4. The trochotron	115
5. THE TRANSISTOR AS A CIRCUIT ELEMENT	119
5.1. Introduction	119
5.2. The point-contact transistor	119
5.2.1. Characteristics	119
5.2.2. Squaring circuit	122
5.2.3. Self-maintained states	124
5.2.4. Pulse delay circuit	125
5.2.5. Shift register	126
5.2.6. Scaling circuit	127
5.2.7. Circuit precautions	129
5.3. Junction transistors	129
5.3.1. Collector characteristic	130
5.3.2. Amplifiers	131
5.3.3. Regenerative circuits	133
Eccles-Jordan circuit	133
Mechanical register driver	133
Blocking oscillator	134
D.C. converter	134
Dekatron driver	136
5.3.4. Gating	136
5.4. Specification and ratings of typical transistors	138
5.5. Evaluation of possible applications	138
5.6. Expected future developments	139
REFERENCES	139

THE BUBBLE CHAMBER

C. Dodd

CONTENTS

	PAGE
1. PRINCIPLE	143
2. THEORY	144
3. SENSITIVE TIME	146
4. WORKING LIQUID	147
5. SPEED OF BUBBLE GROWTH	148
6. LIFETIME OF BUBBLE NUCLEI	149
7. CYCLING TIME	149
8. VARIABLE SENSITIVITY	150
9. BUBBLE DENSITY	150
10. FLASH TRIGGERING DEVICES	151
11. ORGANIC LIQUID CHAMBERS	151
12. LIQUID HYDROGEN CHAMBERS	152
REFERENCES	155

THE RADIUS OF A NUCLEUS

J. M. C. Scott

Cavendish Laboratory, Cambridge

CONTENTS

	PAGE
1. INTRODUCTION	157
2. ELECTRICAL METHODS	159
2.1. x-rays from mesonic atoms	159
2.2. Scattering of electrons	162
2.3. Isotope shift in atomic spectra	167
2.4. Shift of x-ray levels	170
3. COULOMB ENERGY OF NUCLEI	171
3.1. Mirror nuclei	172
3.2. Semi-empirical mass formula	174
4. METHODS DEPENDING ON NUCLEAR FORCES	175
4.1. Cross-sections for neutrons and fast particles	176
4.2. Penetrability of potential barriers	183
5. DISCUSSION	184
REFERENCES	185

ORGANIC SCINTILLATORS

F. D. Brooks

CONTENTS

	PAGE
1. INTRODUCTION	252
2. THE SCINTILLATION PROCESS IN ORGANIC SCINTILLATORS	253
(a) Electronic levels in organic molecules	254
(b) Excitation and emission of molecular luminescence	257
(c) Luminescence process in scintillators	259
(d) Inter-molecular energy transfer	262
(e) Luminescence excited by particles	267
3. ORGANIC CRYSTAL SCINTILLATORS	275
(a) Fluorescence and scintillation efficiencies	275
(b) Response to different particles	277
(c) Emission spectra	279
(d) Fluorescence and scintillation lifetimes	279
4. LIQUID SCINTILLATORS	284
(a) General characteristics	284
(b) Loaded liquid scintillators	292
(c) Large-volume scintillators	296
5. PLASTIC SCINTILLATORS	300
(a) Characteristics	301
(b) Applications	306
REFERENCES	308