

Contents

1	Introduction	1
	References	4
2	Radioactive Decay Chains	5
2.1	The Discovery of the Existence of Isotopes	5
2.2	Discovery of Radioactivity	7
2.3	Discovery of Radioactive Decay Chains	10
2.4	Completing the Radioactive Decay Chains	15
	References	20
3	Isotopes of Stable Elements	23
3.1	Discovery of Isotopes in Stable Elements	23
3.2	Dempster's Mass Spectrographs	25
3.3	Aston's Mass Spectrographs	26
3.4	Other Mass Spectrographs	30
3.5	Molecular Spectroscopy and Nuclear Reactions	32
	References	35
4	First Nuclear Reactions	39
4.1	Artificially Produced Isotopes	39
4.2	Alpha-Particle and Neutron Sources	39
4.3	First Accelerators	45
4.4	Neutrons Produced with Accelerators	52
4.5	Photonuclear Reactions	57
4.6	Identification of Fission Fragments	58
	References	61
5	Transuranium Elements	67
5.1	Creating New Elements	67
5.2	Plutonium Project and Thermonuclear Tests	69
5.3	Neutron Irradiations in Reactors	74

5.4	Light-Charged-Particle Reactions	76
5.5	Heavy-Ion Fusion-Evaporation Reactions	78
	References	82
6	Neutron-Induced Fission.	87
6.1	Identification of Fission Fragments.	87
6.2	Fission Fragments Discovered During the Plutonium Project	88
6.3	Fission Induced by Neutrons Produced with Accelerators	93
6.4	Fission Induced by Reactor Neutrons After 1951	95
6.5	Online Separation Facilities at Reactors.	100
	References	106
7	Neutron-Induced Reactions.	111
7.1	Thermal and Fast Neutrons	111
7.2	Reactor Neutrons	111
7.3	Neutrons Produced at Accelerators	118
	References	123
8	Photon and Pion Induced Reactions	127
8.1	Secondary Photon and Meson Beams	127
8.2	Photo-Nuclear Reactions	128
8.3	Pion-Induced Reactions.	131
	References	132
9	Light-Charged-Particle Reactions	135
9.1	Discoveries with Charged-Particles After 1942.	135
9.2	Isotope Identification Without Chemical Separation	136
9.3	Radioactive Decays Following Chemical Separations	140
9.4	Physical Separation and Identification Techniques	150
	References	158
10	Spallation and Charged-Particle Induced Fission	165
10.1	High-Energy Nuclear Collisions.	165
10.2	Charged-Particle Fission	166
10.3	Spallation	167
10.4	Spallation with ISOL	181
10.5	Charged-Particle Fission with ISOL	187
	References	192
11	Fusion-Evaporation Reactions.	197
11.1	Heavy Ions	197
11.2	Beta-Decay	198
11.3	In-Beam γ -Ray Spectroscopy.	205
11.4	Alpha Emitters.	208
11.5	Proton Emissions and Delayed Fission	217
	References	221

12 Superheavy Elements	227
12.1 Overview and Current Status	227
12.2 Recoil Collection with Helium Gas	228
12.3 Recoil Separators and Cold Fusion	231
12.4 Hot Fusion and Not-Connected Decay Chains	237
References	242
13 Spontaneous Fission	245
13.1 Spontaneous Fission Sources	245
13.2 Isotopes Discovered in Fission of ^{252}Cf and ^{248}Cm	246
References	250
14 Heavy Ion Transfer and Deep Inelastic Reactions	251
14.1 Dissipative Reactions	251
14.2 Target-Like Fragments	252
14.3 Beam-Like Fragments	253
14.4 ISOL	255
References	257
15 Projectile Fragmentation and Fission	259
15.1 A New Paradigm	259
15.2 Light Neutron-Rich Isotopes	260
15.3 Projectile Fission	263
15.4 Heavy Neutron-Rich Isotopes	266
15.5 Proton-Rich Isotopes.	268
References	271
16 Unbound Isotopes	275
16.1 Definition of Unbound Isotopes	275
16.2 Neutron-Unbound Isotopes	277
16.3 Proton-Unbound Isotopes	281
16.4 Proton Radioactivity	285
References	289
17 Summary and Outlook	293
17.1 Present Status	293
17.2 Future Perspectives.	296
17.3 Table of Isotope Discoveries	298
References	384



<http://www.springer.com/978-3-319-31761-8>

The Discovery of Isotopes

A Complete Compilation

Thoennesen, M.

2016, XIII, 413 p. 107 illus., 21 illus. in color., Hardcover

ISBN: 978-3-319-31761-8