CONTENTS

Chapter	r 1	
Introdu	ection	1
1-1	Scope, 2	
1-2	Classification of Collision Mechanisms, 4	
Chapter	r 2	
Relation	nship Between Cross Section and Experimental Parameters	6
2-1	Operational Definition of Cross Section, 7	
	 A. General Formulation, 7 B. Beam-Static Target Gas Configuration, 8 C. Crossed-Beam Configurations, 9 D. Coincidence Experiments, 11 	
2-2	Determination of Cross Section from Measured Emission, 12	
	 A. Spontaneous Decay of the Target, 13 B. Spontaneous Decay of the Projectile, 16 C. Induced Decay of Metastable Projectiles, 19 D. Polarization of Emission, 21 	
2-3	Branching-Ratio Information, 23	
2-4	Summary, 24	
Chapter	r 3	e
Determi	ination of Experimental Parameters	26
3-1	Projectile-Beam Definition and Detection, 27	
	A. Role of Beam Contaminants, 27B. Detection, 30C. Summary, 32	
3-2	Target Definition and Density Measurement, 32	
	 A. Role of Contaminants, 32 B. Spatial Pressure Gradients, 34 C. Thermal Motion of the Target, 34 D. Measurement of Target Pressure, 34 E. Summary, 37 	

X CONTENTS

3-3	Exci	ited-State Density: Direct Determination, 38	
	A. B. C. D.	Field Ionization, 39 Energy-Loss Techniques, 40 Detection of Metastables by Charge Rearrangement, 40 Summary, 41	
3-4	Pho	ton Emission: Quantitative Measurement, 41	
	F.	Optical Detection Techniques, 42 Calibration of Detection Sensitivity, 45 Determination of Polarization Fraction, 52 Influence of Polarization on the Measurement of Emission Cross Sections, 54 Measurements on Many-Lined Sources, 57 Influence of the Doppler Shift, 60 Normalization to Other Cross Section Data, 61 Summary, 62	
Chapter			
		Critique of the Experimental Data	65
4-1		oduction, 65	
4-2	Cata	log of Available Data, 66	
Chapter	. 5		
Experim	nents]	Involving Atomic Hydrogen Targets: Target Excitation ransfer Excitation of Projectiles	86
5-1	Intro	oduction, 86	
5-2	Expe	erimental Techniques, 87	
		General Considerations, 87 Experimental Arrangements, 88	
5-3	Cros	s Section Measurements, 96	
	В. С.	Excitation of the Atomic Hydrogen Target, 96 Formation of Excited Projectiles by Charge Transfer, 96 Polarization of Emission, 97 Data Tables, 98	
Chapter	6		
Excitation	on of	a Helium Target	100
6-1	Intro	oduction, 100	
		General Considerations, 100 Experimental Arrangements, 102	

6-2	Exci	tation of Helium by Protons and Deuterons, 112	
	A. B. C. D. E. F. G.	Excitation of the n ¹ S Levels of Helium, 113 Excitation of the n ¹ P Levels of Helium, 116 Excitation of the n ¹ D Levels of Helium, 120 Excitation of Triplet States, 123 The Formation of Excited He ⁺ , 123 Polarization of the Emission from Excited Helium, 124 Data Tables, 125	
6-3	Exci	tation of Helium by H Impact, 134	
	A. B. C.	Cross Section Measurements, 134 Polarization of Emission, 136 Data Tables, 137	
6-4	Exci	tation of Helium by H ₂ and H ₃ Impact, 139	
	A. B. C.	Cross Section Measurements, 140 Polarization of Emission, 140 Data Tables, 141	
6-5 Excitation of Helium by He ⁺ Impact, 151		tation of Helium by He ⁺ Impact, 151	
	A. B. C. D.	Emission from the Target, 152 Polarization of Emission from the Target, 152 Sum of Emission from Projectile and Target Measured Together, 152 Data Tables, 153	
6-6	Exci	tation of Helium by Various Heavy Projectiles, 16!	
	<i>A</i> .	Data Tables, 162	
Chapter	7		
Excitati	on of	Heavy Monoatomic Gases	163
7-1	Intr	oduction, 163	
7-2	Exci	tation of Neon, 165	
	A. B. C. D.	Experimental Arrangements, 166 Proton Impact, 171 He Impact, 172 He ⁺ Impact, 172 Data Tables, 173	

C. H₂ Impact, 186
D. He⁺ Impact, 186
E. Ne⁺ Impact, 188

Proton Impact, 185

7-3 Excitation of Argon, 178

А. В. Experimental Arrangements, 179

xii Contents

	F. Ar Impact, 188		
	G. Cs ⁺ Impact, 189 H. Data Tables, 190		
7-4			
/	••		
	A. Experimental Arrangements, 197 B. Proton Impact, 198		
	C. He ⁺ Impact, 198		
	D. Ne ⁺ Impact, 200		
	E. Data Tables, 200		
7-5	Excitation of Xenon, 203		
	A. Experimental Arrangements, 203		
	B. Proton Impact, 204		
	C. H ₂ Impact, 205 D. He ⁺ Impact, 205		
	E. Ar^+ Impact, 207		
	F. Data Tables, 207		
7-6	Excitation of Mercury, 210		
	A. Experimental Arrangement, 210		
	B. H ⁺ and H ₂ Impact, 211		
	C. Data Tables, 212		
Chapter	· 8		
Excitat	on of Molecular Targets	215	
8-1	Introduction, 215		
8-2	Excitation of Hydrogen, 216		
	A. General Considerations, 217		
	B. Experimental Arrangements, 218		
	C. Proton Impact, 228 D. Hydrogen Atom Impact, 229		
	E. H_2^+ and H_3^+ Impact, 230		
	E. He ⁺ and He Impact, 231		
	G. Impact of Other Projectiles, 233		
	H. Data Tables, 234		
8-3	Excitation of Nitrogen, 242		
	A. General Considerations, 242		
	B. Experimental Arrangements, 244 C. Proton Impact, 252		
	C. Proton Impact, 252 D. Hydrogen Atom Impact, 259		
	E. Impact of Other Projectiles, 261		
	 E. Impact of Other Projectiles, 261 F. Rotational Structure of N₂⁺ Emission, 263 G. Data Tables, 269 		

8-4	Excitation of Oxygen, 283	
	 A. General Considerations, 283 B. Proton Impact, 285 C. Impact of Other Projectiles, 288 D. Data Tables, 288 	
8-5	Excitation of Other Molecular Targets, 292	
	 A. Oxides of Carbon, 293 B. Oxides of Nitrogen, 295 C. Light Hydrocarbons, 296 D. Data Tables, 297 	
Chapter		
Formati	ion of Excited Atomic Hydrogen Projectiles	303
9-1	General Considerations, 304	
9-2	Experimental Arrangements, 308	
9-3	Charge Transfer into the Excited State of the Projectile, 329	
	A. Helium Target, 330 B. Neon Target, 333 C. Argon Target, 336 D. Krypton Target, 338 E. Xenon Target, 339 F. Molecular Hydrogen Target, 339 G. Molecular Nitrogen Target, 341 H. Molecular Oxygen Target, 343 I. Other Molecular Targets, 344 J. Metallic Vapor Targets, 344 K. Data Tables, 345	
9-4	Excitation of Fast H Atoms, 361	
	 A. Cross Section Measurements, 362 B. Polarization of Emission, 362 C. Data Tables, 362 	
9-5	Simultaneous Stripping and Excitation of Fast H ⁻ Ions, 368	
	A. Cross Section Measurements, 368 B. Data Tables, 369	
9-6	Dissociation of H ₂ ⁺ Ions, 371	
	 A. Rare Gas Targets, 372 B. Molecular Targets, 373 C. Metallic Vapor Targets, 374 D. Polarization of Emission, 374 E. Data Tables, 374 	

xiv Contents

9-7 Dissociation of H₃⁺ Ions, 378

	A. B.	Rare Gas Targets, 378 Molecular Targets, 379	
	<i>C</i> .	Data Tables, 379	
Chapter	10		
Excitati	on of	Helium and Other Heavy Projectiles	381
10-1	Ger	neral Considerations, 381	
10-2	Exc	itation of Helium Projectiles, 382	
	A. B. C.	Experimental Arrangements, 383 Experimental Results, 386 Data Tables, 387	
10-3	Exc	itation of Heavy Projectiles, 393	
	А. В.	Experimental Arrangements, 393 Data Tables, 395	
Bibliogr	aphy		401
Appendi	x I		
Recent	Addit	ional Material	412
Appendi		Front Eurited II and II. Atoms II.d. Multiple	
Collision		Fast Excited H and He Atoms Under Multiple additions	421
Author 3	Index	•	425
Subject	Index	x	433
		•	